Stakeholders And Technology: Challenges For Nanotechnology

Edna F. Einsiedel & Greg McMullen

The innovation trajectory is no longer the linear tale that has been told countless times. As technologies have emerged, their directions have been pushed, pulled, shaped and reshaped by various groups with interests in a given technology's outcomes. Much of the literature on innovation as well as on stakeholder theory has argued that stakeholders do matter – both normatively, as well as practically.[1] While most of this work has focussed on the firm and its stakeholders, we would argue that discussions about technology, as part of an exercise in foresight and, more importantly, as part of anticipating technology's impacts much earlier in the design process[2], need to consider the range and nature of stakeholder interests.

Freeman has described a stakeholder as "any group or individual who can affect or is affected by the achievement of the organization's objectives."[3] 'Organization' may be broadly applicable to public agencies involved in regulating, private sector companies producing applications, scientific organizations involved in technological development. These groups often have responsibilities such as making strategic decisions, providing opportunities to stakeholder groups to articulate their interests, or balancing competing stakeholder interests. Decision-making and resource allocation decisions may be most applicable to government agencies, large companies or major scientific organizations, but increasingly, even scientists doing research find a need to engage a variety of stakeholders, as well as the general public.

Stakeholder analysis is a relatively complex process, where the objective is "identifying and understanding multiple (often competing) political, social, legal, economic and moral claims of many constituencies."[4] Who are the emerging stakeholders on nanotechnology and what sorts of interests are they articulating? What are the policy implications for understanding these interests?

A diverse collection of groups has emerged to put forward their interests in nanotechnology. While these groups might be simplistically categorized as either supportive of or opposed to this particular technology, the spectrum of acceptability is more reflective of a continuum. As was the case with biotechnology, groups have emerged with concerns relating to environmental impacts, health and safety, control and ownership, and ethical questions. On this side of the spectrum is the ETC Group (or Erosion, Technology and Concentration Group).[5] An advocacy group which originated in Canada, formerly known as Rural Advancement Foundation, or RAFI, the ETC Group has played a large role in the debate over GM foods and biotechnology as a whole, challenging policymakers and scientists alike on their rapid development and deployment of gene-altered products and the lack of consideration of issues such as environmental impacts, patents and ownership.

The ETC Group has taken a keen interest in nanotechnology, publishing several papers over the past two years that criticize nanotechnology and its proponents for neglecting environmental, social and health concerns and calling for an immediate global moratorium on its development. The first major ETC paper on nanotechnology, "No Small Matter!" was released in May 2002. It discussed the lack of regulation and the potential problems with unpre-

dictable and largely unproven nanoscale particles within cells.[6] The paper suggests that a concerted effort to "ask and answer the most basic questions" is necessary and that an international body to govern the development and regulation of emerging technologies is necessary.[7]

The second major ETC Group paper is a 'sequel' to the first, updating the technological and regulatory efforts a year later and renewing its call for a moratorium. Pointing out that nanoscale particles are already in use in cosmetics, medicine and sporting goods like tennis rackets, the paper suggests that there has been a disturbingly low investment in research on nanotoxicity or the physical effects that nanoparticles will have on cells. Recent studies on carbon nanotubes, they point out, have been inconclusive on toxicity, and have not been conducted for periods longer than 90 days.[8] Calling for "a transparent global process for evaluating the socioeconomic, health and environmental implications of technology", the group has demanded a moratorium while such a process takes place, and advocates an International Convention for the Evaluation of New Technologies. The ETC Group proved to be highly influential in the biotechnology debate, and it is likely its initial concerns will provide an opening framework for public questions around nanotechnology.

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The ETC Group is not alone in demanding a nanotechnology moratorium. In an editorial in the September 2003 issue of *smalltimes* magazine, Greenpeace UK's chief scientist Douglas Parr noted: "Greenpeace has not called for a ban on nanoparticles, but a moratorium until the hazards are characterized and understood."[9]

Not surprisingly, promoters of the technology are legion. Governments are among the primary boosters of nanotechnology, seeing this as another pillar in national innovation platforms. In the U.S., President Bush recently signed the *21st Century Nanotechnology Research and Development Act*[10], authorizing $3.7 billion in funding over the next four years for the emerging science. The legislation puts into law programs and activities already supported by the National Nanotechnology Initiative, the White House's highest multi-agency research and development priority.[11]

Nanobusiness alliances have sprouted up to speed the technology's business, starting with a U.S.-based alliance[12] followed by similar groups in Europe[13], Canada[14], Israel[15] and Asia.[16] Their respective missions include the promotion of research and education, public policy, public relations, industry development and support, as well as international collaborative activities.

Nanotechnology, like biotechnology and genomics, is already tapping into some of humankind's wildest hopes and dreams, from longevity, or even immortality, to the colonization of space. On the extreme of the support continuum are the transhumanists, who have ambitions of using high technology to become something more than human, achieving a 'posthuman' state.[17] Nanotechnology figures prominently in the transhumanist vision of the future, as its members believe it will enable nanoscale interfaces for cybernetic enhancements, radical life extension through nanomedicine, and other extreme modifications. Some transhumanists wish to give up the body altogether, migrating into a virtual existence, using swarms of nanobots to manifest physically when need arises.[18]

Not surprisingly, members of several libertarian transhumanist groups are pushing for less regulation of, and greater investment in, emerging technology including nanotechnology.[19] The World Transhumanist Association (WTA), started in 1997 by Swedish philosopher Nick Bostrom, is one group of transhumanists that has articulated a stance on nanotechnology, and is watching developments in the field closely.[20] Perhaps the most widely accessible of the transhumanist organizations, the WTA recently held their yearly gathering at Yale University, hosted by their Interdisciplinary Bioethics Project's Working Research Group on Technology and Ethics. [21]1 The WTA's accessibility is drawn from members' willingness to discuss the social, ethical and environmental impacts of emerging technologies such as nanotechnology, but they still suggest in their declaration that "by being generally open and embracing of new technology, we have a better chance of turning it to our advantage than if we try to ban or prohibit it."[22]

Although groups like the WTA are willing to consider social and ethical concerns related to the transhuman step, many other more radical groups, like Max More's Extropians, feel that social issues will look after themselves. The term 'extropy' was created to mean the opposite of entropy, the tendency toward disorder and degradation of matter and energy throughout a system. Extropy refers to the transhumanist belief that order and concentration of knowledge is constantly increasing, to the betterment of all.[23] The Extropians have started taking policy issues more seriously, setting up what they call a Progress Action Coalition to "defend high technology" by lobbying government, particularly in the United States. This move was in direct response to what they call a neo-Luddite movement in U.S. politics, evidenced by the appointment of conservative ethicists Leon Kass and Francis Fukuyama to the President's Council on Bioethics.[24]

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Another organization pushing for nanotechnology to be applied "extra-terrestrially" is the National Space Society (NSS), a space development advocacy organization.[25] Along with the Foresight Institute, an early forerunner organization dealing with information on nanotechnology and advocacy of nanotechnology research, the NSS has released a position paper on space and molecular nanotechnology. It is the first public position paper looking at the implications of nanotechnology for a specific field of activity — the development and settlement of space.[26] This advocacy organization discusses the implications of nanotechnology for short-term, medium-term and long-term planning in space exploration and settlement, focusing on the advancement of molecular manufacturing.[27]

These groups illustrate the range of stakeholders that will be, or already are, expressing hopes and concerns about nanotechnology, illustrating the diverse criteria they expect technological performance to be held up to. While it will be unrealistic to expect all stakeholders to agree on a common vision about the future involving nanotechnology, societal expectations of how a technology is, or should be, more successfully embedded in society rests at the very least on continuing dialogue and on-going examination of the assumptions behind competing visions of the kind of world we want to shape with technology – or without it.

Recognizing the importance of such a dialogue at earlier stages of technology development, scientific organizations that were commissioned by the UK government to carry out an independent study on nanotechnology and its potential applications have recently engaged with civil society organizations to discuss various social, ethical, health and environmental aspects of the technology.[28] In a departure from earlier practices, the working committee of the Royal Society, National Academy of Science, the Royal Academy of Engineering and the National Academy of Engineering initiated a consultation process with stakeholders and the general public as a way to help them define further their terms of reference and to provide input into the shape and direction of the committee's study. Their activities are similarly summarized and progress reports have been provided on-line.[29]

Over and above on-going engagement and dialogue, what do stakeholder groups bring to the technology table? What do we learn from hearing these voices?

First, we gain an understanding of the range of interests that are out there and the values that underlie these interests. Such an understanding may force us to examine some of the more broad-ranging impacts or the secondary and tertiary impacts of technology on society. What are the implications of adopting a technology on the health care system? What are the implications of nanotechnology knowledge on 'normalcy', on 'health', on what it means to be human?

These interests may also influence scientific practice. Patient organizations have become activist funders of research and animal welfare organizations have pushed for more humane practices in the use of animals for research. The story of how the gay community was influential in speeding up and directing AIDS treatment research from 1987 to 1992 has been well documented. It is a story of how activists reconstituted themselves as lay experts, "laypeople who could speak credibly about science in dialogues with the scientific research community."[30]

Some stakeholder organizations and consumers have also shaped policy and commercial decisions. Organizations such as the ETC Group played a major role in labelling gene

use restriction technologies as "terminator technology", thereby defining the agenda which culminated in one company's withdrawal from commercializing this technology and in the move of prominent international development and funding agencies such as the Consultative Group for International Agricultural Research, the Rockefeller Foundation and the government of India to reject its use.

While risks and benefits are often the focus of much debate and discussion, considerations of other criteria such as distributive justice come into play with a more pluralist presence at the table. Even groups with extreme or utopian visions of what a technology can do, bring to the fore the questions that help clarify societal values.

If nothing else, stakeholders often force a general societal reflection about the site and nature of boundaries that are preferred or required. The policies or guidelines on stem cell research illustrate this point, with a few countries opting to allow the creation of human embryos as a source of these cells and others banning such an approach.[31] In asking certain questions of a technology, society will inevitably emerge the wiser.

Edna F. Einsiedel is a Professor in the Faculty of Communications and Culture, University of Calgary, and Greg McMullen is a graduate student at the University of Calgary, Calgary, Alberta.

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1 R. Edward Freeman, *Strategic Management: A Stakeholder Approach* (Boston: Pitman, 1984).

2 Arie Rip, Thomas J. Misa & Johan Schot, eds., *Managing Technology in Society: The Approach of Constructive Technology Assessment* (London: Pinter, 1995) at Introduction.

3 *Supra* note 1 at 4.

4 Joseph W. Weiss, *Business Ethics: A Stakeholder and Issues Management Approach* (Boston: Thomson, 2003) at 35.

5 Online: ETC <www.etcgroup.org>.

6 ETC Group, Communique, "No Small Matter! Nanotech Particles Penetrate Living Cells and Accumulate in Animal Organs" (May/June 2002), online: ETC <www.etcgroup.org/documents/Comm_NanoMat_July02.pdf>.

7 *Ibid*.

8 ETC Group, "No Small Matter II: The Case for a Global Moratorium" (2003) 7:1 ETC Group Occasional Paper Series, online: ETC <www.etcgroup.org/documents/Occ.Paper_Nanosafety.pdf>.

9 Douglas Parr, "Without a Check, Claims of Nanotech's Benefits are a Con" (26 September 2002), online: smalltimes <www.smalltimes.com/print_doc.cfm?doc_id=6706>.

10 U.S., Bill S. 189, *21st Century Nanotechnology Research and Development Act*, 108th Cong., 2003 (enacted).

11 National Science and Technology Council, Press Release, "President Bush Signs Bill Authorizing US Nanotechnology Program" (4 December 2003), online: National Nanotechnology Initiative <www.nano.gov/html/news/PresSignsNanoBill.htm>.

12 Online: NanoBusiness Alliance <www.nanobusiness.org>.

13 Online: Nanodot <www.nanodot.org>.

14 Online: Canadian NanoBusiness Alliance <www.nanobusiness.ca>.

15 Online: Israeli NanoBusiness Alliance <www.nanobusiness.org.il>.

16 Online: Asia-Pacific Nanotechnology Forum <www.apnf.org>.

17 "Transhumanist Declaration" (1 December 2002), online: World Transhumanist Association <www.transhumanism.org/declaration.htm>. One of the principles articulated in the Transhumanist declaration is that:

> Transhumanists advocate the moral right for those who so wish to use technology to extend their mental and physical (including reproductive) capacities and to improve their control over their own lives. We seek personal growth beyond our current biological limitations. (Art. 4)

18 Ray Kurzweil, *The Age of Spiritual Machines: When Computers Exceed Human Intelligence* (New York, Penguin, 1999).

19 James J. Hughes, "The Politics of Transhumanism" (March 2002), online: The Consensus <www.theconsensus.org/uk/principia/life/ThePoliticsofTranshumanism.htm>; Erik Baard "Cyborg Liberation Front: Inside the Movement for Posthuman Rights" *The Village Voice* (30 July – 5 August 2003), online: The Village Voice <http://www.villagevoice.com/issues/0331/baard.php>.

20 "WTA Statement on Funding and Regulation of Nanotechnology", online: WTA

<http://www.transhumanism.org/resources/statements.htm>; Bard, *ibid*.

21 Bard, *ibid*.

22 *Supra* note 17, Art. 3.

23 Hughes, s*upra* note 19.

24 *Ibid*.

25 Online: National Space Society <www.nss.org>.

26 National Space Society, "NSS Position Paper on Space and Molecular Nanotechnology", online: Island One Society <www.islandone.org/MMSG/NSSNanoPosition.html>.

27 *Ibid.*

28 "Nanotechnology: Civil Society Groups" (30 October 2003), online: Royal Society <www.nanotec.org.uk/CivilSociety.htm>.

29 *Ibid*.

30 Steven Epstein, "The Construction of Lay Expertise: AIDS Activism and the Forging of Credibility in the Reform of Clinical Trials" (1995) 20:4 Science, Technology & Human Values 408 at 434.

31 Lori Knowles, "A Regulatory PatchworkCHuman ES Cell Research Oversight" (2004) 22:2 Nature biotechnology 157; see also D. Solter *et al*., *Embryo Research in Pluralistic Europe* (Berlin: Springer, 2003).

Upcoming Events

Home Care: The New Frontier of Health Care Ethics, Canadian Bioethics Society. October 28-31, 2004, Calgary, Alberta. <http://www.bioethics.ca>

Health Privacy: New Compliance Requirements and Best Practices. October 4-5, 2004, Calgary, Alberta. <http://www.insightinfo.ca>

Oncogenetics: Achievements and Challenges. October 7-8 2004, Montréal, Québec. Email: oncogenetics@umontreal.ca. <http://www.humgen.umontreal.ca/cjc>

Building a Culture of Safety. October 14-16, 2004, Edmonton, Alberta. <http://www.buksa.com/conferences/>

International Association of Bioethics. Deep Listening: bridging divides in local and global ethics. November 9 - 12, 2004, Sydney, Australia. <http://www.bioethicsworldcongress.com>