THE HINDU

**Date:10/02/2011 URL: http://www.thehindu.com/2011/02/10/stories /2011021054541200.htm**

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# The public and issues of science

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*A public debate on nanotechnologies in The Netherlands raises awareness about the risks involved, and also creates support for the development of the field of science.*

Science and technology are now more important for the development of a country than ever before. Increasingly, however, the public seems to be suspicious of scientists' work.

In India, Minister for Environment Jairam Ramesh was led by public consultations to declare a moratorium on Bt Brinjal. Last year in Germany, opposition to nuclear power reached a new high. And in 2009, a vaccination campaign against cervical cancer in The Netherlands failed when the majority of 12-16 year old girls, for whom the campaign was designed, refused vaccination against the almost unanimous advice by scientists.

Do we need new forms of relating the public to science and technology? Do we need to innovate the social contract between science and society as it has existed since the times of Wilhelm von Humboldt's (1767-1835) autonomous university for the Bildung of citizens, or Vannevar Bush's ( Science The Endless Frontier, 1945) pure science that could be trusted to deliver the goods?

On January 27, 2011, the Dutch public's agenda on nanotechnologies, titled "Responsibly forward with nanotechnologies," was presented to Joop Atsma, State Secretary of Infrastructure and Environment, Government of The Netherlands. In this public's agenda, the people of The Netherlands speak out about their priorities for nanotechnologies research and development: what to do and what not to do, what do they fear and what do they hope for, how to balance the risks and the benefits? This public's agenda resulted from the Societal Dialogue on Nanotechnologies, held between January and November 2010.

Nano science and technology deal with the very small: building blocks smaller than one millionth of a metre are used for new materials and instruments. Several products in the market such as sunscreens, anti-bacterial surfaces, automobile tyres, and some anti-cancer drugs already incorporate them. The promised benefits are large, and there is no field of science and technology that does not have potential applications of nanotechnologies (hence the use of the word here in the plural).

But there are possible hazards, too. Scientific evidence points to toxicological risks. Nanoparticles of gold and silver seem to be seriously toxic, while gold and silver as bulk materials are inert and safe. This is worrying: there is scientific evidence of toxicity, but not yet absolute scientific certainty about that nanotoxicity. Unlike in the cases of asbestos or radioactive radiation, where we have absolute scientific certainty about the risks, nano-scientists do not yet have the complete story on nano-risks. But we know enough to be worried about the application of especially synthetic nanoparticles.

The most striking result of the Dutch Societal Dialogue on Nanotechnology is that now, after the dialogue, the general public in The Netherlands is more aware of the risks of nanotechnologies, and at the same time more supportive of the further development of nanotechnology.

At first sight this is surprising and in sharp contrast to the long-held views on the relation between the public and science. The standard views about the "public's understanding of science" and the need for better "risk communication" are that the general public does not understand science and technology sufficiently to appreciate its benefits, and that because of this lack of knowledge it irrationally fears new science. We now know, however, that the Dutch people are more fearful of a government that hides the potential risks of nanotechnologies than of those risks themselves — when monitored and researched well.

Let me give an example. Several hundred Tenth Grade students in schools around Maastricht worked during three months on nanotechnologies, often in their physics or chemistry classes. They started with laboratory experiments related to nanotechnologies and did literature studies using the Internet. They then broadened their agenda to also address questions of benefits and risks. Project groups prepared reports and films about the future of specific nanotechnologies, which finally were presented at a conference attended by students, teachers, some politicians, industrialists and scientists.

As a physicist and teacher, I was impressed by the level of knowledge displayed in these presentations; I was equally excited by the students' well-informed personal positions on the future of nanotechnologies.

They certainly did not all agree with each other. Some were suspicious of the multiplier effect that nanotechnologies might have on existing power relations: "Most developments are spurred by commercial aims, and multinational companies will acquire even more unchecked influence than they already have." Others especially valued the promises of better medical diagnosis and treatment. But the latter group asked for prudent studies of risks, as much as the first group concluded that nanotechnologies research should proceed.

Four elements were crucial in the set-up of the Societal Dialogue on Nanotechnologies. One element was that an independent committee was responsible for the organisation of the dialogue. This clearly added to the credibility of the process, since the Dutch government could not interfere and push its own agenda. Whether the price of a consequentially limited political clout was worth paying is still to be seen.

The second was that the committee created a three-step process of providing information, raising awareness and having the dialogue. This was necessary because knowledge about nanotechnologies amongst the Dutch people was weak. First, information had to be given and awareness raised, before a proper dialogue was possible.

The third element was that most of the substantive work was outsourced, to keep the organising committee credibly independent. Almost 40 projects performed the information, awareness and dialogue activities. The committee had a budget of euro 4.5 million (Rs. 28 crore) and selected these projects after an open call for proposals. A broad variety of scientists, NGOs, firms, and individuals was responsible for these projects.

The fourth crucial element was that the use of a broad spectrum of media (from TV and Internet to science cafés, theatre plays and teaching materials) and the participation of a wide range of people (from children to scientists, from fundamentalist Christians to Muslims, from patient organisations to industrialists) contributed to the solidity of the resulting public's agenda.

This set-up worked well. Parallel to the process of the dialogue, the knowledge and opinions of a representative sample of the Dutch population was surveyed. “Having heard of nanotechnologies” increased during the societal dialogue from 54 per cent to 64 per cent of the Dutch population, and “knowing the meaning of nanotechnology” increased from 30 per cent to 36 per cent. An analysis of the process brings the committee to conclude that it was especially the heterogeneity of means that proved successful. Rather than a naïve belief in the Internet as a “global panchayat,” the committee used a combination of small-scale but specifically targeted activities, with large-scale broadcasting and publishing via TV, printed media, and the Internet (see www.nanopodium.nl).

This dialogue thus yielded an interesting result that is potentially farther reaching in terms of its societal importance than the regulatory governance of nanotechnologies. A decade ago, the Dutch people opposed GM foods. Most analysts agree that this resulted from a public debate that many perceived as biased towards the pro-GM lobby. In contrast, the Dutch people are now in favour of cautiously proceeding with nanotechnologies, while recognising its risks. The general attitude certainly is not anti-science; but the public is not prepared, as in the 1950s, to give scientists a blank cheque either. Instead, a continuous critical appraisal of the risks and the benefits of science seems to be called for: a new form of democratic risk governance.

The mechanisms to provide such a risk governance of science and technology are not readily available. The Societal Dialogue I described is just one example. Countries need to experiment with such innovations of democracy, as much as scientists experiment with the new technologies that shape our world. It is unlikely that what worked in The Netherlands will work in India, and vice versa: the difference between the proverbial consensus-oriented Dutch and the equally iconic diversity-celebrating Indians may be too large. But the democratic issues remain just as pressing.

Can The Netherlands find ways of democratically coping with the oppositions around

nuclear power: the ‘new' benefits of lower CO2 emissions versus the ‘old' risks of nuclear waste storage, the ‘old' benefits of energy autonomy versus the ‘new' risks of international terrorism? Can India find ways of democratically reaching a well-informed and broadly shared policy on Bt Brinjal by moving the current moratorium to a next phase?

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