258. Public Engagement with Nanotechnology: Initiatives, Strategies and Challenges

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Abstract. Public engagement with science and technology (S&T) has assumed significance in recent years particularly in the context of emerging technologies. Public engagement implies that the public, as non-experts, are an integral part of all deliberations on policy, regulation and governance of S&T. Increasing scholarly attention in science and technology studies (STS) is given to public engagement in nanotechnology (NT), arising at the intersection between science and society in both developed and developing countries. This paper discusses the role and importance of public engagement in NT; attempts to map the various initiatives as well as strategies for NT governance and identifies various challenges to be addressed for its responsible development.

Keywords: Emerging Technologies, Nanotechnology, Public Engagement, STS

Introduction

Engagement in common parlance is used to mean involvement. Public engagement has become an umbrella term covering public consultation, public discourse and public involvement. Public engagement with S&T can be attributed to a tendency towards increased democratization of science. It can also be seen as a reaction to technology development policies that are seen as contributing factors to unacceptable technologies. Whatever the reason, stakeholders–government, business groups, scientists, citizen and interest groups–are currently arguing for the radically new technologies like nanotechnology (NT). NT is currently referred to as leading, innovative research field. Besides revolutionizing a range of scientific and technological areas, R&D in NT promises to have favorable environmental impacts, on the one hand and on the other, adverse health implications of particles at the nanoscale level are compared to those of asbestos (Poland et al., 2008). The most prominent are the messages that portray nanotechnology as "the asbestos of tomorrow" (Scheufele, 2006).

This paper intends to answer questions such as: What activities are contemplated under the label of public engagement? How public engagement is ensconced in science and technology studies (STS)? Why is it important? It then outlines the need for public engagement with NT and examines how dialogues, initiatives and resources in NT have been utilized in various countries to engage the public. To do this, a review of the existing literature and policy documents was undertaken. An attempt is made to map the various public engagement initiatives worldwide in terms of degree of spontaneity and intensity of engagement by adopting the theoretical framework originally developed by Bucchi and Neresini (2008). We also consider the perspectives from institutions and organizations collected during field-surveys on NT in India. Finally, the paper addresses various challenges for engaging the public with NT.

Science, technology and public engagement

What are public engagements? According to Nanotechnology Engagement Group (Gavelin, et. al., 2007: 9), public engagements are "all the different ways in which institutions interact with the general public outside of formal democratic structures such as elections". In this definition, institutions include members of what we call the NT establishments (government, scientists, technologists, academic researchers and policy-makers). Public engagement

with science and technology (PEST) has become an important new dimension as well as a specialized area of investigation within STS. It springs from a report, The Public Understanding of Science, which was published by the Royal Society in 1985. This report provided how scientists learn to communicate to non-scientists later known as the 'deficit model' of science communication. Here the public is assumed as ignorant and needs to be educated by scientists with the aid of the state. It legitimates further public expenditure on science through popularization programmes and pays no heed to the public response. In fact, science could be problematic for society if the latter is ignored.

Today the debate has gone beyond the 'deficit model' in science communication studies. An attempt in the deficit model arose when government scientists in 1986 tried to protect consumers from sheep contaminated by the Chernobyl disaster. But a classic study in this regard by Wynne (1989) showed that scientists didn't pay attention to other available knowledge when making claims in the Chernobyl case. Because scientists did not consult with farmers on how to best monitor grazing habits and take samples from the sheep, leading farmers to directly witness the messiness of scientists' sampling methods. The scientists' ignorance, lack of interest in local realities, and imposition of false assumption about the agency of local people ended up in a loss of trust among the farmers and the consecutive failure of scientific experiments and predictions.

Wynne's study suggested a new perspective of engagement of the public with science and later known as the 'public engagement' model. In the deficit model, the public distrusts science because it is ignorant, but in 'public engagement model' the public distrusts science because it has good reason to. The latter model established the agency of the public and demanded scientists to be more reflexive in science. This model has been widely accepted now as participation by public in dialogues or engaging with science and expertise without agency is impossible. In case of a technology like NT there is a need to increase awareness, involve stakeholders like trade unions in dialogues about occupational health issues, address concerns of consumers about product safety, discuss with environmental groups about the environmental impact of nanoparticles and nano-products and instill confidence about the regulatory regime.

What makes new technologies like NT worthy of being engaged? According to Toumey (2006), NT and public engagement have come to the fore at the same time "is a historical coincidence, not a scientific result". In the 1990s, it emerged into public knowledge that genetically modified organisms (GMOs) had been added to the human food chain without public consultation (Gavelin, et. al., 2007: 2). In 2003, the British government began the GM debate and reviewed the science and the costs-benefits of GMOs? It consulted widely with citizens about why they opposed GMOs. Unfortunately, towards the end of the 1990s, as consumer anger was reaching a peak, civil society had convened conferences, and these were organized long after large companies had invested heavily and brought products to market. The government initiative was seen as "too late" (Ibid: 4). It is reported that the government's desire to appear 'precautionary' led to a reactionary ban of GMOs, and public consultations that favoured environmental lobbies.

The public biotechnology (BT) debate has been pervasive in shaping S&T discussion in the field of NT (Gaskell et. al. 2005). The two fields show intrinsic similarities, not on material level but regarding their scientific, commercial, and governmental framing, and the actors involved in science communication. Experts in science, social science, civil society organizations, and technology assessment (TA) offices who had worked in public relations in biotechnology often became involved in the field of NT (Barben et. al. 2008). Thus, public engagement in the field of NT was from its beginning shaped by three factors: (i) the idea that science communication should have "learned lessons" from earlier S&T related controversies such as agricultural biotechnology; (ii) the idea that science communication in the notion of Public Understanding of Science (PUS) was "ill-defined" and not the right way to create public acceptance' (iii) the claim for a broader involvement of the public in decision-making of S&T issues, in the notion of open democratic governance.

Public Engagement in Nanotechnology

Why do we look at what kinds of engagement have been undertaken? One reason is to illustrate how the shift from downstream to upstream and from one-way to two-way engagement is still going on. Primarily, we give a sense of what it is that we are discussing when we talk about public engagements. To understand these engagements, we have used the adapted version of the framework, originally developed by Bucchi and Neresini (2008), to map public participation in NT. In Figure 1, the X-axis denotes the level of public engagement in knowledge construction process. It is characterized by two extremes in the continuum ranging from low to high level of engagement. The Y-axis denotes the continuum of extent of public participation elicited by a sponsor to the spontaneity. In this diagram, a wide variety of forms and cases of public engagement exercises in NT can be mapped.

The upper left quadrant comprises forms typically elicited by a sponsor and characterized by low-intensity participation of the non-experts in the knowledge production of NT e.g. the public opinion surveys, citizen's conferences and citizen consultation exercises.

Public Opinion Surveys: This method of engagement has been the Danish and Spanish Board of Technology's response to NT engagement so far. Their surveys or interviews meetings involve a questionnaire to ensure that all thirty participants have a chance to be heard, and the group interviews provides some context for why people believe the things that they do about a given technology. This allows organizers to ask the questions that they think are important. These events take three hours of a weeknight and participants are sent material beforehand to get them acquainted with the subject. Participants are selected based on getting a range of representation, and on a lack of prior knowledge of the technology in question. The topics that are typically considered are complex, new and have an ethical component to them. The results of these interviews are published in a report and made available to policy-makers. Danish NT survey showed an overview of what those citizens found to be important. It found that citizens are excited about the possibilities of NT having a feeling that Denmark should take an active role in the development of NT. However, the interviewees urged for the technology to be developed for socially beneficial ends, and actively opposed developing the technology just to improve consumer goods and enhance human biology. Similarly, public opinion surveys were conducted in Spain for a project 'Dialogue on Nanoscience and Nanotechnologies' and disproved the stereotypes that public has little interest in S&T issues.

Citizen Conference: The most common form of engagement exercise is the citizen conference. It is being used in France, England and Switzerland. For example, Nanomonde and Nanoviv in France helped in generating public awareness and identify potential problems and solutions related to the development of NT. Nanoviv, a series of "public debates" organized in Grenoble by Vivagora, an association led by a small group of former science journalists. The objectives of Nanoviv are the 'identification of the actors and stakes', and 'formulation of recommendations for policy-makers'. These events normally last between one evening and few days. Participants are recruited through advertisements in a regional paper, or at universities. After expert presentations, participants from groups and discuss their viewpoints and have questions answered, before a plenary session summarizes the conversations. These events center on a particular issue or scenario.

The lower left quadrant in the diagram is characterized by spontaneous mobilizations through protest group. Protest groups use non-institutional means of communication e.g. Topless Humans Organized for Natural Genetics (T.H.O.N.G.) has protested in front of an Eddie Bauer clothing store in Chicago over the issue of health problems that could result from using coatings of NT in textile industry for manufacturing clothing. However, such actions have a little impact on influencing the dynamics of research because they lack argumentation, mission statement and list of members.

The lower-right quadrant includes spontaneous participatory forms of knowledge production through non- government organizations (NGOs)/Not-for-Profit Organizations (NPOs) without a deliberate sponsor.

NGOs/NPOs: They promote their positions through research, consultancy and lobbying. In the NT debate, these groups include ETC, Greenpeace, the Loka Institute. For example, the Action Group on Erosion, Technology and Concentration (ETC) Group is the organization calling for a halt to NT research and distribution until the sociological and safety issues are more thoroughly addressed. Interestingly, though the group has been consistent in their call for a moratorium, this is not the group's primary concern. Their primary recommendation is "that

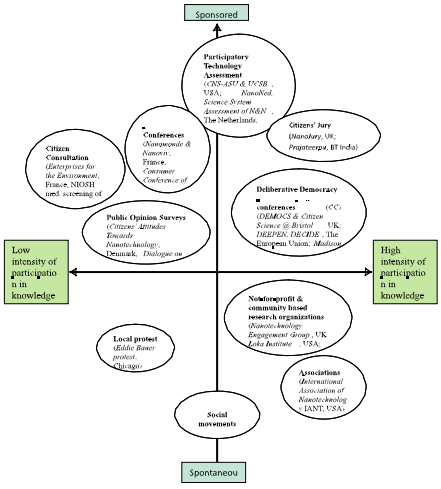

Figure 1. Framework for public engagement in Nano science and technology research Source: Adapted from Bucchi and Neresini, (2008)

society become fully engaged in a wide discussion of the role of converging (nanoscale) technologies" (ETC Group 2004: 53). This includes involving marginalized people, who the group holds in focus through their critique of this technology.

The upper-right quadrant is characterized by high degree of elicitation and high intensity of participation by a sponsoring institution such as consensus conferences, citizen jury, and deliberative forums.

Consensus Conference: It is being used in University Communities of Wisconsin and North Carolina, USA. This involves two preliminary, weekend-long meetings wherein a group, made up of fifteen to twenty lay-people from a variety of backgrounds, is introduced to the technology in question. They decide what issues are most important, debate those issues, and develop questions that they put to invited experts from the sciences and humanities, businesses and NGOs. A consensus conference topic should be "topical, not too abstract, contain conflict, call for clarification of objectives and attitudes, depend on expert contribution for clarification, necessary knowledge and expertise are available" (Grundahl, 1995: 2). Recent topics of consensus conferences in Denmark have included social topics
(technological marginalization), environmental concerns (renewable construction), and topics that are of interest mainly to those in scientific fields (research grant size, information technology management).

The actual consensus conference occurs on a third weekend, and is open to the general public. Here the initial questions are answered, more questions are asked and the experts respond again. Finally, the citizen panel produces a consensus document based on the opinions of the participants. The involvement of the lay panel is stretched over three months. Consensus conferences support both quality and responsibility. By giving participants lots of time to consider evidence provided by several experts they can come to well-reasoned judgements, which will lead to better conclusions. They pass these conclusions on to those that attend the final conference and read their report. Furthermore, in Denmark these events sporadically garner wider public attention, leading to a lively public conversation, which reinforces both the feeling of responsibility that people have, and their ability to judge what options will lead to high quality.

Citizen Jury: The most intensive form of public engagement has, so far, been the citizen jury. NanoJury, a citizens' jury on nanotechnologies in UK organized by the Cambridge University Nanoscience Centre, Greenpeace UK, the Guardian, and the Policy, Ethics and Life Sciences Research Centre (PEALS) Newcastle University and used the method of "two-way citizens' jury." The UK Nanojury used a group of twenty-five randomly selected people and met every weekend for six weeks. To persuade people to give up so much of their time, they held another citizen jury before the nanotechnology jury based on a topic, youth crime that the participants chose themselves. The plan was for this group to have more control over what was brought up, being able to call the experts, or 'witnesses', that they felt were important. In general, jurors found the witnesses to be either pro or con, resulting in a more confrontational event than the one on youth crime. At the end of this process, the 'verdict' of recommendations was presented to regulators.

The few unanimous recommendations concerned continuing public engagements, labeling NT products clearly, and making funding transparent and tied to socially responsible projects. Consequently, the jurors wrote recommendations for nanotechnology's future development in the UK and received a promise from the Department for Business, Enterprise and Regulatory Reform of a response. The framing of the public as "citizens" and "jurors" and scientists as "witness" or "audience" reversed the traditional roles and thus supported the idea of mutual learning and two-way communication.

Deliberative Forums: It involves citizens, stakeholders, experts and decision-makers, for an in-depth understanding of socio-ethical challenges and implications posed by NT. For example, Deepening Ethical Engagement in Emerging Nanotechnologies (DEEPEN) of the European Union.

As part of the IDRC supported project on "Capabilities, governance and nanotechnology developments: a focus on India", The Energy and Resources Institute (TERI), a premier think-tank in India, carried out a field-survey for a period of two and a half month. The survey showed that scientists agreed for the communication and public engagement with NT as essential to avoid unexpected or unintended negative consequences. Since NT has been perceived as a much-hyped technology during the survey scientists remarked that "hype-generation is dependent on media due to the accessibility of various media to the scientists". A bio-medical scientist at a leading technological institute for research and education said that "awareness is good thing, hype is not, and paranoia is not. Rather there should be correct awareness". NT awareness can be done through campaign, public forums, exhibitions (e.g. where they showcase NT products, the potential applications of nano-medicine etc.), and seminars regarding its various features such as cost-effectiveness, user-friendliness, eco-friendliness and efficiency. Scientists agree that if there were

greater public awareness of NT then there could be more support towards it. NT community should come forward and publicize more materials in this regard and finally the government should advertise ongoing NT research in that country.

Challenges and the way forward

The biggest challenge for public engagement in NT would be first of all to ascertain what do we collectively (aspire to) mean by public(s) and thereupon to ensure a wider representation of 'publics' during the process. Given the fact that the nature of technology is so complex with even scientific community finding it difficult to comprehend, there could be a possibility of engagement from only highly informed groups that are not truly representative and may not reflect the views of widely segregated and differentially capable 'publics'. Further who can speak for publics? NGOs and other "voices of civil society" have their own axes to grind? One significant dimension of the problematic of the PEST is how non-experts can understand, discuss and debate the latest developments in S&T such as NT and its most notable products. The question of the PEST is challenging because it is fundamentally about the participation of non-experts in S&T. In this regard, Melissa Leach and Ian Scoones proposed a set of 'citizens' commissions for S&T futures at the local, national and global scale in developing countries addressing particular sectors, technologies or policy issues, and generate input and perception of people about S&T, and the way in which it should be governed.

It is needed now to develop an appropriate public education programme about NT. It will bring the involvement of many publics. Many people will get virtually all of their understanding about NT from such programme. The entire NT community – scientists, engineers, policymakers, social scientists, lawyers, journalists, indeed the public at large – has much to gain from efforts to put into wide circulation better information about the nature of NT and what its realistic opportunities and risks are. More than anything else, institutions should promote and support avenues for discussion about the issues associated with NT. By doing so, would help overcome the cross disciplinary and cultural boundaries. Only with such new habits in place, one can fully tap NT's potential while avoiding its problems.

Concluding remarks

The theoretical framework emphasizes upon the fact that it is difficult to predict the outcomes of any public engagement exercise based on the structural features and sponsors' objectives. It would be important from the policy perspective to gain an understanding on conditions under which these diverse range of initiatives emerge. To conclude, a prudent approach to engage with NT could be to address the interface between NT and society from the perspective of social equity, social purpose, and structure of economic and social enterprises. Towards this, building up expertise in social science research in NT and increasing investment on the issue of public engagement in emerging technologies could help immensely. Finally, negotiations and deliberations between experts and lay people would provide new directions for research.

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