# A Prospective Look at Risk Communication in the Nanotechnology Field

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*Public scepticism and resistance can significantly hamper the development of new technologies. As nanotechnology unfolds worldwide into commercially available products, discussions on how to assess and manage the potential risks are gathering momentum.*

## I. The Current State of the Evaluation of Nanotechnology

Initial scientific data on the impact of nanomaterials on health have recently been released. Though initial results are preliminary and inconclusive, a joint study by the NASA Johnson Space Center and the University of Texas Medical School suggested that single-walled carbon nanotubes directly injected onto the lung of mice at a dose of 0.5 mg led to the formation of microscopic nodules in lungs after a week.[1] These nodules – which can potentially cause more serious lesions – persisted and became more pronounced after three months. Another toxicology research team at DuPont independently conducted similar studies with the difference that carbon nanotubes were placed in the rats' trachea.[2] Results showed that with high doses of carbon nanotubes, fifteen percent died. The cause of death was attributed to suffocation. Nodules were also found in surviving rats but were not persistent beyond a month after instillations. This study suggested that nodules resulted from a reaction to presence of foreign substances – the carbon nanotubes – rather than from a toxic reaction.

These initial studies have received a lot of attention from scientists, industry, non-governmental organisations (NGOs), specialised media and the mass media. Since then, the topic of toxicology of nanomaterials is on the radar screen of the mass media, both in Europe and USA.[3] The Canadian-based ETC Group (Erosion, Technology and Concentration, formerly RAFI group), who in the past was active and successful in campaigning against biotechnology, was early to pick up on the potential negative aspects of nanotech. Last year, the ETC asked for a moratorium on the commercial production of nanotechnology[4]; this largely contributed to bring the public debate to the international level. Greenpeace has taken a more balanced approach, acknowledging both the potential benefits and risks of nanotechnology, but asking that the debate around nanotechnology be inclusive and transparent, by including public consultation and participation in decision-making processes.[5]

These ongoing discussions may have already contributed to framing initial attitudes among the interested public – technophiles and supporters – as well as among technophobes or rejecters. But the vast majority of the public probably has little knowledge of, or interest in, nanotechnology and its potential hazards.

## II. In the Near Future

More data on the impact of nanomaterials on human health and the environment is expected to be made public soon. The European Commission recently initiated a programme called Nanosafe. This programme will examine the risks involved in the production, handling and use of nanoparticles in industrial processes and consumer products and will recommend regulatory measures and codes of practices for the workplace. In July 2003, the US Environmental Protection Agency launched a call for proposals, with a budget of $4 million, to academic and not-for-profit organizations on the impact of manufactured nanomaterials on human health and the environment with a focus on toxicity, environmental and biological transport, exposure and bioavailability. In addition, a growing number of others institutions, NGOs, industries and researchers worldwide are getting involved in the technical assessment of nanomaterials.[6]

The outcomes of the current toxicology studies are likely to affect the trajectory of industrial applications of nanotechnology, favouring one type of application over another, for example. The stakes are high for both the public and private sectors. The global public investment in nanotechnology research and development is now close to $3 billion, more or less equally distributed between Europe, the USA and Japan. In the USA, the federal budget for nanotechnology has increased from a mere $116 million in 1997 to a requested $849 million in 2004. From the private sector standpoint, the long awaited profits from nanotechnology products are now turning into reality. The *Wall Street Journal* recently wrote that:

> [s]ome of the biggest gains in the stock market are coming from the littlest things lately. […] the hottest stocks right now are a group of companies racing to develop nanotechnology, which uses tiny particles to create and improve all kinds of products.[7]

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## III. Challenges in Risk Communication

The field of risk communication suffers from a lack of a universal and widely accepted definition. Scholars in risk communication have many profiles: psychologists, sociologists, anthropologists, behavioural scientists, decision science theorists and communicators. Therefore, literature on risk communication spans a vast number of disciplines. This article will focus on four main areas of risk communication: public attitudes towards technological risks, public perceptions, the media and trust.

### Public attitudes towards technological risks

It is now well established that public attitudes to a given technology depend on the end-use applications. For example, data from the 1999 Eurobarometer survey on biotechnology show that while the vast majority of the European public is opposed to genetically modified food and animal cloning, attitudes to medical (genetic testing and the production of pharmaceuticals) and environmental (bioremediation) applications are positive. One conclusion of this survey was that "… moral concerns attach specifically to particular applications and not necessarily to underlying molecular biology techniques."[8] These findings may be a useful barometer for nanotechnology. They suggest that some applications of nanotechnology will likely pose more public concerns than others. Since only very few applications of nanotechnology have so far turned into commercial products and their hazards are not fully appreciated and understood, it is premature to identify which applications of nanotechnology are likely to be accepted by the public and which ones are likely to face public resistance.

### Public Perceptions

Psychologists Slovic[9] and Fischhoff[10] have shown that risk perceptions are shaped by a range of various psychological factors that explain why some risks trigger higher states of anxiety than others, regardless of the 'objective' risks assessed by scientific methods. Psychological factors that trigger anxiety lead to risk overestimation. Among those factors are whether a risk is perceived as involuntary, whether it is seen as dreadful and whether authorities seem to lack knowledge and control over risks. These psychological factors explain how the public forms attitudes, thinks, and makes decisions about risks. In addition to individual psychological factors, culture may also play a significant role in public perceptions.[11] The implication is that risk perceptions may not be uniform across society. In fact, public risk perceptions across Europe may vary from country to country, region to region, or culture to culture. Since no one risk communication strategy will be suitable in all places and at all times, risk communication messages around nanotechnology need to be tailored to targeted groups.[12]

### *The Role of the Media*

The media are an important part of risk communication. Daniel Yankelovich showed that the media are more than just a source of information about risk, but help to shape public opinion and how issues are initially framed. The media also play a significant role in amplifying social processes, such as controversies over risk.[13] Peter Bennett of the UK Department of Health found that the question of blame – that is, identifying the party, whether government or otherwise, upon whom to place blame in a case of an accident such as a chemical spill – is the most important media trigger that turns a potential risk to public health into a major story. Other triggering factors include alleged secrets and attempted cover-ups, conflicts between parties, links to existing high-profile issues or personalities and the number of people exposed to the risk.[14] For the nanotechnology community, it suggests that policy-makers should not overlook the importance of initial framing around nanotechnology issues and need to find ways to minimize amplification effects. Furthermore, in the case of a nano-technology-related accident, governments should be prudent and open.

### *Trust*

Trust is the cornerstone of risk communication because it influences public attitudes and behaviours.[15] Trust is a broad and multifaceted concept and involves many actors such as governments, scientists, industry, the media, and NGOs and others. It is generally accepted that in risk communication the source of a message, more than the content, determines how the message regarding risks is perceived. To risk communicators, it comes down to answering the question "who trusts whom?" Surveys in the risk communication of food hazards in the UK shows for example, that consumer organizations and medical doctors are perceived to be trusted sources, whereas governments and private companies are perceived to be untrustworthy sources. Low levels of public trust in government present real challenges for governments communicating the risks of upcoming technologies like nanotechnology. Recent efforts at risk communication have focused on how to increase trust. Elements such as openness in transferring information to the public, transparency on how decisions are made, public presentation of both the benefits and risks, acknowledgement of the uncertainties in risk assessment methods, and incorporation of both the experts' and public's views in decision-making process help to reinforce trust.[16]

## *IV. Risk Communication Opportunities for Nanotechnology*

In the light of the knowledge from studies on public attitudes, public perceptions, the media and trust, risk communication strategies for nanotechnology can benefit from including the following elements:

> Collecting data on the public awareness and opinion of nanotechnology. Such a collection of surveys may help identify the list of psychological and cultural factors that influence public perception and judgment. For example, is risk involuntary? Inequitable? Inescapable? Is the source of risk unfamiliar and novel? Is risk man-made rather than natural? Is risk hidden and/or the source of irreversible damage? Does the risk imply a danger to the young and to future generations? Does the risk appear to be poorly understood by science? Are there cross-cultural or cross-country differences in risk perceptions?
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> Engaging in an open dialogue with the different stakeholders – that is those that affect and are likely to be affected by risks – namely regulatory bodies, public funding agencies, policy-makers, scientists, NGOs (such as consumer groups and environmentalists), the media, industry and the public. As more data on the impacts of nanomaterials on human health and the environment unfold, tensions may arise as some stakeholders will want to reduce the impact of toxicology data on research, development and commercialisation of nanotechnology, while others might attempt to amplify the bad news. Open dialogue with the different stakeholders is believed to help find common ground on which to build consensus on contentious issues.
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> Integrating both the perspectives and views of experts and those of the public in decision-mak-

ing processes around risk and make decision processes regulatory environment transparent. These two elements should constitute a good basis for gaining public trust, even more so in times of tension or conflict.

Observers have concluded that denial of the public's concerns by politicians and public institutions and the manipulation of the public opinion over the benefits and risks of technology (for instance in the case of genetically modified foods) contributes to an erosion of public trust in the government. It can ultimately lead to public scepticism – if not outright rejection – of specific technologies.

***Examples***

In an attempt to avoid mistakes from the past, the UK government commissioned the Royal Society and the Royal Academy of Engineering to "carry out an independent study of likely developments and whether nanotechnology raises or is likely to raise new ethical, health and safety or social issues that are not covered by current regulation." The Nanotechnology Working Group, created in the summer of 2003 is leading this study. Its programme consists of creating forums where the various stakeholders, such as NGOs, academics, industry, regulators and the public, would share their perspectives. The emphasis is on probing the public's awareness and understanding the public's concerns around nanotechnology. The results of these studies are expected to be posted on the Nanotechnology Working Group website by the summer of 2004.[17]

By comparison, current risk-communication efforts relating to nanotechnology are timid in the USA. This might be because the American public is poorly aware of genetically modified food or because the American public has not experienced major food scares.[18] Nevertheless, it is worth mentioning that there have been some efforts to engage discussions on the health and safety of nanomaterials and what it implies for public policy and regulations. For example, the Woodrow Wilson Center, a think-tank based in Washington DC, recently held a workshop on the health and safety of nanomaterials that gathered academics, FDA and EPA experts, industry and trade groups. For now though, such discussions have not yet involved the public or reached it to a significant extent. Efforts should be focused on making this stakeholder dialogue more inclusive.

## V. Concluding Remarks

This article has sought to offer a brief prospective look on risk communication, with nanotechnology as a case study. Though the field of risk communication is broad, four areas of particular interest have been identified: public attitudes, public perceptions, the role of the media, and trust. All these factors are interrelated and likely to contribute to shaping the public's opinions and acceptance of nanotechnology. In the light of previous studies on risk perception, it is suggested that the nanotechnology community should engage in an open dialogue with the various stakeholders, including the public, and integrate their viewpoints into decision-making processes. To some extent, it becomes a matter of negotiating risks – to define, for example, an acceptable level of risk among all stakeholders – rather than merely communicating risks.

But this might be easier said than done. Some worry that public consultation and engagement in decision-making processes will do nothing more than give quirky outsiders a public space and voice. As a result it could even further polarise the debate rather than solve issues.

But there can be negative consequences of not engaging in far-reaching public discussion. In fact, if there is one lesson to learn from the past controversies over genetically modified food, it would be this: failure to involve the public in the strategic development of new technologies and to take the public's concerns – whether or not they seem sound to scientists, policy makers or regulators – into consideration leads to distrust of public institutions. Trust is subsequently very difficult to regain. Though public consultation and engagement raise some legitimate concerns, the cost of not including the public in the decision process around nanotechnology may be much higher: it may lower the public trust in scientific and public institutions and trigger public resistance, which in turn may affect the trajectory of nanotechnology development.

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2 D.B. Warheit *et al.*, "Comparative pulmonary toxicity assessment of single-wall carbon nanotubes in rats" (2004) 77 Toxicological Sciences 117.

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18 Except recently with the discovery of the first mad cow in Washington State announced in the media on December 23, 2003.