

Scientific and technological culture: a new field for science and technology indicators

Sandra Daza and John Reyes
Researchers, Colombian Observatory of Science and Technology
sdaza@ocyt.org.co; jreyes@ocyt.org.co

During the last five decades, S&T culture has become a theme discussed both in sciences and technology policies and in the academic realm. In the first case, the concern is related to the sustainability of public support for research and the decreasing demand of youngsters for scientific careers. On the academic side, the aim has been understanding the ways in which science relates to society and in investigate how public understanding of science vary across time and context.

Despite the ubiquity of term there have been some attempts to give a suitable definition. According to Godin and Gingras (2000:44), Scientific and Technological Culture could be understood as the expression of all the modes through which individuals and society appropriate science and technology. The value of such a definition lies in its applicability to individuals as well as to institutions and to society as a whole.

The field has been growing heterogeneously and still lacks the necessary theoretical development that issues a paradigm and a supporting methodology. Meanwhile, science and society plans have been delivered in all countries promoting science education and culture as means for approaching science to citizens. Beyond the formal schooling and curricular education of science, those actions involve an ever-growing dimension of out-of-school resources. The actors involved range from the scientific community to the media, including public and private laboratories, science communicators and cultural agents such as museums, galleries, libraries and publishers and most recently deliberative activities like citizen juries, consensus conferencing, national debates and hearings.

According to Correira (2005:21), despite the promotion of S&T culture is itself a bona fide objective, quite prone to warm-hearted intentions; it easily delivers uncoordinated and unaccounted-for actions. Prospective and monitoring efforts require the application of national and international assessment exercises, urging for the development of improved tools in this area.

S&T culture indicators are needed at least for three reasons. First, the increasing expenditures coming from private and public funds to carry out science communication actions. Second, those actions are time-consuming, require know-how, and are thus increasingly outsourced to a new forming private sector of professionals which Bauer (2008) has called "angels". Those "angels" are age-old mediators between a disenchanting public and the institutions of science, industry and policy-making. Third, it is necessary to develop tools for monitoring changes on attitudes, perceptions and uses of science and technology in society.

The analysis of cost and benefits of these areas and of its impacts over society requires process and impact measures. Until now the most common tool are "Public understanding (PUS) surveys" despite of critiques they are a very useful for comparative and dynamic analysis. However, those surveys deal just with individual (subjective) aspects of S&T culture and do not give us elements to understand institutional and organizational aspects.

On the other hand, there are some attempts to develop benchmarking exercises related to actors and actions devoted to communicate science to society. But those are very descriptive and lack metrics.

As Rajesh Shukla and Martin Bauer (2009:8) have pointed out, there appears to be momentum in national and international efforts to put science indicators on a broader basis and also to consider

subjective indicators as measures of intangibles assets. However, not much effort has been made to integrate objective and subjective indicators into a single model of science culture.

Some new and more sophisticated approaches have been made through the development of scientific culture indexes (Godin and Gingras, 2000; Correia and Mira, 2005; Shukla and Bauer, 2009). These indexes are constructed from the combined results of PUS surveys with STS performance indicators such as R&D expenditure, science publications, citations and impact, high-tech employment, and penetration of high-tech goods. Nonetheless is necessary to prove that methodology in other context and conditions.

Given this scenario what we want to point it out is the emergency of a new field for S&T indicators and for the debate around "positioning indicators". There is a fertile and unexplored area to work with. In the perspective of science and technology systems, to develop these types of indicators involves a double challenge. First, to be able to provide global analysis approach to enable decision-making policies and at the same time that could be serve for qualitative studies and second, deal with heterogeneous sources of information that comes from different sort of actors.

The purpose of our proposal is to offer a landscape of those developments and to show through the experience of Colombian Observatory of Science and Technology the efforts that will be needed to design a desirable indicators set of scientific culture indicators. We will focus on the results of three projects: Evaluation of science communication policies and activities, Public understanding surveys and indicators of scientific production on nontraditional media like magazines.

In the three cases we will show the type of information that is needed, the sort of indicators that can be developed and the possible methodologies to exploit different sources of information like factor analysis, social network analysis and data mining. Finally, we will propose a future agenda of S&T culture indicators in the framework of a national system of science and technology.

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