Towards a Knowledge Commons by Recognizing the Plurality of Knowledge— Experiences with democratic governance of science and technology

Wiebe E. Bijker
(Maastricht University, The Netherlands; and KICS, Hyderabad)[1]

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What could "knowledge commons" mean? One interpretation would be: The best knowledge made commonly available to all. In this interpretation, it is implicitly assumed that there is *one best type* of knowledge, and typically this one best type is then taken to be modern scientific knowledge. In this paper I will argue for a second interpretation: "knowledge commons" is the common sharing of a *variety* of knowledges. This interpretation builds on the recognition that a plurality of knowledge systems exists; and one of these systems is scientific knowledge; and that a variety of 'common' people also have valuable forms of knowledge and expertise.

An international project with participants from India, Africa and Europe has been working to give more recognition to the plurality of knowledge. This paper traces some of the roots for that project in current practices of democratic governance of science and technology in Europe. It will thus describe some of the groundwork on which both the Indian and the African Manifestos for Science and Technology have been founded.[3]

Setting the scene

In the town near the coast of Andhra the Nawab was the ruler. He was a wise and powerful man. In a nearby village there was this perfume maker, who was revered as the master perfume maker by everyone in the village in the town. For years he had been experimenting to make a unique smell. He took years to work on this. People were—perhaps because he already was a master craftsman—a bit ridiculing him: why is he spending years and years on perfecting this perfume? Finally he had a small bottle. He took it to the town and intended to give it to the Nawab. He goes to the Nawab. By that time there is an institution in place, which gives a validation and recognition to any practice. The institution has wise people and foolish people. The Nawab is the true appreciator of things, but he was also governed by this group of people. So this craftsperson could not get access to the Nawab. Day after day he was going there, trying to negotiate entry. He did not

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[1] Wiebe E. Bijker is professor of technology and society at Maastricht University, the Netherlands. He was trained as engineer (physics) and holds a PhD in history and sociology of technology. Bijker has chaired governmental advisory committees in the Netherlands on biotechnology, nanotechnology and the role of precaution. His most recent book (with Roland Bal and Ruud Hendriks) is Paradox of Scientific Authority, MIT Press 2009. Bijker has been a core member of the Knowledge in Civil Society (KICS) forum in Hyderabad since its creation in 2005. w.bijker@maastrichtuniversity.nl

[2] I apologize to the reader: this paper still needs some serious editing.

[3] For more information on this European-funded project, including the draft Manifestos, see http://www.set-dev.eu/ .

get access to the ruler. After two weeks he took the perfume, wrapped in layers and layers of cloth because he did not want even a whiff of the perfume by others to smell before the King had a chance to actually appreciate it. So, at the end of 15 days, when he was denied access again, he unwrapped all the cloth, broke the bottle of perfume in front of the palace gates, and went away. Within seconds the entire palace establishment came running, because the smell was everywhere. And everyone immediately knew who was the craftsman who had made it. And the Nawab ran to the village, to the craftsperson to remedy the mistake. But the craftsman refused to remake the perfume.

This story is about the location of knowledge, about its also being located in craftspersons. If I say that we want to relocate knowledge in the craftsperson (such as the perfume maker or the handloom weaver), I use "knowledge" in a specific way. Knowledge is a heterogeneous combination of abstract and concrete, of practice and science, of local and universal: it is socially positioned, and it includes knowledge about and handling of technology.

This observation of knowledge being localised leads to the conclusion that we need to recognize a plurality of knowledge. Since knowledge is socially rooted, and since there is a plurality of contexts, knowledge must be plural too. With this plurality of knowledge, there also is a plurality of technology, of invention, of social identities, of communities, of democracies.

The perfume maker was an inventor. He had a broad and deep knowledge: not only his craft knowledge (about how to make a perfume), but also marketing knowledge (about which smells are valued). We can only understand our perfume maker when we describe him as having knowledge in this broad sense. Equipped with that knowledge he was more powerful than the Nawab. The Nawab begged him to remake the perfume, but the perfume maker refused and the Nawab could not do anything about it.

This paper is about the power of the knowledge of the commons, and the need to incorporate commons' knowledge into the governance of our world. After a general argument to recognize a plurality of knowledge, I shall analyse the role of expertise and argue that a spectrum of expertise needs to substitute the simplistic dichotomy between expert and lay knowledge. I will then conclude with a report about a recent experiment with democracy in the Netherlands, in which we tried take the previous arguments seriously by giving a voice to this broad spectrum of expertises in a societal dialogue on nanotechnologies. This societal dialogue I thus submit as an experiment on incorporating commons' knowledge into the governance of science and technology.

Plurality of knowledge

Science and technology have played a crucial role in the development of India.[4] This encompasses centuries-old traditions of medical, architectural and agricultural science, as well as recent investments in science and technology that moved India to the forefront of international modernisation in the global south and east. The latter has resulted in giving India a prominent role in the international scientific communities of most natural sciences, engineering and agricultural disciplines, social sciences and humanities. The expertise that these scientific and

[4] This is true for all current societies and cultures, and many old ones. Since this paper was written in the context of developing an Indian Manifesto for Science and Technology, I will focus on India.

engineering practitioners have is duly recognized in Indian society and Indian policymaking and politics. This manifesto will argue that other forms of expertise—typically labelled as non-scientific—need to be incorporated into scientific policy making when aiming for a long-term sustainable culture and society.

Indian society has a long history of recognizing that there are varieties of knowledge. That history goes centuries back to when a broad spectrum of philosophers, mathematicians, astronomers, and ayurvedic doctors built up the body of Indian knowledge. A *second* more recent occasion of recognizing that expertise is not a monolithic, mono-dimensional concept happened in the discussion about the role of specialists versus generalists. During the 1960's a debate centred round who should head a government department. There was a simmering dissatisfaction about an I.A.S. Officer—who typically is a generalist—presiding over, say, the Department of Agriculture, which otherwise consists of highly qualified agricultural scientific specialists. The view that prevailed was that even if an agricultural scientist presides over the Department, (s)he would be knowledgeable only on one specialized aspect of agriculture. Overall, the debate concluded in favour of a generalist as director of the department, who then would draw on specialist advice but be able to weigh and evaluate this advice and then take responsibility as a generalist. It was also considered that this goes with the spirit of democracy where an elected person is in overall charge. Nothing should be so esoteric that it cannot be broken down to essentials that can be understood by an intelligent generalist. There was also an anxiety that if a specialist had a final say, (s)he would tilt in favour of his/her speciality which may not be what is needed to further common good. Yes, there is a need of specialists but they must be kept on leash by generalists who are intelligent and are ever keen to keep abreast of science and technology. The *third* recognition of the need to broaden the conception of expertise is happening now. It is happening in similar ways in the global west and north. It asks for transcending the dichotomy between expert and layperson. The remainder of this paper will follow that argument.

The standard, modern image of expertise makes a distinction between expert and layperson, and most often equates the expert with the scientists and the layperson with someone without scientific knowledge and expertise. Increasingly this standard image of experts and expertise is producing problems. The problems partly arise because scientific knowledge proves not to be sufficient to solve societal problems, and partly because the general public does not always trust the scientists anymore.

Knowledge from the natural and technical sciences is not sufficient because every large technological project has many aspects that are beyond the narrow confines of engineering and science. In addition to technical aspects of design and construction, irrigation systems also have agricultural aspects of matching the irrigation plan to the farming styles, social aspects of how relations in the villages may be affected, economic aspects of how the benefits are distributed, and legal aspects of ownership, compensation and regulation. The mentioned aspects call for social science or humanities expertise to supplement the natural scientific and technical. However, there are more kinds of knowledge and expertise that need to be included—these are not scientific or scholarly, but could be labelled 'experience-based.' Increasingly, for example, European advisory institutions on health and medicine include representatives from patient organisations on their committees; industries involve users in their design process; and infrastructural projects consult with citizens. So, a variety of forms of knowledge—scientific, scholarly and experience-based—needs to go into the design and implementation of any large scientific-technological projects. India also has committees such as these, but in Europe they seem to work better than in India. The members of Indian committees do not listen to each other as well as seems the case is European fora, probably because of a deeply engrained standard image of expertise that creates a deep divide between the scientists and the non-scientists.

The second problem is that increasingly the general public does not trust scientific advice as unhesitatingly as it used to do. Citizens and consumers have more sources of knowledge, also on matters scientific and technological, than the official spokespersons of science and technology: these may come from NGO's, the mass media, or a variety of Internet sources. In Europe genetically modified crops and food were banned when the general public felt that some of the risks associated to GM had been underestimated or misrepresented by the scientists and the industry. At this moment there is hardly any GM food on the European shelves, and scientific statements that argue the safety of GM crops are mistrusted. The Dutch government has now concluded that to avoid a similar chain of events in nanotechnologies, other forms of knowledge and expertise need to involved early on. Various programmes have been created in Europe and the US to tap the expertise of social scientists, philosophers of ethics, stakeholders, users and citizens in policy making about nanotechnologies and in implementation of nanotechnologies research and development programmes.

The Indian and African Manifestos argue for societies to use science and technology for their development; they argue for a style of doing science and technology, and for a science and technology policy that transcend the dichotomy between experts and non-experts. They argue for using science and technology for the benefits of the people, and they argue for including into that science and technology the rich variety of expertise, knowledge and experience that is available in respectively Indian and African culture and society.

In the following I shall investigate the concept of expertise, which is slightly more specific and narrow than knowledge. The argument for recognizing a plurality of knowledge, for allowing a parallel existence of several knowledge systems, is more encompassing and builds on the analysis of expertise.

Exploring expertise

Expertise has many components and can be evaluated along many dimensions. It thus is not only about competences, but also about social status. Having an English education, having a degree, and coming from a high caste and class make an Indian expert in terms of social status. Having inside expertise of a certain domain amounts to expertise in terms of competence.

Such inside expertise can come in different forms. We distinguish two forms: (1) expertise to understand and follow discussions and (2) expertise to actively contribute to the further development of the inside knowledge or to the design of a particular technology. The first is easier to acquire than the second. The first kind of expertise is typically sufficient for interaction with scientists and engineers about policy choices or about balancing risks and benefits of a specific scientific or technical development. The second kind of expertise is needed to actively contribute to the making of scientific or technical knowledge. The mistaken opinion that citizens, users, patients, or stakeholders cannot be consulted on issues scientific and technological results from confusing these two forms of expertise. Since most of the time non-scientists indeed cannot contribute to the substantive scientific work, it is erroneously assumed that neither they can interact on choices of priority, policy and ethics.[5]

Taking the multifaceted character of modern science and technology seriously makes it inevitable to adopt the previously introduced view of expertise. It does not make sense to talk of "scientific expertise" per se, as was already recognized in the earlier example of the debate on specialists and generalists. A nuclear physicist does not have expertise in dam building and *vice versa*. The dam building engineer is in no better position when discussing a nuclear power station than any other well-informed citizen. The only sensible way to conceptualize expertise is as a spectrum of different forms of expertise. There is no ground for prioritizing the expertise of a certain domain, at least not in a general fashion. For certain questions you need expertise of physics, for others of sociology. For some questions you need expertise that can actively contribute, for other questions the expertise that allows you to interact is sufficient.

For a "scientific audit", or a peer-review assessment of a project you need contributory expertise in that specific domain. For a "social audit", or a "commons audit", such expertise would not be enough and perhaps not even necessary. For a social audit you need a variety of interactional forms of expertise. Depending on the precise question of the social audit, you will need citizens, stakeholders, scientists, and/or engineers. And, of course, not any citizen, stakeholder, scientist, engineer; but those with the specifically required interactional expertise for that particular social audit. From all experts we expect a form of critical self-reflection, of knowing where the limits of their forms of expertise are and where and when to involve other experts.

Once the need to involve other forms of expertise in policymaking on science and technology is recognized, there are more implications than merely pertaining to the set-up of advisory committees and the inclusion of citizens and stakeholders in certain fora. Some of these implications address fundamental characteristics of India society. It is one thing to argue for the recognition of the expertise of citizens in addition to the expertise of scientists. But what about non-citizens?; what about scheduled castes and other radically marginalized people who are not recognized as citizens in any practical and plain meaning of the word? These are so marginalised that they will not claim space to be heard. Nobody can speak on their behalf, though some will speak to support them.

Recognizing the spectrum of expertise implies the need to also recognize the spectrum of identities, of people; and to recognize that identities are context-dependent. One may be a physicist, or a Brahmin, or a citizen, or industrialist, or Greenpeace activist—or some of them together. Caste identity, for example, implied a clear structure and guarantee of livelihood. Caste also represented a knowledge hierarchy. Social relations were clearly laid out and social movements were structured; by birth it was determined what you could and could not do. But politics of caste—in terms of questioning the hierarchies of the caste system—was not possible. This is changing to some extent, but much of these characteristics of Indian society are still in place.

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[5] For a more detailed analysis and argument, see the recent work by Harry Collins: Collins, H. M., & Evans, R. (2002). The Third Wave of Science Studies: Studies of Expertise and Experience. *Social Studies of Science*, 32(2), 235-296; Harry Collins (2010), *Tacit & Explicit Knowledge.* University of Cgicago Press

The new view of expertise has far-reaching implications for the politics and management of science, technology and society. The standard image of expertise caused an externalisation of all problems, conflicts and dissent: such problems were not part of science, but belonged to the outside, non-scientific world. If something went wrong, like a chemical plant explosion or an unaccepted irrigation scheme or a lower yield of a crop than promised, this was due to bad management, wrong political decisions, or unprofitable market conditions. With the new view of expertise the blame cannot so easily be diverted anymore. When things go wrong now, more fundamental characteristics of society, knowledge and technology need to be addressed. The cosmology of how we see the world in relation to fundamental sense-giving views will inevitably come into play: one cannot ignore the deeply religious character of Indian society, including the secular consumerism of the middle class.

The different forms of expertise affect all stages of scientific and technological development. This is evident and already discussed in the stages of production, implementation and evaluation of scientific and technological knowledge and design. But an earlier stage is at least as important: the stage of problem definition. A problem is not intrinsically and *a priori* technical or economic or scientific or political. During the stage of problem definition the problem is given its key characteristics, depending on how the relevant forms of expertise play out. And once a problem has received its main characteristics, these will also determine which kinds of expertise can claim to contribute. When in the now pesticide-free village of Punukula (A.P) the number of farmers' suicides and health-affecting accidents was abnormally high, the problem could, for example, have been made into one of public health (better medical services nearby), one of transportation (better connection to district hospital), one of technology (safer pesticide spraying equipment), or economics (more affordable loan schemes). Instead, SECURE and CSA, with their combined expertise of social self-help groups, watershed committees, and sustainable agriculture, succeeded in getting a problem definition accepted that focused on the synthetic chemical character of pesticide treatment. Once that definition was accepted by the villagers, the farmers' expertise of locally grounded pest treatment and the cycle of the various pests in addition to the scientific and social expertise of CSA and SECURE became crucial.[6]

Risk governance of nanotechnologies

When the previous analysis is taken seriously, this should have implications for the democratic governance of science and technology in society. I shall, report on a recent experiment in The Netherlands with a societal dialogue on nanotechnologies. To understand the context of that dialogue, in this section I review discussions on risk governance of nanotechnologies.

First, however, I want to pause and broaden the agenda by picturing the debate about nanotechnologies in a wider discourse on the vulnerability of our modern societies. I want to make two points about the vulnerability. The first

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[6] For more information, see several brochures from the Centre for Sustainable Agriculture, Hyderabad. See also the PhD thesis Julia Quartz (2011), *Constructing Agrarian Alternatives. How a creative dissent project engages with the vulnerable livelihood conditions of marginal farmers in South India.* Maastricht University.

point is that vulnerability is a characteristic of our modern technological cultures, in two ways.[7] On the one hand vulnerability is often caused by science and technology or at least mediated by science and technology. (Of course, hurricanes or cyclones are not science and technology. But the dikes that have been built to create an illusion of safety in New Orleans are technology; and the illusion to have forecasted knowledge about where the hurricane lands and how strong it is, derives from science.) On the second hand, we typically use science and technology to defend ourselves against these new vulnerabilities. (We build higher dikes. We develop better meteorological programs to forecast hurricanes. We use sophisticated econometric statistics to help insurance companies not go bankrupt when risky areas are flooded.) Whatever way you look at it, vulnerability is a key characteristic of modern societies.

The second point is that vulnerability is inevitable. It would indeed be foolish to think of a society that would not be vulnerable. Try to imagine a world that is completely non-vulnerable. That must be worse than the worst Stalinist dictatorship. It's a world where nothing can change, where no learning happens, where no development is possible. All development and learning involves risk, inevitably. So if you want to live in a developing society, where we have innovation, where we improve things, then we should also allow for some mistakes, some vulnerability. So, vulnerability is inevitable as an unintended consequence of science and technology. Even stronger, vulnerability is a prerequisite for modern societies. If we don't allow for some vulnerability, we don't allow ourselves to learn and to develop and to change society.

With this broader perspective on the vulnerability of societies in mind, we turn to risk. The one-sentence summary of my point here is: risk is more than a number. Risk is more than only a quantitative analysis of effect and chance. Risk depends on how you define problem situations. Different perceptions add to the variation too. People living next to an industrial plant who are being employed by that plant, do assess the risks of that plant lower than those who are not employed by the plant. Risks are value-laden. They are not context-independent. If you're really a mobile person and you like to live in an individual way, you will perceive the risk of car driving as being smaller than if you have a different style of mobility and prefer the train.

If risk is more than a number, then the idea that we just would need to better communicate risks to the citizens is not enough. We really should try to think of new democratic ways of governing risks. The implicit assumption behind 'risk communication' is often that 'we, the scientists,' know the risks and that 'they, the citizens,' don't. My argument is that it is not that easy: because of the value-leadenness, because of the context dependence, because of the different perceptions. It's not just a matter of getting the right numbers across. We need much more a two-directional communication, and new forms of democracy to deal with risks.

Let me now turn to the risk governance of nanotechnology. The core idea is to identify different risk situations and then try to be specific for every risk situation. Depending on the risk situation then, other experts, action groups, stakeholders, and citizens will be invited to participate, and at the end of the story

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[7] For more details, see Bijker, W. E. (2006). The Vulnerability of Technological Culture. In H. Nowotny (Ed.), *Cultures of Technology and the Quest for Innovation* (pp. 52-69). New York: Berghahn Books.

there is a whole array of policy instruments that can be called upon for each situation.

Nanotechnologies are everything that happens on a scale of 1 to 100 nanometers, 10^{-9} meter. There are two ways of understanding it. There is the top-down movement in nanotechnology: making things smaller and smaller; the transistor, then the integrated circuit, and then still smaller and smaller. That is one way to get to nanoscale. The other way is to get up from the molecular level using sophisticated instruments to combine molecules and build nanostructures. The current state of nanotechnology is one of very high expectations, but only a small (though increasing) number of applications. If you use a sun lotion, it probably contains nanotechnology products. All our car tires contain nanoparticles to strengthen the rubber. It is very difficult to find a field in the scientific and technological world that is not potentially touched by nanotechnologies.

Some people say: "well, it's nothing new, it's just small; all our existing rules and regulations should work." Others say: "no, there is something fundamentally new going on, and we need a completely new style of governing this technoscience, these innovations." You'll see that the Health Council advice is in the middle position here. Why is this so important? It is important because nanotechnologies promise huge benefits and at the same time seem to create new risks. One beneficial example would be a nanotechnological drug delivery systems that would deliver chemotherapy exactly at the cancer place and not all over the body; then you wouldn't have all the awful side effects that we now have with chemotherapy. An example of a risk is the toxicity of synthetic nanoparticles. These risks we do not completely understand yet. And thus it is unclear to what extent the current regulations for chemicals, for example are applicable, or that we should conceive of completely new rules and regulations. The option of completely stopping—a moratorium on nanotechnologies—is not acceptable either, because of the promising benefits. So here is the true democratic problem. I will argue to not leave it completely to the experts, but also I do want input from the experts.

When the bad effects and the benefits of a new technological development have become clear, then quite often the development has gone so far, that it is difficult to change its course and steer that technoscientific development. On the other hand, at the moment we can still easily steer the development, we don't know the benefits and the risk. This is called the Collingridge dilemma. Do we wait until the problems surface, but then we might not be able to regulate and to steer; or do we now steer, but then we do not really know what we are doing. That dilemma is another fundamental dilemma in governing risks and benefits of new technologies like nanotechnologies.

We distinguish four risk situations. (1) *Simple* risk situations are situations where scientific evidence is completely clear. In the case of nanotechnology an example are the degradable nano particles. Another example would be asbestos or radioactive radiation. So 'simple' does not mean that it cannot kill you. But it means that scientific knowledge is quite certain and complete, and it thus is possible to design regulations and safety measures. You know exactly, for example, how much lead you have to hold between the X-ray equipment and the nurses that handle the equipment. (2) *Complex* problems. We're still talking about a world where scientific knowledge is pretty complete, but the problem now is so complex that scientific knowledge isn't quite enough to formulate a policy. An example is the way that nanotechnologies would affect sustainable development.

There is a lot of knowledge about how, for example, biotechnological developments influence food processing and agriculture. But how everything hangs together with international trade, social reform, financing schemes to possibly produce a more sustainable agriculture: that is so complex a problem that it cannot be solved as a straightforward scientific puzzle. (3) *Uncertain* problems are radically different. That is the kind of problem where scientific knowledge is not complete and not certain enough. An example is the following. We all learned in chemistry class that gold and silver are inert and thus do not react with other chemicals. They are not toxic and we wear them as jewelry. At a nano scale, gold and silver suddenly seem to turn highly toxic. Now that's worrying. There is solid scientific evidence that there is a problem with nanoparticles of gold and silver. But the scientific evidence it not complete yet. There is no complete understanding of nanotoxicity, as it is called. This thus is a different class of problems: we know that there is a risk, but we don't understand it as well as the risks of radioactive radiation or asbestos. (4) *Ambiguous* problems are yet of a different character. In the nanotoxicity case we at least know in which direction we want our society to move: towards a world without toxic materials, to put it briefly. In ambiguous risk situations we do not even know that. The nanotechnology example here is a memory chip implanted in my brain. This would help me to memorize the big family that my wife has, and better survive birthday parties and funerals where I meet all those uncles and aunts. But I suppose that in Italy as much as in the Netherlands there are fundamentalist Christian groups who would consider this as tinkering with God's creation and as the last thing that they would want our society to move to. Ambiguous risks thus are about situations where not only the scientific knowledge is uncertain, but where it is also unclear in which direction we want society to move to. There is disagreement about the fundamental values and aims for policy in society.

The next step—but I will not discuss this in detail—is that for each of those four risk situations we can specify a different style of risk governance. Also there is a different sector of people to be invited into the process of deliberation about these risks. (1) In the case of *simple* problems, regular university scientists are all we need. There is no reason to bother other people to take a vote on 2 + 2 = 4. I don't want lay persons to meddle around with the toxicity of asbestos. I trust scientists to do a proper job on defining the rules and regulations for the toxicity of small particles of asbestos. (2) In the case of *complex* risk situations, it is still a completely scientific issue. But it's important to recognize now that science is not neutral, that also scientific knowledge depends on the perspective that scientists have. So here it is important to also invite scientists from the pharmaceutical industry, from Greenpeace, from stakeholders and action groups. (3) For *uncertain* risk situations we really need something more. By definition, these are risk situations in which scientists do not know enough. So we need stakeholders to sit at the table and participate in the deliberations. In that way the balancing of economic, health, ecological and other kinds of values can weigh into the negotiations and decision making. (4) In *ambiguous* risk situations, there is no other way than also to include the citizens. Here is at stake the direction in which we want our society to move. There is no escape of thinking of ways of involving citizens. But it is difficult, and that is what the final section will be about.

The big question is now: who decides about the characterization of a problem into one or the other category? Do nanoparticles pose a simple or uncertain risk situation? The answer is that this needs to be settled by a broad monitoring committee. This broad committee will include university scientists, scientists of specific organizations, stakeholders, and representatives of the general public. This committee then will do something like a triage of problems. If a problem is, for example, characterized as *simple*, it can be given to a purely scientific advisory council. If a problem is complex, in the Netherlands we give it to a 'sector council' that also has scientists from industrial agents. In some cases you really need a public debate of some sort. The next and final section will discuss one such example that we currently are carrying out in the Netherlands.

Experiment with democracy: societal dialogue on nanotechnologies in the Netherlands

We started a year ago with this societal dialogue on nanotechnologies, and it will be finished by March 2011. The government decided on this dialogue by following the advice by the Health Council and two other bodies in the Netherlands. The organizing committee, of which I am the vice-chair, is made completely independent of the government. That is because we have some experience with previous public debates in the Netherlands. Especially in the case of genetic modification the public got suspicious that the government was not intend to listen but only wanted to use the debate as a kind of lubricant to push already made decisions through society. With this experience in mind, both the government and we as committee wanted to make sure that the public debate was as clearly as possible separate from the government. The flipside is that the government is not committed to immediately do what we conclude from the debate. That's the price that we pay. But I'm happy to pay that price.

Our agenda is really open in the sense that as a committee we don't have an opinion on what we want out of this. So what we do? We then were immediately confronted with that fundamental problem that you can only have a dialogue once you understand what you're talking about. Very few people know about nanotechnology in the Netherlands, so we first have to do a lot of information giving. That needs to be followed by awareness raising so that people understand not only what nanotechnology is about, but also can recognize problems and promises, risks and benefits—that there is actually something to debate and something to think about and engage with. And then finally a dialogue can follow. The outcome of all those projects of information giving, awareness raising, and dialogue are collected by our committee and translated into a societal agenda on nanotechnology. We will present this to the government in the last week of January 2011.

The committee had 4.5 million euros, which we used to create a plurality of perspectives and voices. We made a preliminary list of issues that we thought would need to be discussed. This was done on the basis of a stakeholder consultation of action groups and industry scientists who already know about nanotechnology. Then we issued an open call for proposals, and anyone—individuals, action groups, churches, institutions, university departments, industry, labor unions—could submit proposals to do a project of information, awareness building or dialogue. One project had a maximum budget of 130,000 euros. We received about twice as many proposals as we could fund, and we selected as transparent as possible a series of projects that together cover all three stages of the process. So, as a committee we are not the authors of the information; we do not set the problems for awareness; we do not control the agenda of the dialogue.

There have been books written, TV programs broadcasted, exhibitions displayed in libraries, hospitals and museums. A bus travels around the country with nanotechnology experiments that will allow people to tinker with nanotechnology. If we see information that we think is really wrong, then we'll ask another expert to provide her expertise to contrast the evidence that we thought was a bit fishy. So we do try to orchestrate, but we do not control. Same applies to awareness. One example of a project is "nano in the baby room". It will be a virtual project with a baby room and you can point to particular aspects of the furniture or food or toys, and ask how much nanotechnology is in there now, how much might there be in the future, and what could be the benefits and the risk. There will be theater plays and artistic productions to create different kinds of perspectives and stimulate awareness. We have no idea what will come out of it, but we figured that using such different vocabularies and styles of thinking might help the general dialogue. Philosophers write vignettes and scenarios that in two pages take one particular problem and then describe how nanotechnology might play out in both positive and negative ways. These vignettes and scenarios are used by other projects too. A school project started with laboratory experiments and school class lessons, and finishes with a debate with CEOs of industry and politicians of the provincial government. There will be web debates, science cafes. One project of Protestant Christians discusses the potential of human enhancement: is this tinkering with or improving upon God's creation? They are planning to liaise with Islam scientists and try to compare an Islamic perspective and a Christian perspective on the ethical dimensions of nanotechnology. And there is one project that explicitly relates to international relations and the role that nanotechnology may play both on the weapon side and on the reconnaissance and peace enhancement side.

To conclude, let me return to the question of commons' knowledge. The most fundamental point is the issue of expertise and democracy: we need to balance a variety of knowledge types in our society: scientific knowledge but also other kinds such as users' knowledge or patients' knowledge. The approach that I have outlined helps to do that balancing act, by showing when scientific expertise is necessary, and when you need stakeholder expertise to be added to that, and when you also need the expertise of citizens. Second, I have argued that institutions like the Health Council of the Netherlands and the US Academy of Sciences are needed to make our technological cultures democratic. These institutions themselves seem, paradoxically, undemocratic in the sense that all their deliberations are completely confidential. The Health Council, like the National Academy of Sciences in America, provides a place for scientists to debate, to have controversies about how to interpret scientific evidence, and to translate their knowledge into a serviceable truth, into an advice that may work for politics. It is crucial that these discussions remain confidential so that there can be a true, scholarly discussion about what is the political meaning of some scientific evidence. This also loads a great responsibility on the shoulders of such scientific advisory institutions. If they do not do an excellent job, checked by solid peer-review, they loose credibility. In some sense there advisory reports needs to be even more scientifically sound than an average scientific publication.[8]

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[8] That is where the advice by the Indian Academies of Science on the Bt Brinjal controversy went wrong, which may turn out to be quite damaging to the credibility and authority of the Academies.

So finally, the core message is that we need to experiment with our democracy. We need to do that because the character of our technological culture asks for a new constitution. All democracies still work with, basically, 19th century constitutions. We can't blame Montesquieu that he didn't think of our nanotechnologies, biotechnologies and nuclear technologies. So we need to think about developing a new political constitution to democratically govern our technological cultures.