NEW TOOLS AND DIRECTIONS TOWARD A BETTER UNDERSTANDING OF SOCIAL PERCEPTION OF SCIENCE IN IBERO-AMERICAN COUNTRIES

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Abstract
The social perception of science & technology in Ibero-American countries seems to be acknowledged with growing interest by researchers and policy-makers as quite relevant for strengthening science communication activities and promoting qualified citizenship. In very recent years, several countries of the region (Argentina, Brazil, Colombia, Mexico, Panama, Portugal, Spain & Venezuela) have been carried out studies and national surveys to investigate the issue. This current scenario has been supported in part by institutions like the Organización de Estados Iberoamericanos (OEI), the Red Iberoamericana de Indicadores de Ciencia y Tecnología (RICYT/CYTED), the Fundación Española de Ciencia y Tecnología (FECYT) and Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP). These organizations have been working as catalyst for researchers and countries in the region to review concepts, instruments and share methodologies. Despite the fact that Ibero-American countries have entered this research field later then several Northern countries, and that they have adopted, in part, the usual, standard methodologies and questions of classical surveys, they have been able to conciliate the need for international comparisons with the attention to local context, putting data and methodologies within the context of the recent critical debates about scientific culture. Currently, as a part of this process, RICYT, FECYT & OEI have started a new project to develop a set of common indicators for the region, working in network with experts and policy-makers. This presentation will focus specially on both a review of the historical development of this field in the region and its current situation in terms of shared experiences, methodologies and conceptual debate. The common framework conceives public attitudes, beliefs, behaviors, knowledge and information as a part of a composite model of scientific culture where S&T interact with the whole of culture and society.

Key words: Indicators – social perception of science – Ibero-American standard – scientific culture

1. Main international surveys and their analysis of PUS and scientific literacy

The major, classical reference to indicators of public understanding of science (PUS) and scientific culture is represented in USA by the National Science Foundation/National Science Board (NSF/NSB) science indicator surveys, that include, since 1972, a section on public understandings of and attitudes to S&T. In Europe, major references are the U.K. surveys of 1988 and 1996 (Durant, Evans, and Thomas 1989; Bauer et al., 1993). The Eurobarometer, an European Commission project to investigate public opinion on several topics, dedicated important surveys to S&T (European Commission, 2001, 2003, 2005; Bauer, Durant, and Evans 1993; Bauer, Schoon 1993). Other studies, involving similar methodologies and questions, were developed in Sweden (Fjaested 1996), and Bulgaria (Petkova et al. 1997). Besides these broad purpose perception studies, several surveys were also conducted to investigate public perception and understanding of specific S&T issues, such as information technology or biotechnology and GM-foods (see, for ex., Gaskell et al., 2000; Gaskell & Bauer 2001; Mori, 1999; European Commission, 1997, PABE, 2001). Outside Europe and USA, methodologies and typologies of survey were less homogeneous, but tended to possess a core-set of questions identical or very similar to those of NSB and Eurobarometer, in order to permit comparisons. Studies of this kind were performed, for example, in India (Raza & Singh, 2002), SouthKorea (Kim, Carter, Stamm 1995), Canada (Einsiedel 1993), China (Zhang and Zhang 1993), Malaysia (Mastic, 2001), New Zealand (Capper & Bullard, 1997), Japan (Japanese Prime Minister's Secretariat, 1995). In Russia, the first pilot survey of public's opinions on science was carried out in 1995 (Shuvalova, 1996). In 1996, 1997, and 1999, three surveys of public opinion on S&T were carried out, trying to develop a methodology intended to reflect the specific features and problems of S&T development in Russia, and to ensure international comparability of data (Gokhberg and Shuvalova, 1997, 1998).

While several studies involve qualitative methodologies (focus groups, open interviews) as preliminary tools to set up the surveys, the analysis of data tend to be focused on statistical analysis based on quantitative data. In spite of quite marked differences in the attitudes toward specific bio-medical or technological issues and toward social and ethical implications of S&T, we can say that most researchers tend to emphasize in their analysis some common, “global”, broad characteristics of public perception of S&T:

- In spite of often and widespread lamentations by scientists of a diffuse, growing “fear of science” or “hostility” against S&T, all indicators point to widespread, and relatively stable, support for government funding of basic research. For example, the great majority of people in most countries of the world agree with statements similar to this: “Even if it brings no immediate benefits, scientific research that advances the frontiers of knowledge is necessary and should be supported by the government”
- In spite of the bemoaned “lack of interest” in S&T, over 50% of adults in most countries declare being interested or at least moderately interested in scientific discoveries and the use of new inventions and technologies. Even if, in fact, these numbers could be biased (because respondents tend to see the interviewer as a researcher and want to show “positive” attitudes toward him/her), an overall positive vision of S&T and its main purpose emerges from several indicators
- At the same time, people allover the world tend to declare themselves bad or very bad informed about S&T
- When measured by means of the usual indicators and questions, the level of scientific literacy is quite stable and low or very low allover the world. Most people – NSB claims – “do not know a lot about S&T” and “lack a clear understanding of the scientific process”
- Most adults learn about the latest developments in S&T primarily from watching television
- Social representation of science tends to be di-polar: science is perceived both as magical, esoteric and as a source of a logic, objective, democratic knowledge about the world. It touches our lives intimately, but at the same time is “not for us”. Scientists are depicted as clear-headed and absent-minded, mad and rational, passionate and with no sentiments, altruist but potentially dangerous. Euphoric, symbolical elements about the wonderful products of scientific and technological advancement – linked to the myths of Prometheus, Ulysses, etc. – go hand in hand with negative connotations of scientific knowledge (revealed by metaphors linked to Pandora’s box, Dr. Frankenstein’s story, forbidden fruit or sorcerer’s apprentice dilemmas, etc.). Such di-polarity, bizarre or embarrassing to someone, was interpreted in the classical context of the “deficit model” as a mere consequence of an insufficient level of scientific literacy (what we don’t understand, scares us). We will discuss later some alternative points of view.

Besides this, analysis of correlation and relationships between different dimensions of PUS (knowledge, attitudes, interest, access to information) and different social and cultural indicators, caused debate. For example, the correlation between low levels of scientific literacy and negative attitudes toward S&T (a strong explicit or tacit assumption in many programmes of science popularisation) was posed in doubt by many authors. Other relationships deserve careful analysis. For example, while some surveys seem to link the level of rejection of GM-food to lack of interest or knowledge in facts and concepts of biotechnology, careful statistical analysis seems to show that:

- higher levels of knowledge or exposition to media may eventually be correlated, at least in some cases, not to more acceptance in general, but with more complex and more critical points of view and perceptions.
- low levels of factual knowledge do not automatically imply the impossibility for people to participate in societal debate (for example, about cloning or GMOs) with some competence, derived from lay-knowledge (see PABE/EC, 2001).

2. Measuring in Ibero-American countries

The social perception of science has also reached some theoretical and methodological devolopment in many Ibero-American countries. The regional outlook shows important progress, reflected in the proliferation of qualitative and quantitative academic work on specific topics [GMOs, information society, energy, pollution, etc], as well as in the number of massive surveys made by governments in the last five years [Argentina (2003), Brazil (1987), Colombia (1994, 2004), Mexico (1997, 2001, 2003), Panama (2001), Portugal (1996, 1997, 2000), Spain (2003, 2004) & Venezuela (2004)]. During this period of time, academic cooperation networks have also grown thank to the support of institutions like the Organización de Estados Iberoamericanos (OEI), the Fundación Española de Ciencia y Tecnología (FECYT), the Red de Indicadores Interamericana/Iberoamericana de Ciencia y Tecnología (RICYT/CYTED) and the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), and also thank to universities and researchers, through networking and debates where the issue of measuring the social perception of science has been discussed and widely situated in the fields of scientific culture and citizens participation in science and technology issues.

An interesting aspect of some of these surveys is that Ibero-American countries, while entering in this research field later then several northern countries, and while adopting in part the usual, standard methodologies and questions of classical surveys such as those by NSB, were able to conciliate the need for international comparisons with the attention to local context, putting data and methodologies in the context of the recent critical debates about scientific culture. The need for integration of the standard PUS indicators with more sophisticated ones, able to describe the complexity of scientific culture in a broad sense, is a central point in reflection made by several researchers in the region. So, while survey methodology in these countries is basically similar to the one chosen by NSB or Eurobarometer, several additional questions were planned to fit the regional reality. And, more interestingly, this starting point of view could become a major point of strength for the development of new classes of indicators, especially if joined to the development of a network of researchers working toward common goals and methodologies.

In many aspects this process was stimulated by RICYT and OEI. Since 2001, these organizations have been developing together several studies on public perception, scientific culture and citizen participation in science & technology. RICYT has examined the traditional models of measuring public understanding of science in the international literature. Also, it has developed qualitative studies: institutional framework of S&T; citizens participation in S&T issues; perception and consumption of scientific information sources; perception of risks related to S&T; and social imaginary of S&T. The outcomes of those projects were utilized to formulate a comparative pilot survey, implemented by RICYT and OEI in November 2002 in cities of Argentina, Brazil, Uruguay and Spain to analyze perception of science & technology in terms of social imaginary, communication and citizen participation. The survey joined, moreover, different methodological approaches in order to explore valid mechanisms to interpret iberoamerican public answers in this field of social research (see Vaccarezza et al, 2003c).

The pilot survey results' were significant and motivated regional interest and debate. The general tendency was the same in the four countries. The social imaginary views science like an adventure of "big discoveries" and "technological advances", being useful to improve the quality of life (material conditions, health, racionality, etc.). In addition, despite negative points of view on specific sources of risks (nuclear energy, biotechnology, etc.), the public perceives science as a need. All these impressions, nonetheless, come out within a general context where ussualy the news about science are not followed by public and the citizen participation in technological controversias is unusual. Beyond the results themselves, the investigation allowed, in methodological terms, to confirm limitations in massive surveys to cover the linkages between science, technology and society. Scientific culture in society includes not only public understanding and supporting science but a complex social, cultural and political framework. Moreover it showed the importance of developing qualitative studies and specific regional indicators which should allow international comparisons. These experiences were discussed in several regional workshops [Salamanca (2003), Bogotá (2003), Sâo Paulo (2003), San José (2004), Buenos Aires (2004), St. Lucía (2005), Sâo Paulo (2005), Antigua (2005), Tenerife (2005), Lima (2005) etc.]. As a macro general result, the researchers have proposed some directions to improve this field of research: to meliorate the surveys with more accurate and representative questions; to put the results into the local contexts of S&T policies; and to complete the analyzes with qualitative studies.

3. Ibero-American standard for indicators on social perception of science

We must to take into account, moreover, that the S&T policies in the world have acquired more complexity since science and technology themselves are highly intricated with economy, policy and culture. This way, the decision-making processes in terms of S&T & innovation imply "(..) abundant qualitative and quantitative information about the available sources, the achieved results, the tendencies and the future scenarios. The necessity of statistic information, indicators and interpretative models to know and interpreting what is happening with the scientific and technologic system is vital; because of the limitated sources, the policies decided must be based on reliable information" (RICYT, 2004). The social perception of science is one of these examples of a new kind of indicators that needs to be constructed according to both the local and international scenario.

One of the main aspects of this current scenario is, nevertheless, that the indicators constructed in the region, when looked in detail, show a high degree of heterogeneity and lack standardization. Many times, even when some effort for asking similar questions has been done, the methodological dispersion of the surveys makes difficult to compare the results (or the surveys themselves).

The state of art in the region lets us assume that the moment has come to make social perception indicators subject to wide conceptual and methodological debate, similar to the one that input-output indicators of the S&T system where subject to during the '90s, as well as innovation indicators more recently. The process should lead to indicators that can fulfil a double purpose: being an accurate reflection of public opinion trends and peculiarities in Ibero-American countries; and being good parameters for international comparison. FECYT, OEI and RICYT have now understood that elaborating common criteria at the Ibero-American level is indispensable for obtaining reliable and comparable macro indicators. In this line, these institutions have recently signed a Macro Agreement for the project "Ibero-American standard for indicators on social perception of science", which has the aim of including the regional community of specialists in a wide revision and definition process. The main idea is to have, in the mid term, a proposal of a discrete set of questions and a common methodology for data collection and interpretation to provide specialists and governments with a validated proposal for analyzing results and designing social communication policies based on information under a regional perspective but respecting wider international guidelines.

The fact that perception has become an important matter for regional public policies is related to – like it happened in developed countries more than two decades ago- a wide debate on how to bring society closer to the field of science and technology. More specifically, there is the expectation that society could take advantage of scientific and technological knowledge as a resource for its own growth, and the same time, be able to involve responsibly in the course of events mediated by experts knowledge. The legitimization of the survey among other equally valuable tools for social perception analysis was possible due to the fact that its implementation guarantees an extensive inquiry in the short run to discern attitudes, opinions and certain guidelines on the behaviour of the population or on some segments of it. This way, the survey became the most important tool for the construction of indicators on the social perception of science– as they are known in the region- or *public understanding or public attitudes toward S&T*, as they are referred in the rest of the world.

However, measuring these matters in Iberoamerica requires a different understanding to the one made in developed countries, since in the former, science and technology are not enough socially institutionalized and, in general, are not part of the national growth resources. This makes that those questions primarily developed by NSF for measuring attitudes and knowledge had been largely accepted in other countries, and that the methodology had validated itself far beyond the ability that sociology and communication analysts have had in reviewing scientific culture models underlying these surveys. Since science and technology, undoubtedly, have universal characteristics, but they are performed by concrete social actors within the framework of concrete political, economical and cultural realities, it is possible to think that Ibero-American countries should make an effort to adequate methodologies to the common features of the region. It is also an opportunity to revise and attempt to improve these underlying models devoted to understanding the phenomenon. In this sense, it is necessary a process for methodological harmonization and classification, aiming at synthesizing and attempting to improve the international expertise, maintaining international comparability as a requisite, but being also adequate in the local contexts. In terms of public policies, the indicators are quantitative representations that make possible aggregate information at different social levels and, therefore, to analyze their construction necessarily implies to determinate which kind of diagnosis is intended to be made. In other words, you need to define what kind of policy are you expected to develop.

A standard is essential in order to assure that when the countries report about the results of their surveys, they do it upon the basis of the calculation of equivalent information. Only by this way it could be said with a greater precision that the information referred to the population's consumption of scientific information, knowledge of institutions of the S&T system, or the attitude toward public founding of research, just to mention three examples, is comparable a regional scale. An operative definition of the concepts involved in the issue of social perception and scientific culture in the first link that needs to be addressed for building a methodological standard. This issue is especially relevant at the starting point, but, at the same time, it is a problematic question since, as argued above, the specialized literature appeals to different concepts –sometimes interchangeably- when referring to that linkage between science and society. By the same way in which operative concepts are needed, it is also necessary to open discussion to all those inherent methodological aspects in order to answer the question about how must we measure. Among the issues that should be considered we can mention:

- <u>Determination of variables that are attempted to be measured</u>, reflecting previous conceptual agreements and including a methodology that unifies the values assumed by such variables.

- <u>Confection of analysis samples</u>, in order to facilitate the reliability of results and the existence of universes fully comparable between countries, in statistical terms.

- <u>Elaboration of the survey's questions</u>, reflecting the variables to be measured and facilitate international comparability.

- <u>Construction of indicators</u> which would represent an aggregate and complex measure allowing describing or assessing a phenomenon, its state and evolution. These indicators should have some of the following characteristics: generality, correlate of different (or coming from different contexts) variables, temporality, and possibility of becoming basic components of theoretical developments (E. Martínez, M. Albornoz, 1998: 11). By this way, for example, the level of consumption of scientific information of a population could be measured, considering the weight of several variables.

- <u>Proposal of proceedings adequate for measuring</u> (personal or telephone interviews, supervision, etc.) and the recommended intervals in the periodical application of studies (once a year, every two years, etc.).

It is very important to underline that this such of methodological proposal, and the indicators that could arise from the standar, intends not to exhaust the complexity of social perception and scientific culture. This would be impossible. The standar is primarily conceived as an operative synthesis for the Ibero-American countries could compare them national surveys by means of a common methodological proposal.

4. Beyond the national surveys: toward a system of scientific culture indicators

Despite the strong debate and tradition in the field of public understanding of science, it is significant to notice that scientific culture could not be analyzed simply in terms of individual knowledge and competencies. According to Roth & Lee (2002), for example, scientific literacy is

> A property of collective activity rather than individual minds. We think of knowing and learning science as situated in and distributed across social and material aspects of a setting. […] Collectively, much more advanced forms of scientific literacy are produced than any individual (including scientists) could produce. Creating opportunities for scientific literacy to emerge from collective activity, irrespective of whether one or more participants know some basic scientific facts, presents challenges to science educators very different from teaching basic facts and skills to individuals.

By means of a different approach, but in a similar context, Godin & Gingras (2000) define scientific and technological culture as “the expression of all the modes through which individuals and society appropriate science and technology”, and claim that it has two dimensions, individual and social:

> S&T culture is much more than all of the above. Our path has led us to consider the process of appropriation of science and technology and its effect on the individuals within a society. However, can the simple reference to the sum of the attributes and practices of individuals adequately describe a society’s effort to appropriate science and technology? To answer this in the affirmative would, in our opinion, amount to short-circuiting the specifically collective dimension of S&T culture.

In a detailed way, Albornoz et al. (2003; see also Vogt & Polino, 2003), based on arguments by Wynne and others, discuss the very notion of scientific culture and literacy, adopted by RICYT/OEI’s initiative:

> Scientific culture, from our point of view, is not a stock of knowledge appropriated by individuals. This would be only a dimension of the phenomenon and a valid –though limited- methodological resource (later expressed in indicators). The society’s culture is impregnated with science and technology contents. Supposing science and technology as parts of society (institutions, processes, means of power, etc.) and conditioned by it, it is interesting to analyze to which extent it achieves levels of integration enough to become contents that are expressed at the general practices of the society, and through components of its members’ common sense. Thus, we seek to articulate a more comprehensive framework for the analysis and evaluation of how “scientifically oriented” a society is at a certain historical moment, which enable us to evaluate the functioning and performance of science at the cultural and productive dynamics of society.

This way, the scientific culture in a society is a composite ecosystem of ideas, symbols, sources, activities, etc. Following Albornoz et al. (2003), we could claim that the complex social processes that lead to the negotiation and construction of scientific culture and public representation of S&T can be investigated by individuating some macro-indicators that describe emerging collective properties. As a proposal, we give here some inputs to think a system of indicators which could contribute to measure the scientific culture in our countries.

a) Reformulating standard indicators of scientific culture

The classical measures of individual interest in, knowledge of, and attitudes toward S&T, should be used in order to develop a core-set of indicators that permit international comparisons. However, a careful analysis should be performed:

- The “quiz” questions regarding knowledge should contain a core-set of internationally used items that can be considered equivalent. This should be done not only (as usually discussed in several surveys) from the point of view of the statistical significance of the chosen items, but also from the point of view of the collective appropriation of the involved concepts. To achieve this, preliminary investigations on local educational curricula and on the kind of social and mediatic discourse on each topic could be effectuated to check that the chosen items for true/false questions possess comparable levels of incorporation in social agenda. For example, a common and apparently simple claim such as “the oxygen that we breathe comes from plants” could actually have different meanings in different countries. In USA and Europe such claim is socially classified as true. In Brazil, social and political interests led to strong claims that the Amazon rainforest is not the “green lung of the planet” and educational and media popularization diffused the notion that most oxygen we breath comes from microorganisms in the oceans, so that people with medium or high levels of “scientific literacy” could answer the quiz in a very different way from their northern peers.

- While these questions can be used for comparisons, careful investigation should be performed in order to understand what we are actually comparing: is it "scientific literacy" or, maybe, some kind of indicators measuring, for example, levels of exposition to/incorporation of certain kind of social discourse on some topics?
- Statistical analysis, especially when directed to detecting correlation between knowledge, attitude and interest, should be strongly significant and taking into account the problems cited above
- Indicators of interest could be constructed measuring also levels of scientific information demand by the public (for instance: quantity of science in the media and its "audience" level), to correct possible biases linked to self-declaration. Agenda-setting effects should also be evaluated
- Careful analysis of the groups of publics should be performed, by qualitative and quantitative methods. As OST (2000) showed, in some aspects the usual bipartite (interested/not interested) or tripartite classifications may not respond to the complexity of public perceptions.
- In a similar way, the usually observed dipolarity and apparent contradictions in public perception of science can be viewed not only as a proof of illiteracy, but also as a symptom of the fact that science is so deeply rooted in culture and social life that it assumes some mythical connotations (Castelfranchi, 2004).

b) Indicators of collective processes

Collective processes leading to construction of SC can be studied taking as indicators things such as: social consumption of S&T issues (media, science centers, museums); social conflicts; social participation; groups of interest; risks discussions; social representations, etc. (Albornoz et al, 2003). Among these topics, proposals for possible indicators could be developed along the following tracks (these proposals are not exhaustive and only preliminary, and just one or two indicators should be chosen, after careful evaluation and exploratory studies of relevance and reliability):

b1. Indicators of S&T impact in the media. For example:

- Suitable indicators to be tested may be linked to the percentage of space that the media dedicate to scientific and technological issues and debates, weighted by convenient factors linked to the position, evidence, importance and genre of every informational item. A relevant index could be eventually represented by such percentage divided by the percentage of the gross internal product dedicated to S&T in each analyzed country. Preliminary analysis developed in Italy and Brazil provided clues that the social demand for S&T information tends to be greater than the offer of S&T in the general media, and that the latter is, on the average, greater than investment in S&T. This index could represent eventually a useful tool also for policy-makers;
- Another possible indicator can be represented by the relevance attributed to S&T by the media. For example, the percentage of space dedicated to S&T, divided by the percentage in number of articles of S&T, could lead to an index that shows if a typical article on S&T tends to be, on the average, greater or smaller then a typical article covering other topics.

b2. Indicators of social debates/appropriation of S&T. For example:

- Percentage of debates/discussions/voting in Parliament linked to S&T issues. This is steadily growing in several countries of the world
- People's self-evaluation of participation and debate. Open ended and closed ended questions in surveys could be used, such as: "Do you remember to have discussed in last month/week with someone about topics linked to S&T?"
- Some knowledge questions commonly used to decide if a person is "scientifically literate" or not (deficit model) could be inverted and reformulated to measure the level of social appropriation of some fundamental scientific concepts or debates. Instead of measuring the "literacy" of people (basically detecting what people don't know), we could try to detect the level of social incorporation of S&T, measuring what people know even when they are not fully literate. Reformulating the concept of "cultural distance" (developed by Raza, Singh and Dutt, 2002), we could say that when a scientific issue is dominated by a majority of non-literate people, or people with few years of school education, it means that it can be considered part of the collective culture.

b3. Indicators of penetration of S&T in social representations and images

- Indicators of deep connotations and symbols in public image of science, technology and scientist. For instance, the quantitative "Draw-a-scientist-Test" (DAST) checklist, if reformulated in order to study not only the "defects" in perceptions but also the full construction of scientist's image both in children and teenagers, could be a useful indicator of some deep elements of public representation of science and of scientist's role in society. For this purpose, the checklist should be modified in order to include not only "negative", "stereotypical" images of scientist but more complex aspects of science and scientists "in action". Preliminary works in this sense was effectuated with 3rd grade Italian children by means of focus groups integrated with DAST-like activities and situated inside a narrative environment (Castelfranchi et al., 2004; Castelfranchi, 2004).

- Indicators of "transversality" in public image of science. The presence of science in the media outside the classical "compartments" (Health & Medicine sections, S&T sections in newspapers and magazines, documentary films, science TV channels) and transversal to classical genres, fluxes and channels of communication (science news, popular science) could be an interesting indicator of how much scientific discourse is incorporated in culture as a whole. The frequency of some selected scientific and technological key-words and concepts in editorial articles, letters to the editor, political opinion articles, etc., could represent a quantitative indicator of incorporation of S&T in social the discourse.
- Science & publicity: concepts and facts used in advertising use to be very deeply rooted in social image and agenda. Things coming from S&T that are used to sell a product may represent good indicators of the level of penetration of science into collective processes. In this sense, a quantitative checklist of metaphors and symbols coming, also indirectly, from science (e.g.: metaphors or images based on "evolution", "complexity", "plasticity", "network", "organisms", "simulation", etc.) could provide indicators even more interesting than explicit words, facts, discoveries and technological applications (that are easily detected in advertising).

c) Indicators of the institutional level of SC

In this class, we can include some of the classical, well studied S&T indicators, such as S&T policies indicators (investments, university, number of scientists, engineers, PhDs in S&T, etc), scientific and technological productivity, quantity/type of scientific institutions, etc. But other indicators of the intensity of presence of S&T in the institutional agenda and debate should be taken into account, too. For example:

- Indicators of institutional public communication of science and technology: how many scientific institutions do public communication of research? How? Spending how much money? With what impact? (Open-days, publications, internet sites for the public, scientific cafés, etc).
- Indicators of institutional spaces and activities promoting public debate and awareness of S&T (i.e.: monitoring science centres and museum activities, forums, etc.).
- Indicators of institutional organisms devoted to the evaluation of social impact, risks & benefits of applied science and new technologies (ethics committees with open public participation, consensus conferences, risk evaluation committees, etc.).

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