A Point of View: Sciences, Societies, Cultures and Their Evolutions

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Abstract Scientific research is now a large international activity and has become very professional with many connections among researchers, but also has formed an alliance with the world's economic sphere. The benefits of research are mainly oriented towards economic competition. More recently, a local to global movement has been born with a goal to promote a *bottom-up* approach to research questions. Participative researches could be the new paradigm of the *knowledge society* promoted by the European Community and the main part of the *Science in society* scientific domain. Many initiatives have been developed at different levels of interaction with the public and they are in a position to continue making significant contributions to the democratization of sciences.

Keywords Science in Society · Participative research · Collective research · Citizen scientist · Commons · Responsibility in research and innovation

1 An Introduction

The relationships between sciences and society are, today, subject to some serious contradictions. A strong rejection of sciences, extending to blind technophilia, has been observed, and the voices of civil society actors have become audible. Some recent technoscientific overflowing, combined with the increasing need for participative democracy, are the main reasons (Sclove 1995). It is urgent that we question the linkage of the sciences, not only between themselves but also with such diverse entities as *profane* knowledge and *Civil Society Organizations* (CSOs). The difficulty in building cooperative support for a wide variety of scientific researches, at the same time interdisciplinary and open to other highly influential partners, is characterized by numerous gaps in understanding and perceptions of differences in goals. Among them are: very few reflections on the choice of disciplines to be involved for global research, failure of methodology for interdisciplinary dialogue,

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R. Pisano (ed.), *A Bridge between Conceptual Frameworks,* History of Mechanism and Machine Science 27, DOI 10.1007/978-94-017-9645-3_28

little convincing relevance of evaluations making difficult the capitalization of best practices, lack of tools to codify and share knowledge, low recognition of experimental facilities, absence of ethical guidelines, etc. The disciplinary approach to the sciences has, from the beginning of scientific awareness, allowed a considerable inflation of acquired knowledge and, in modern times, the technologies of information and communication have made accessibility an ever more powerful reality. However, it seems important to continue to better synchronize scientific research with the societal and environmental stakes inherent in this acquired and accessible knowledge. A question arises*: How can we imagine a link between the field of the sciences, which are disciplinary, and that of our multiple-faceted society where problems are strongly transdisciplinary*? A scientific mediation appears fundamental to answering the societal stakes.

2 What Possible Perspectives Exist for the Sciences in Society?

In order to re-open debate on scientific and technological questions, the *knowledge society*, as defined by the *European Union,* could open a bottom–up perspective on the sciences in society, replacing the top–down approach known commonly as the *knowledge economy* (Wynne 1991). This potential extension of the field of scientific research answers the question of connections with the sciences of information and communication. Technologies are at a very high performance level today but real communication between them and the public at large remains weak, especially considering that mediation of scientific knowledge is central. *What about scientific mediation for whom and by whom?* The institutionalized and recognized scientific mediations are the ones of the scientific and technological cultural centers and scientific journalism. They constitute the emerged part from an iceberg in the making. The recent phenomenon of *participative researches*, which renews the need for scientific mediation of knowledge, still remains too little known and too parsimoniously funded. Of course, it is necessary to know what sort of participative researches are in the lead. The answer to the implied question is thorough analyses that will lead to a real understanding of research activity and the best practices of such researches. Beyond these analyses, a theoretical approach will be able to develop promotion of participative researches while avoiding exploitation of the CSOs. For example, some research groups use citizens simply as labor for gathering data. The group then does not associate the results to the hypotheses, concepts or methodologies underlying the data. It is the same whether the results are tightly held or are published. Moreover, with the development of data mining, some researches are conducted without the knowledge of the participants, e.g., gathered from their intelligent phones. (Irwin 1995; Stilgoe 2009). Other projects, in the case of more traditional researches by companies, aim to determine the acceptability of selected technologies. Researchers in humanities or social sciences are more and more involved in such programs for questioning people on their using or testing some products. These practices are new but they do not give automatically a scientific

caution for complex researches, generally controversial. In these cases, we speak about embedded scientists.

3 A New Scientific Dynamism

A research challenge today is to analyze participative researches, which have different significances. Recently in France, the association for a "Fondation Sciences Citoyennes" has recorded 200 experiences of scientific works realized within civil society Storup (2013). Perhaps, in a short analysis, we can distinguish three different realities, which can be evaluated by public engagement: participative, cooperative or citizen researches.

We use the term *participative research* for the well-known phenomenon of the amateur scientist that has existed for a long time (Gall et al. 2009; Joss and Durant 1995). Typically, astronomy or biodiversity studies benefit from the data collected by citizens interested in these scientific questions. They are trained by a scientist to properly collect thousands of data. There has been a deep mutation of this process by the increasing use of information and communication technologies. Many people are involved in these researches throughout many small associations. I think that we can speak of a truly active scientific mediation. Academic researchers are the main users and managers of these kind of studies.

More recently, a new type of interaction between scientist and citizens emerged. We call this *cooperative research*. In this case, the research program is co-constructed between a CSO and an academic research laboratory. These programs exist in France at a regional level. They have increased slowly since 2005. We have today three different regions on twenty two where these well funded programs exist. The first of them, created in 2005 in the Ile de France region, is the *Institution Citizen Program for Research and Innovation* (PICRI). It was followed in 2009 by the *Social appropriation of sciences* (ASOSc) in the Bretagne region and in 2011 by the *Scientists-Citizens Program* in the Nord-Pas de Calais region. The research subjects are very different, varying from humanities to more technological realizations. It is interesting to note that a number of such submissions are made each year, showing a real interest and a social demand for research. In the same way, the ministry of sustainable development has created a national program called *Exchange and Projects Network on the Piloting of Research and Expertise* funded in 2009.

The last type is the *citizen research* where the research promoters are the CSOs. We have now non-governmental organizations, which have sophisticated measurement means. They, for example, realize counter-measurements for evaluating the quality of an expert's reports but also, they can build a research program in collaboration with an academic department.

At the international level, we observe the same dynamism. The United Nations Educational, Scientific and Cultural Organization (UNESCO) has created a chair at the University of Victoria (Canada) in 2012 entitled Community-based Research and Social Responsibility in Higher Education. This chair is co-animated with Participation Research In Asia (PRIA) located in India.

Special mention must be made of the establishment of science shops. I consider these shops to be tools for developing a scientific *mediation in situation* between actors of civil society and the world of research, with transdisciplinary questions on societal issues, health, environment, energy, etc. Science shops are organizations that provide access to academic knowledge and research at a low cost (Hellemans 2001; Mulder et al. 2006). This structure recognizes the social demand for research, evaluates the research level required (bibliographic study up to experiments) and establishes connections with research units. Three conditions are required for accepting demands. Firstly, the customer organization has no monetary object and no financial means. Secondly, the research results must be published in peer-review or open access journals to insure common availability. Thirdly, the customers must have the capacity to use the results for accomplishing their social objective. There are many different models around the world. In the Netherlands, most shops are found inside universities. They can be attached to departments and known as the physics shop or the biology shop. In Germany, most of these structures are outside universities and are funded directly by foundations or by the government and the European Union. The *Science in Society* area, a part of the European Research Area ERA), is actively promoting a European network of science shops. Note that there already exists an international network named *Living Knowledge*. It can re-evaluate what we expect from science, and in the future, this structured network could influence science itself.

A large part of society challenges knowledge as an *ivory tower*, and consequently also takes little notice of the condition of research realizations. This is true for pure academic researches but also for research projects associated with companies. Citizens in general claim their interest in opening of research practices to their needs. Everybody knows today that scientific research is a key to a better understanding of the global world, but under some conditions. Participative researches underline the contradiction between the dominant questions on which researchers work and the true questions asked by the people. They contribute to the empowerment of CSOs about scientific and technological questions. The logical follow-up is that they can question the starting hypotheses, the methodology employed during the researches and more globally the epistemology. However, do not be afraid. Researchers could be interested by such approaches. The hyper specialization of scientific disciplines no longer allows narrow interests to determine research directions. Moreover, the obligation to get results (publish or perish) and a feel of a *taylorization* of scientific work could make participative researches attractive for researchers.

4 On the Horizon 2020 Initiative *Science in Society*

As I have mentioned before, the program *Science in Society* belongs to the European Research Area. It has existed since 2001 and some evolutions have occurred. A new instrument called *Sciences with and for society* has been defined for *Horizon 2020*. The goal is to develop new original ways for increasing connections

between sciences and society and for demonstrating their innovative character as well as their economic, social and environmental sustainability. The principal interests for this instrument are how to fashion a more attractive appearance of science or how to raise the appetite of society for innovation. It hopes to work together with all societal actors during the whole research and innovation process. This approach is called Responsible Research and Innovation. These topics seem to me the true challenges. The technoscientific solutions today are very complex, with many socio-economic, political, ethical and environmental externalities. In this way, we must also consider that the CSOs and stakeholders could participate in the co-constructions of research programs, and not only on their technological acceptability. The true innovative process for research and innovation in this domain will be mixed academic researches with associative members. Four calls are proposed for 2014–2015, but the more interesting call is entitled *Integrating society in science and innovation*. Clearly, the European Union wishes to improve the integration of society in science and innovation.

5 What Conditions are Necessary for Democratization of Sciences?

All these issues put the question of relationships among all disciplinary researches, which have today multiple subdivisions. The specialization of researchers, their professionalization, but also the complexity of their experiments and measurement tools, aim at autonomous sub-disciplines. If this way, defined by Descartes and called reductionism, has led to an extraordinary sum of knowledge, this one today is dramatically fragmented. If disciplinarization remains necessary, the inverse way, defined also by Descartes (understanding the whole by understanding each part) must be seriously investigated today. *What should be meant by seriously?* It signifies that more means must be affected to transdisciplinarity by creating new types of laboratories in each university where researchers come from different scientific horizons. These new laboratories must be connected with the civil society. Each transdisciplinary laboratory will have its own methodology that depends on the social and natural environment. A first consequence is that we are going to reconnect science with society, but also it will increase the *biodiversity* of research subjects (Farkas 2002).

Better national and European supports could make more fertile the hillside of the participative researches. They could gather a large number of different initiatives: collaboration with amateur associations for the collection of data; cooperation for building joint research projects; eventual citizen researches where some associations employ researchers (doctors, engineers) or can fund academic groups; etc. Nevertheless, these experiments, however rich, are still only experimental and leave the majority of profane actors outside of the research system. The emergence from the CSOs of their enhanced knowledge is a chance for the academic world, which should welcome such a chance, not to make it an ultimate research subject,

but to find a balanced relationship with the citizens. This opening way could allow us to be more synchronous with reality and to more fully apprehend the stakes of a planet that may in the near future be occupied by about 10 billion human beings.

6 Conclusion

We have seen that participative researches are a real dynamical movement coming from society. They define the relationship between the two spheres: scientific research and society. We are about to know and/or to understand, to verify and/or to answer, but also to put in relation the projects of society and required knowledge. It is quite different with research judged by one's peers or associated with companies. We have seen also that these researches are more and more supported by institutional organizations at regional, national and international levels. In consequence, it is fundamental that academic institutions where research is done (universities, colleges, engineering schools), take a part in this movement. Be sure that real research efforts in that complex lead to forging new forms of knowledge and new methods to get into the sciences in society. For better or for worse, science is now being shared with more and more actors from civil society organizations.

Is it necessary to be afraid to democratize the research?

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