Convergence of Science and Society: "Power of Small Nanotechnolgy"

ICAN

Inverness Research Report

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INVERNESS RESEARCH

Table of Contents

Convergence of Science and Society
"Power of Small Nanotechnolgy"

I. Introduction

Overview

This project pursued a novel approach to science education around an emergent science and technology topic of importance to society and the public at large, namely nanotechnology. The central goal of the ICAN Nanotechnology: Convergence of Science and Society project was to increase the quantity and quality of community-based discourse about key issues associated with nanotechnology, in particular societal and ethical issues. By doing so the project hoped to engage the public in learning about nanotechnology and influence the quality and content of discourse among stakeholders such as the business/industry leaders, environmentalists, scientists, consumers, etc.

The project generated a series of television programs, three Fred Friendly Seminars entitled *Nanotechnology: the Power of Small*, that were carefully designed to focus on key topics of interest to the public and target key societal and ethical issues around nanotechnology. The project involved stakeholders with a high interest and/or investment, and designing a variety of approaches for using the project products and programs as a tool to provoke deliberative discourse around societal and ethical issues related to nanotechnology. Our role as evaluators was to document key aspects of the project, in particular those aspects of the project that supported and facilitated community-based discourse, and to portray the work in such a way that it will inform NSF and the field.

NSF's major investment in this effort was directed to the production of the Fred Friendly programs. Therefore, understanding them and their relationship and contributions to the various formats for discourse—the various forums designed to amplify the impact of the series—represented a core focus for evaluation. The project formats and deliverables that we studied included the Fred Friendly Seminar series, the face-to-face NanoFutures Forums that complimented and incorporated Fred Friendly taping sessions, online-moderated forums through an interactive website sponsored by the University of California, Berkeley, Lawrence Hall of Science, Earth and Sky radio programs, and a subset of the American Association for the Advancement of Science (AAAS) Outreach Activities that occurred across the country.

This Report

This report presents a summary of findings from our evaluation and conclusions that may carry broader implications. The audience for this report includes The National Science

Foundation (NSF) and other funders (particularly science research funders), the leadership and staff of Nanotechnology: the Convergence of Science and Society project partners, and the informal science education field. The main body of the report is organized into two sections. The first section discusses the project's logic model, or theory of action and frames what the project set out to do and how. The project's accomplishments are discussed in some detail in this first section. The second section presents what we think is a core outcome of the project, namely a promising model for engaging the public, stakeholders and scientists in dialogue about social issues related to nanotechnology and other emerging science areas, the NanoFutures Forums. We consider the second section to be the heart of our evaluation, as it related most directly to the goals of the project, addressed our evaluation questions most succinctly, and we believe offers the most promise in terms of contributing to ways science and society issues can be addressed directly with the public, stakeholders and scientists. We conclude the report with a section about lessons learned, applications, returns-on-investment and future investments. Finally, attached to the report is a set of appendices, which provide additional detail, data, and the framework we generated and used to consider and evaluate the discourse that took place at the NanoFutures Forums.

II. The Evaluation

Purpose

Inverness Research was contracted by ICAN to engage in formative and summative evaluation of selected aspects of Nanotechnology: the Power of Small project. In particular, our focus was on those aspects of the project that involved direct engagement with the public and stakeholders in events that involved discussion and discourse. Through monitoring and documenting the quantity and quality of public discourse around nanotechnology issues in these event settings our aim has been to help discern an emerging model for public engagement around societal and ethical issues related to nanotechnology.

Our primary focus has been the NanoFutures Forums organized by ICAN, with lesser attention to other project activities (Fred Friendly Seminars, AAAS Community Outreach, media-based strategies) as they influenced or were integrated into the Forums and/or involved deliberative discourse.

The larger goal of our evaluation is to distill lessons from these aspects of the project that might inform the design of similar efforts to engage the public in issues related to nanotechnology.

Evaluation Questions

We focused on three evaluation questions:

- How effective is the project in meeting its goals for influencing the content, quantity and quality of the dialogue around nanotechnology among key stakeholders and the public?

- What is the impact of the NanoFutures Forums, in particular, on the level and quality of discourse and on participants' thinking?

- Do these strategies for public engagement appear to be effective and to be a worthwhile investment?

Evaluation Activities

Evaluation activities revolved around four aspects of the project. (1) articulating and ground-truthing the project's theory of action, (2) studying the NanoFutures Forums, (3) studying the AAAS Community Outreach Events, and (4) communication with project leadership. Evaluation activities associated with each of these are listed below.

1) Articulating and ground-truthing the project's theory of action

Attend kick-off meeting and Community outreach meeting; interview PI at key junctures; monitor project activities and products

2) Study of the NanoFutures Forums

Administration of pre-post event surveys for participants at the three project Forum sites; development of an evaluation framework for the purpose of planning and assessing the NanoFutures Forums' structures, organization and the content and quality of the discourse that occurred at the forums; administration of pre- and post- participant surveys; observations of two Forums; transcription of selected Forum table discussions; observation of FFS taping; observation of training, interviews and surveys of Forum facilitators; interviews of local hosts of Forums; follow-up interviews with participants at two sites

3) Review of AAAS Community Outreach events that had forum/symposium type of activity

Participation in AAAS kick-off meeting for outreach sites; interviews of selected outreach site coordinators; attendance at one forum-like outreach event and administration of pre-post event survey for participants; review of outreach site reports; ongoing conversations with and post-project interview of AAAS project director

4) Communication with project leadership/"Critical Friend"

Ongoing participation in partner update and planning conversations; conversations at key junctures with project leadership for the NanoFutures Forums; interview of PI at key junctures, review of evaluation reports for other components of the project

Collectively, these evaluation activities contributed to our conceptualization of the project's theory of action, and understanding of its strategies and outcomes as laid out in the next section.

III. Nanotechnology: The Convergence of Science and Society Project Model

Project Theory of Action

As originally conceived, through NSF's investment, Nanotechnology: the Convergence of Science and Society would support a multi-modal approach to promoting, supporting and facilitating community-based opportunities for key stakeholders and the public to engage in discussion and deliberation around nanotechnology and its associated societal/ethical implications. The graphic below describes our understanding of the project's theory of action, or logic model (figure 1.) It provides a framework for our study and this report.
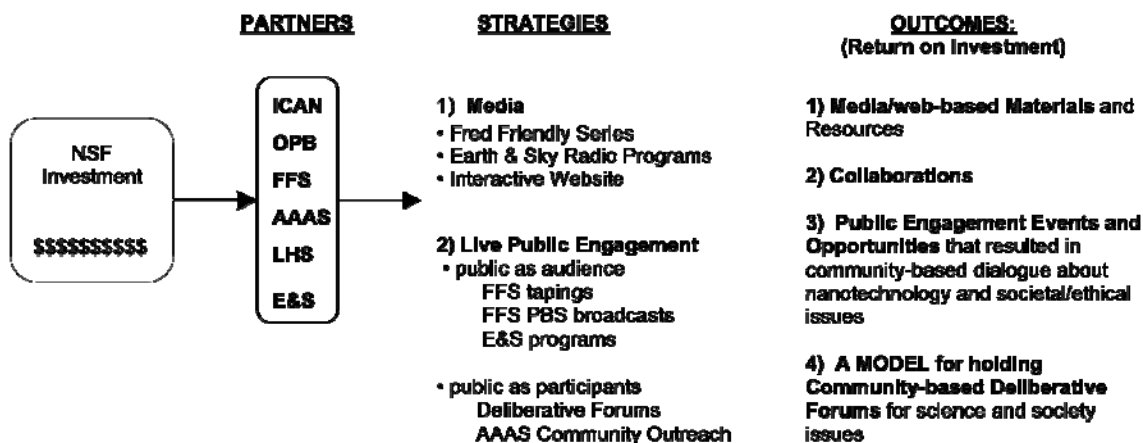

Figure 1. Convergence of Science and Society Theory of Action

NSF invested in a project designed to increase the quantity and quality of public discourse around societal and ethical implications of nanotechnology. The project designed and employed a multi-modal approach to engaging the public in learning about and considering the science and societal/ethical implications of nanotechnology. The effort required various arrangements of partnerships and collaborations at local and national levels. These arrangements were facilitated by the PI and focused on particular strategies that drew on partners' expertise, resources and networks, and that pertained to a particular strategy for engaging the public.

Partners

ICAN Productions provided vision and oversight for the entire project. It convened all partners at the beginning of the project, facilitated conference calls amongst partners as

the project got underway, organized and facilitated the NanoFutures Forums, maintained communications with each faction throughout the life of the project, spearheaded the content work for the Fred Friendly Seminars and assisted with identifying panelists and locations for filming, and worked to make new connections and collaborations beyond the originally funded groups (Department of Energy, Center for Advancement of Informal Science Education, Nanoscale Informal Science Education Network, Woodrow Wilson International Center for Public Policy's Project on Emerging Nanotechnologies, John Hopkins University Center for Talented Youth, European Commission's Nano and Converging Science and Technologies Unit). Oregon Public Broadcasting served as administering agent for the grant and presenting station for the FFS series, spearheading and documenting regional and national carriage of the PBS series. Fred Friendly Seminars took responsibility for the filming of the seminars and worked with ICAN to produce the programs and with OPB to advertise and broadcast the programs. They also created shorter clips of each program for use via the website and for use during live forums.

AAAS organized and supported regionally based outreach efforts via their established network to bring nanotechnology activities and events to the public. Earth and Sky produced six radio programs that aired across the country via public radio along with 10 Clear Voices for Science podcast, which are available on the web. UC Berkeley's Lawrence Hall of Science provided web-based expertise and produced the website and created the companion viewer guide for the Fred Friendly programs.

Strategies and Outcomes

Strategies for engagement included. (1) a variety of media-based efforts for stimulating discussion and discourse via television, radio, and the web, and (2) structured face-to-face public community-based deliberative forums and outreach events that engaged the public as audiences and as participants in a variety of programs and events. Development and implementation of these strategies occurred in parallel during the first couple of years with some integration.

Key outcomes from these approaches included media-based materials, curricula and resources that are still "live" and available via the web, new collaborations, live events and opportunities for the public at large and key stakeholders to engage in dialogue and discourse. Equally important, the project created and implemented a model for organizing and facilitating community-based deliberative forums that can be applied to science and society topics beyond nanotechnology.

Below we describe each of the media-based efforts and then the live face-to-face public engagement components.

MEDIA-BASED STRATEGIES AND OUTCOMES

(1) Fred Friendly Seminars Series—"Nanotechnology. the Power of Small"

A core strategy for the project was to generate a series of three Fred Friendly Seminar (FFS) programs that focus on key societal and ethical issues around nanotechnology and that model the kind of deliberate discourse envisioned for the "live" aspects of the project. The series, "Nanotechnology: the Power of Small" was aired on public television. The series was conceived as a core product of the project that could be used within and beyond the project activities.

The filming of the seminars took place in Berkeley, Boston, and South Carolina. At each site a live public audience was recruited and invited, but direct engagement of the audiences with the FFS panel members was minimal. In two cases, the filming of the programs constituted one of two public events that took place at collaborating local Informal Science Education Institutions who were collaborators (at the Boston Museum of Science, and South Carolina State Museum).

Based on the theme/topic for each seminar, an advisory group made up of stakeholders and scientists informed the development of each program. With input from various project partners, the advisory group was identified and facilitated by the PI. Titles for the three programs were. "Watching Me, Watching You", "Forever Young" and "Clean, Green, and Unseen". The FFS programs were aired on PBS in 36 states as of July 2008 and they continue to be broadcast on stations throughout the system.

Fellows & Fellows led the station carriage effort to get the Fred Friendly series broadcast on PBS stations as well as to promote interest in "Nanotechnology: the Power of Small" via online activity. Their report of July 2008[1] reports that

> *"As of June 30, 2008, the national television broadcast presence for "The Power of Small" stands at 66% with commitments to carry from another 18%, bringing the potential national distribution of "The Power of Small" to a healthy 84% of the United States… "The Power of Small" has had 455 broadcast hours on 70 stations/channels in top thirty US markets… [in] twenty-three states." [p. 2]*

An accompanying Excel workbook, *Final Carriage Report 8-30-08*, provides detail that documents the fact that stations that carried the series in April-August 2008 are viewable by over 75 million Americans, or a quarter of the nation's population.

The report asserts that the series' failure to secure an airdate when the series would be shown across the country (i.e., 'common carriage') was ultimately advantageous:

> *"With almost fifteen hundred April/May/June/July broadcasts to date on a healthy mix of analog and digital channels, this series has had an ongoing broadcast presence in almost every state in the country providing wide access to a national audience.*

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[1] Maynard, A. D. (2008, July). "Nanotechnology: The Power of Small": Combined Final Report - Broadcast & E-Networking. *Woodrow Wilson International Center for Scholars*.

The staggered broadcast dates also allowed the outreach and social networking efforts to accumulate, thereby contributing to a sustained momentum and <u>a continuous broadcast presence that so far stretches over four months</u>, which in turn keeps the word of mouth buzz about the series alive. . . . " [p. 2]

It also documents the broad range of individuals and institutional representatives that expressed interest in and opinions about the broadcast series and the topics it covered.

"Beyond broadcast, this series has clearly demonstrated the ability to spark local dialogue and conversations. A fascinating mix of industry experts, retired scientists, forensic experts, students, educators, parents, non-profits, healthcare workers, citizen activists, faith groups, law firms and insurance companies have responded with requests and opinions. <u>We are able to demonstrate activity and reactions in every state</u>, even in those that have yet to have airdates."

The Fellows and Fellows report also identified a barrier to public education efforts on behalf of unfamiliar science topics, i.e., the unfamiliarity of PBS programmers with nanotechnology, and their own strategy for overcoming that barrier:

"Early in this project, it became quite evident that the science of nanotechnology was something many PBS programmers were not familiar with. That lack of awareness both justified a series on the subject, but also complicated efforts to encourage people to air it. To help overcome hesitations, the current state of nanotechnology in many individual areas of the country was carefully researched and the resulting market-specific articles and information about regional nanotechnology initiatives and efforts were used to educate PBS programmers about the significance of nanotechnology to their particular economy and viewing audience." [p. 11]

The project has been opportunistic in finding other strategic uses for the seminars. It has, for example, distributed programs and support materials via NISE-Net, with the intent that they be available and of use for NISE-Net's annual Nanodays. Though a logical venue for dissemination and integration into Nanodays, the results of these attempts were disappointing from this Project PI's perspective.

(2) Earth and Sky Radio Programs

A radio series broadcast on the Earth and Sky Radio Programs that focused on nanotechnology topics of interest to the public was produced and aired. Ten audio podcasts produced especially for this project were "heard, seen, read and accessed more than 60 million times in 2008 by people from around the globe"[2] They included:

- "Whose bodies' benefit in a nano-enabled future?"

- "Will nanotech democratize medicine?"

- "Nano-vaccines could immunize developing world"

- "Nanotechnology for 'smart' soldier uniforms"

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[2] "Nanotechnology: The Power of Small" Supplementary Audio Podcasts Produced by Earth & Sky, Distributed via the Earth&Sky Network - Final Audience Evaluation. (2009, January).

▪ "Hockenberry speaks on 'power of small'"

The Earth and sky report indicated additional distribution for the project included mobile phones via AT&T/Alitel, U.S. landline telephones (Cellecast) and a list of 17 podcast directories. These ten shows also provided an opportunity for listeners to engage in online blogging.

(3) "Power of Small" Website: http://powerofsmall.org/

An interactive website was envisioned for this project from the beginning. It was, however, very challenging to create a site that would generate interactivity. The project experienced the most activity on the website during and after the airing of the Fred Friendly Seminars. As of February 2010, the site has received 28,330 unique views and 62,298 page views. Visits are from 126 countries even though the Fred Friendly Seminars series was broadcast only in the U.S. This site remains live and offers the three programs in segments, prompts and a viewing guide that includes background about nanotechnology, a pre/post survey, scenario role-plays, program viewing guides for each program, and "critical consumer cards". The project leadership monitored the streams of conversations that occurred on the blogs for each program.

This website remains live; through it interested parties continue to have access to the Fred Friendly Seminars and accompanying materials. To date there have been 142 public comments made on the Privacy seminar page, 96 on Health, and 20 on the Environment. The site has also generated close to 3500 user votes on the questions posed as part of the series broadcasts. While the numbers are not nearly as high the project hoped, the comments are largely well considered and represent a range of stances and levels of knowledge. This suggests that the website as designed can function as an ongoing venue for public—stakeholder engagement around nanotechnology issues.

LIVE FACE-TO-FACE PUBLIC ENGAGEMENT STRATEGIES AND OUTCOMES

(1) Deliberative Forums

Another core effort was to host three highly structured 3-part "NanoFutures Forums" in three different locations and communities across the country. We invested most of our evaluation time and resources into studying this effort and we consider the forums and lessons learned about them to be a core contribution of the project.

Each of these deliberative forums involved collaborative planning and engagement with an Informal Science Education Institution (Boston Museum of Science, St. Louis Science Center, South Carolina State Museum). In two cases these forums were held in tandem with the filming on location of the Fred Friendly seminars. Web-based discussion opportunities for participants were also provided (see http://powerofsmall.org/index.php). Organization and facilitation of these forums was carefully designed, the structure being informed by models of successful examples of deliberative democratic forums[3], though they took on

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[3] Macoubrie, J. (2003). Deliberative Democracy: Conditions for Deliberation.
http://www.ncsu.edu/chass/communication/www/faculty/faculty_profiles/macoubrie/Conditio
(footnote continued)

their own qualities. Each forum required in-depth coordination and collaboration between ICAN productions, the Fred Friendly Seminar project coordinators and an Informal Science Education institution. Audiences were recruited by ICAN staff and local ISE partners from among stakeholders such as business and industry leaders, environmentalists, scientists, consumers, educators, and also from the interested public. Local partners also helped locate and engage community stakeholders as presenters and found suitable table facilitators (who were trained by ICAN staff). Each event was grounded in a Fred Friendly Seminar and a thoughtful protocol for table leaders. Revisions to improve the format and experience for participants were made after each event.

A more extensive discussion of these forums, including a brief portrayal of a typical event, our methods for studying them, and discussion of the "best case" forum are presented in the next major section of this report.

(2) Community Outreach Activities

The Community Outreach Activities were coordinated by a project lead from the American Association for the Advancement of Science (AAAS) and occurred at ten Informal Science Institutions across the country. A spectrum of activities and events sponsored by this component of the project resulted, ranging from cart-based exhibits that engaged the public in very informal ways to symposia that engaged graduate students and the public. We attended one of the outreach events that was most forum-like, reviewed the sites' final reports for the project, and interviewed the AAAS program leader.

Table 1 presents an overview of the outreach activities, their locations, nature and audiences[4] as summarized from their final reports on the efforts that were supported by "The Power of Small".

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nsforDemoDelib.pdf. Also cited in Macoubrie, House, E. R., Howe, K. R. (2000). Deliberative Democratic Evaluation Checklist. Also ICAN DDF proposal (2006).
[4] No report was available from the Oregon Museum of Science and Industry.

Community Outreach Site	Program Activities	Type of public engagement	Audiences reached
Museum of Science an Industry	• "Innovations in Nanotechnology. Holiday Lecture and Public Demonstrations"	• modeled after Christmas lectures and public demonstrations produced by Michael Faraday in 19th-century lay audiences; keynote lecture, live demonstrations, Q&A, Panel presentations and discussion, reception	• 8th-12th grade students and their teachers and parents, other interested adults; 238 people registered: 51 teachers, 87 pre-college students, 5f4 college or grad students, 24 parents, 22 other; 125-150 people attended
California Science Center	•*Science Matters* Speakers Program "Nanotechnology. Small World – Big Issues"? panel presentation and public audience discussion	• Jan. 2007; adult education Saturday program series designed to stimulate critical thinking, science learning and provide a forum for current science issues including societal implications	• approx. 200 participants
Saint Louis Science Center	• establishment and building of collaborations with local research institutions • continued development of Cyberville Nano Exhibit; prototype activities/demos		• NANO-CEMMS Center at U of Ill. Produced an NSF proposal; also with Washington University in St. Louis – collaborators on three nano-focused grant proposals • Promoted airing of FFS on local PBS channel
Denver Museum of Nature and Science	• Two public forums organized as panel discussions. nanotechnology 101 (2007), and "Nanotechnology. It's Not Your Father's Science" (2008)	• Interactive forum: community-based experts present core concepts and applications of nano, panel follows with attention to ethical implications, the audience Q&A	• 220 participants year 1; • 200 participants year 2
New York Hall of Science	• Diffusion immersive exhibit • NanoDays tabletop and cart activities	• Visitors explored measurements, reactions, ferrofluid, and products that utilize nanotechnology such as resistant fabrics and reversible sunglasses	• Seen by 100,000 visitors in the first six months • 850 participants in one day
North Carolina Museum of Life and Science	• NanoManipulator exhibit • Public Forums • Purchased video editing software to create multi-media content around nano science, technology and engineering	• Visitors interact remotely from MLS to an atomic force microscope at Chapel Hill via the NanoManipulator • Public Forum on alternative energy and nanotechnology during NanoDays 2008; promoted FFS "Nanotechnology: The Power of Small" via email and newsletter	• Not indicated in report

Community Outreach Site	Program Activities	Type of public engagement	Audiences reached
Maxwell Museum of Anthropology	• Developed a committee and a mini-conference to update current exhibit on "Ancestors" exhibit.	• 2-day meeting, included distribution of FFS to help facilitate the discussion of how to incorporate nanotech into project	• 4 project organizers; 8 content specialists (scientists); 4 Exhibit specialists; 3 ISE specialists
McWane Science Center	• Staff information and training session • 2-day NanoDays 2008 six activities	• Promoted collaboration between CNMB at U of A, Birmingham and MINT at U of A, Tuscaloosa • Interactive exhibits and activities provided by NanoDays kits and enhanced with five faculty from Uof A	• Over 2000 visitors
Pacific Science Center	Nanpalooza. The World's Smallest Science Fair – cart exhibit	• Delivered at two events off site and at the Pacific Science Center for four months	• 2234 visitors reached; 11 staff/volunteers trained to offer cart

Table 1. Summary of "Power of Small" Community Outreach Activities

Site Visit to Community Outreach Activity

We visited the California Science Center of Los Angeles, a community outreach site, in January 2007 because it hosted one of the most "forum-like" AAAS outreach events. Inverness Research conducted interviews with Dr. David Bibas, Curator of Technology Programs and local contact for the project, attended the event, and administered pre- and post-surveys to attendees. The CSC presented "Nanotechnology. Small World—Big Issues" as part of its Science Matters Saturday afternoon series. The series is a successful strategy for engaging the public in discussion of science issues such as cloning and end of life issues. Typically a large number attend presentations and a panel and a smaller number stay for moderated small discussions. The programs put a strong emphasis on the fundamentals of science that ground discussions of ethical issues.

Promotional emails touted it as an opportunity to learn about "the basic science of nanotechnology and current research of possible health and environmental risks. Panelists discuss these issues as well as promising future applications and the legal issues of this emerging field." Nanotechnology may have been a lesser draw for the public than other topics considered in the series. 350-400 people attended the presentation; up to 1000 people attended prior events in the series. About half of the two-hour event was given to presentations by panelists from the California Institute of Technology, industry and the National Institute of Environmental Health Sciences. A fifteen-minute panel discussion, facilitated by a local media personality, followed. Panelists responded to audience questions for 40 minutes, and stayed to answer individual questions.

Unlike the deliberative NanoFutures Forums, dialogues at the Science Matters event were between experts and the interested public, and exchanges did not extend to deliberations. Because of a conflict that made the usual series room unavailable, round table discussions were not possible. Audience questions concerned the timeline for FDA approval of a medical use; the "gray-goo" issue; nanotechnology's possible contribution to fighting

global warming and oil dependence, and improving the efficiency of the energy grid; defense applications; and federal regulation of nanotech.

Those who attended this event rated it positively; ratings were similar to those given by attendees at the NanoFutures Forums (see appendix A). It is also important to note that in April 2008, almost 500 visitors participated in Nanodays at this site, during which the CSC screened segments from the Fred Friendly series.

Reflections And Lessons Learned From Community Outreach Strategy

In the fall of 2008 we interviewed the project leader for the Community Outreach component of Power of Small. Her insights and reflections, based on long experience with similar initiatives and with informal science institutions, as well as on this effort, offer a perspective on the process and effectiveness of the effort from the point of view of a partner organization. They attest to a partnership that supported the strengthening of the ISEs that were involved without imposing unrealistic expectations on them. Following are some key ideas and selected, slightly edited quotes from this interview.

Site selection had to do with supporting and nurturing an established network of AAAS-affiliated ISEs; it was grounded in personal relationships between the leader of the project component and individuals at the ISEs.

> *Whenever you do this kind of thing, because it is such a small amount of money, it is all done on personal relationships. You can look at anything on the web and that will tell you nothing about their ability to carry out a program.[5]*

> *…The networking that was involved in this (project) has been between AAAS and the community outreach sites. The sites themselves do not network… In order to have a network, you have to feed the network. It is true of anybody's network. When you stop feeding the network, then the network disappears.*

The funding, in the form of small grants, was used to stimulate and explore new efforts at the outreach sites, and to draw on the strengths, structures and interests of the sites.

> *The nice thing about doing site grants like this is that this gives them discretionary money in very tight budget times (but it's always tight budget times of science center. to be able to explore new programs that they really could not do without that money. In almost no case can I say that they use this money to do something that they are already doing. They always use the money either to expand their nanotechnology area, or to investigate new ways of dealing with nanotechnology in a science center environment.*

> *There are hardly any costs… Sure the benefits outweigh the costs. The fact is, the materials were developed, publics were reached, and so for a relatively small amount of money, they got a fair amount of impact.*

"Public audiences" can be and were broadly defined for this aspect of the project

> *From adults to kids… the hands-on part of the Pacific Science Center really was geared to children, where certainly the California Science Center symposiums were geared for adults and the science-interested public.*

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[5] The quotes in this report have been lightly edited for clarity without changing the intended meaning of the speaker.

The Museum of Science and Industry in Chicago worked with both students and members of the public in ways that they hadn't been able to do before.

The outreach sites reached different publics by using a range of public engagement strategies that sometimes stretched beyond their usual programming formats.

The Pacific Science Center developed a whole series of hands-on (cart-based) science activities around nanotechnology… That was actually new for them…. Chris Roman's expansion of her program [at Saint Louis Science Center] with her graduate students in nanotechnology would be another example, where she was able to expand something that she was already doing. The Chicago Museum of Science and Industry did symposium like events.

[For the AAAS sites] the TV shows are always secondary to the outreach, because the outreach is what the science center is doing to explore a subject and engage the public in a different way.

The outreach centers were "all successful in their own right"

To the extent that science centers used the opportunity to expand their audiences, expand the programs and get their staffs involved in different kinds of things, they are all successful for that very small amount of money that they got.

Somebody will always do this kind of thing because as long as NSF funds television shows, there is always going to be a need for… to the extent that you can try new and different things to do, is always useful to do it.

Why they were all successful…

You are not putting any pressure on them to do something that they can't do. Whenever I have done this kind of a PBS outreach, if you ask them to design their own programs, which is what I always do, around the topic, it is always successful…

If you force something on them (outreach sites), it doesn't work as well. So in this case, they altered the design to what they wanted to do. So you weren't forcing them to participate, you weren't forcing them into a mold.

Some thoughts and advice drawn from experience with outreach supported and associated with television program development and airing…

The television show is an artist's concept or it is somebody's concept of what they want to tell the public. However you are doing the outreach, you need to reach a public with what you think they will respond to. It is very different. So, television outreach historically, has little direct relationship with the program (at the outreach site) and the outreach site has no input into the program. When the programs are done, by then the outreach is started, because that is just the way it is. If it is aired on prime time they get a little more involved in it because people are proud that it is on PBS at 8 o'clock on Monday night. You can get more reviewer audience, because there is an appeal to that. But when you don't even have that, it makes it very difficult to have any tie-in...

Why would a science center use that television program when they can mount their own forums?

IV. NanoFutures Forums. A Core Outcome

Purpose, Structure and Organization for NanoFutures Forums

As stated in a proposal ICAN submitted for additional funding to support the forums, the goal for these events is to engage the public in a way so they can "explore the important social benefits and potentially controversial societal challenges raised by nanotechnologies… The forums will provide participants with opportunities before, during, and after their dialog and deliberations to learn more about nanoscale science and nanotechnologies, the societal issues that may arise as they come into use, and the regulatory framework and policy areas surrounding them."

The forum model involved an opportunity for the public to participate in two kinds of events. One was the opportunity to attend live taping of a Fred Friendly Seminar. The other was to attend NanoFutures Forums at three ISE partner sites—facilitated evenings of presentations, discussion and deliberations. Boston and South Carolina hosted both types of events—a live Fred Friendly Seminar and two evening NanoFutures Forums. At St. Louis there was no taping, but a seminar segment was integrated into the second evening's program there.

It was initially intended, but frequently not the case, that individual participants would attend both the taping and forums.[6]

The NanoFuture Forums, which took place on weeknight evenings, each considered a single issue, related to health, privacy or the environment. Participants were provided with a light dinner and an opportunity for informal conversation. The formal program began with short presentations by ICAN project directors and local experts to provide background on the project, nanotechnology and issues that would frame the evening's discussion. Local facilitators (e.g., museum staff, young academics), who were introduced to the evening's topics and given a structure for table conversations prior to the evening, led table discussions. They used a carefully structured set of questions to move the group from a personal response to a dilemma potentially posed by nanotechnology to a series of table deliberations on policy level considerations around the same dilemma.

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[6] The project also endeavored to involve NanoFutures Forum participants in dialogue on the website to extend discussions and explore questions raised about the science of nanotechnology. However, development of the website was slower than anticipated, and when the site did come online, it proved difficult to attract the forum participants to it.

Portrait of a NanoFutures Forum

The second event at the State Museum of South Carolina on April 3, 2007, focused on nanotechnology and human enhancement. As about 30 participants of mixed ages and ethnicities finished dinner, the ICAN PI and NanoFutures Project Director introduced the evening and gave a PowerPoint presentation on emerging areas of nanotechnology and human enhancement. Dr. Davis Baird, Professor of Philosophy and Dean of the Honors College at the University of South Carolina, spoke briefly and discursively on the ethics of human enhancement, followed by several vignettes from the Fred Friendly Seminar to help frame the questions for the evening.

Tables were facilitated by the ICAN PI, the NanoFutures Project Director, Dr. Christopher Toumey, (cultural anthropologist, local project liaison and member of the USC NanoCenter), and Dr. John Beasley, Asst. Professor of Risk Communication at USC's School of Journalism and Mass Communications). Groups introduced themselves, and then were given 15 minutes to share and collect their points of view on the use of deep brain stimulation (DBS) to alter moods for themselves or family members. After a break, the groups considered three questions. Should society as a whole pay for DBS to correct Parkinson's symptoms? Should it pay for DBS therapy to correct serious depression? Should it pay for the use of DBS devices to enhance mood—i.e., to do away with crankiness? Emphasis was given to ensuring that everyone at the table had a say. Tables were asked if they could come to a consensus, which they generally could not. Each table documented its discussion on chart paper and reported its decision(s) and supporting/dissenting rationales out to the full group.

■ *"The best should be done for everyone to restore functionality."*
■ *"Now if it is an accident that could have been caused by your own actions, it gets a little grey. Maybe insurance will pay, maybe not. But it will be available. How you pay is the question."*
■ *"One of the things for us is exercising control of nanotechnology by having the consumers paying for it, and if consumers are paying for something, then they will have a bigger voice in what it is being used for."*

After a break, groups spent 45 minutes considering first, whether "cognitive interfaces"—currently under development for military purposes and likely to become increasingly available (though expensive)—should be a right for all or available only to those who can pay. Secondly, does their response differ based on whether the capability is therapeutic—correcting a deficiency—or an enhancement beyond our basic capabilities? Again, table groups reported out to the whole group.

■ *"We discussed some of the equity of the enhancements. Is it possible? …We had a hard time agreeing on what the equality was, in reference to these enhancements. Who should pay, to what level?"*
■ *"We didn't really have a consistency about enhancements per se, but we have a variety of caveats or concerns or qualifications."*
■ *"We had a bit of discussion about whether various technologies could have an inherent likelihood of being used for sort of bad or evil ends, or if they are sort of ambiguous and it depends on how we control them or guide them or who is using them?"*

Project staff collected and kept the sheets for possible use in synthesizing forum deliberation and decisions for papers directed to public policy makers and evaluators collected the pre- and post-surveys.

As at the other NanoFutures Forums we observed, conversations stayed largely on track thanks to the facilitators and the seriousness with which participants undertook their charge. Also, nanotechnology was deeply imbedded in the conversations, and participants seldom asked for more science or referred to it explicitly.

Studying Audience Impact: Survey Data

SURVEY DEVELOPMENT AND ADMINISTRATION

Inverness Research developed short paper and pencil pre- and post surveys for administration immediately before and after NanoFutures Forums. Forms were modified slightly to meet local site's informational needs.

SURVEY RESPONDENTS

We collected a total of 164 surveys for NanoFutures Forums, from estimated 100-120 different individuals. In addition, 184 attendees completed the survey at the CSC partner event. Host sites played an important, but not the only role in publicizing the forums. ICAN and local partners attempted to attract interested audiences from various stakeholder groups including industry and education with some limited success as reflected in who came.

Audience characteristics varied across sites. The typical audience member was a white male who is personally interested in nanotechnology and who may have other ties to the topic. The attendees in South Carolina who completed surveys included a slightly higher proportion of women (67% the first evening, 50% the second) and persons of color (16% the first evening, 29% the second)[7]. More people in the South Carolina audience had prior ties to the topic of nanotechnology (especially through the South Carolina Citizen's School of Nanotechnology). Women were a slight majority in St. Louis.

SURVEY FINDINGS

On the pre-surveys, a majority of the participants said that they feel comfortable with expressing opinions about science and technology and have strong opinions about the role of the public in science decision-making. Fewer agreed that they have strong understandings of societal and ethical issues or the science of nanotechnology. Among reasons for participating in the forums was an interest in learning more about nanotechnology in general and/or the specific topic that was featured, an opportunity to interact with and hear from experts in the field, curiosity and interest in how science happens and interacts with society, resources for educative purposes, and an opportunity to articulate their thinking and questions with others.

Responses on the post-survey were positive and quite similar across the three NanoFutures Forum sites and the partner site. Most participants reported that they enjoyed the experience and felt comfortable voicing their opinions. They gave high ratings to the facilitation, and said they were interested in learning more. The small group discussion, the general topic of nanotechnology and the specific focus of the evening contributed most to participant satisfaction. Ratings were generally slightly higher at the second event than at the first. When asked about what they valued most about the experience after the event participants said things like:

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[7] Informal observation of the South Carolina audience put the proportion of non-traditional audiences even higher; not everyone completed a survey.

I valued all the information presented to me tonight, all the pros and cons and meeting all the great people.

Getting non-political/commercial perspectives on the subject.

Hearing views of both scientists and public policy makers.

The interaction with the participants. It was a great exposure to diverse points of view.

Simply learning more.

Complete results for this survey are included in Appendix A.

Studying Audience Impact: Discourse Data

DEVELOPING A FRAMEWORK TO STUDY THE DISCOURSE AT THE DELIBERATIVE FORUMS

Inverness Research generated a Forums framework that was intended to serve several purposes (1) to consolidate pertinent ideas from key resources about approaches and structures for deliberative forums; (2) to frame questions and provide some analytic guide-posts for the project staff as they planned for and organized the forums and events; and (3) to help us discern the nature and content of the discourse that occurred during the NanoFutures Forums. The framework (Appendix B) was first and foremost designed to use the literature to ground our evaluation activities and data analyses in core ideas about approaches to engaging the public in deliberative discourse.

The Framework served our purposes, but also reminded us how labor-intensive and complex discourse analysis is. Because of limited resources, we were able to use the framework for the third purpose only to a limited degree.

Research on deliberative forums comes out of social science and political discourse analysis. As we read transcripts of table discussions and reporting out at project events and consulted with project staff, we refined our initial Framework to better reflect the goals and realities of discourse around nanotechnology.

The following sections from the final Framework proved to be most useful in our assessment of the content and nature of the table discussions that occurred at the forums:

> What is the content of the deliberation? To what extent is the conversation around each of the following?
> - social and ethical issues (medical, environmental, military, legal, etc.)
> - policy and regulatory issues
> - commercialization and business
> - scientific concepts related to nanotechnology
> - other domains of cutting edge science
> - off-topic conversation
> - personal experience/stories
> - preconceptions about related topics
> - other
>
> How extensive is the deliberation? Is there reflective deliberation?   To what extent is the deliberation characterized by each of the levels? [e.g., comments and exchanges could be recorded and coded by role, demographics and type of statement; at the least, examples can be collected]

Three examples from sections of the table discussion transcripts are cited in Appendix C (Appendix C is available to project leader). Examples in this appendix are representative of aspects of the framework and show the nature and content of the conversations and the role of the facilitators. We acknowledge this framework to be a working tool and believe use of it could stimulate research around public discourse of science and society issues.

We studied the transcripts several times. Using the framework as a guide in coding sections of the transcripts, our general sense of the nature and quality of the discourse included the following:

(1) Exchange of views, thoughtful argument and some cognitive integration were observed most often. Integrative decision resolution, the highest form of deliberation was rare if observed at all. "We agree to disagree, but at least we know what we're disagreeing about"…quote from South Carolina forum.

(2) Participants drew on a range of useful examples and comparisons drawn from prior knowledge (x-rays of feet, lead paint, cigarette smoking, etc.). In some cases these examples showed preconceptions and misconceptions.

(3) More often than not, there were knowledgeable participants at the table who prompted the groups' thinking and improved the conversations.

(4) There were some, but limited, references to the video and presentations that were part of the program.

(5) There was limited call for more science information.

(6) The carefully scripted questions contributed to the quality of the discussion.

St. Louis NanoFuture Forum: A Best Case Scenario

We believe that the final St. Louis forum, held in May 2008 and titled "NanoFuture: You and the Environment Series," drew on and embodied some of the best ideas and approaches used by the project in terms of impacting the nature and quality of public discourse around nanotechnology. In the points below, we give a flavor of the forum, discuss reasons we consider it "best case," and provide data on participant experiences and impacts.

▪ **The forums were offered as part of a long-term nanotechnology initiative by the host institution.**
Since 2003 the SLSC has engaged in a number of activities as part of an institutional initiative to educate the public about nanotechnology. It participated in NSF's first workshop on nanotechnology education in 2003, and became a member of NSF-funded NISE Net. As part of the initiative, it provided a half-day public program on Nanotechnology in Everyday Life in 2005, and participated in NanoDays for the first time in 2008. It used AAAS outreach funding from Powers of Small to help create a "Nano Center" within its Cyberville Gallery. The 300 square foot center includes graphics panels, a video loop and hands-on exhibits on nanoscience. The site liaison, Chris Roman, Associate Director, Emerging Technologies, oversees all exhibits, programs, grants and collaborations related to emerging technologies at SLSC, including Cyberville and other NISENet work.

▪ **The forum introduced the host institution to a format that is "provocative as an adult program." [Roman]**
The fact that 60-90 people signed up for each evening was seen as an indicator that the format might hold high public interest.

▪ **The program combined various approaches that provided different access points and learning modalities for the audience, which had implications for their discussions.**
The overarching context, purposes and processes for the evening were discussed by the local host and the PI of the project. To illuminate a brief presentation on core concepts about nanotechnology, museum staff did a demonstration that required participants to stand up holding a rope to create a circle representing the circumference of a hair to help provide a scale for the fact that a hair is 80,000 nanometers across. A local nano scholar presented a PowerPoint on the promise and risks of nanotechnology; a selected section of one of the Fred Friendly Seminars programs about environmental implications was shown, more for the sake of modeling the discourse than for the content of the program; and a "discussion framework" was introduced that would guide the table discussions and provide some goals/endpoints for particular phases of the discussions These multiple modalities kept people engaged and provided for multiple ways to think and talk about the topic.

▪ **The host site liaison took a proactive role in finding "win-win" opportunities for broadening SLSC institutional and local involvement in the forums.**
Roman seized the opportunity offered by the forums to involve numerous SLSC staff already trained as facilitators—but with no prior experience working with her program area—to lead table discussion. All 11 staff she invited—from SLSC senior staff, area coordinators, to younger staff—agreed to participate. They were provided protocols with generative questions to guide table discussions, making for satisfying table discussions for themselves and participants.

She also reached out to the St. Louis Science Academy to partner by publicizing the event. This was a new kind of cooperative venture for the city's two major science institutions.

▪ **The forums attracted members of "the engaged public" for science.**
Almost three-fourths of the participants were regular or frequent visitors to SLSC.

▪ **"NanoFuture: You and the Environment" engaged participants in discussion and deliberation about topics of immediate concern to the public**.
Participants at the first evening Forum considered the use of nanotechnology in personal care products and its potential risks. At the second Forum, participants examined the impact of the use of nanotechnology in common household products such as paint and considered the role of public policy in regulating the use of nanotechnology.

At each event, guest scientists and industry representatives presented different viewpoints and research related to nanotechnology. SLSC facilitators then led table discussions where participants discussed various scenarios related to the presentations, and reported out to the whole group.

- **Participants found the Forum to be of high quality and informative**
Participants were randomly provided either a short SLSC internal evaluation card or the longer Inverness Research pre- and post- survey. For the two forums, 41 SLSC evaluation cards were collected, and 43 IR surveys were completed. Data presented in this section are drawn from both evaluations and for both this event and the earlier one at St. Louis.

On the SLSC survey, participants said that the event was consistent with the institutional mission (giving average ratings of 3.8 on a 4-point scale) and that they were satisfied with their experience (3.4 on 4-point scale). Their average rating of interest was 2.6 out of 4.

Respondents to the Inverness pre-survey were asked about their reasons for attending. They came with more interest in the topic of nanotechnology and learning about its potential societal impacts than in the opportunity afforded by the forums to question experts in the field and discuss the topic with fellow citizens. At the end of the evening, they indicated that they learned new information about nanotechnology in general, and the forums helped to inform them about the societal and ethical implications of nanotechnology and also increased their interest in learning more about the role of nanotechnology in security, biological, and environmental issues.

- **The two-evening format allowed the host site to help refine the basic project forum agenda and approach to strengthen participant experience and benefit.**
At the event we visited, for example, more time was given at the beginning of the evening to explain the origins and goals for the NanoFutures Forum series than had been given at the first St. Louis forum.

- **The local site perceived a number of payoffs from the evenings.**
Staff from different areas and at different levels had an unusual opportunity to learn about one another by working together. The format holds promise for use for other purposes at the SLSC such as at an event planned around stem cells.

Involving the St. Louis Academy of Science could lead to other fruitful work together. The Science Center hopes to offer similar programs in the future.

Areas for improvement

Naturally, this first time effort revealed some areas for improvement:

- Some facilitators would have liked more context on the project and NanoFutures Forums during their 2-hour orientation. (What is the nature of deliberative forums? What are the origins of this project, and where will information generated go?)

- Some visitors found the vocabulary level too high in the lead in presentation, which suggests a need for even more careful prepping of participating scientists.

The local site liaison thought that ICAN should provide a "handbook" detailing ICAN's own commitments and its expectations of local partners. It could also include practical tips based on experience.

Long-term impact for participants

The project hypothesized that effective forums should be memorable and might spur participants to engage in follow up discussions or other activities.

Inverness Research conducted follow-up phone calls with six participants at the forum we attended, selected to be broadly representative of those attending. The calls were made two months after the forum.

- The participants remembered the evening clearly.

- Looking back, participants were consistently pleased with the overall evening, said they learned a lot, and appreciated the opportunity to dialogue with a diverse group of people.

- They believed that the evening's purpose was to raise awareness and public understanding about nanotechnology, and feel that the evening was successful in doing that.

- Everyone we spoke with had attended the forum(s) with little or no background knowledge about nanotechnology, and came away feeling that they knew more about the science and issues surrounding it.

- They appreciated learning about the new technology from "unbiased" perspectives.

- They were all surprised by how much nanotechnology is already a part of our everyday lives and how much research is still needed on possible negative side effects. Although concerned and perhaps more alert to nanotech-related issues, none of these participants seemed particularly fearful about nanotech.

- None of them had engaged in follow up discussions with others, accessed the project website or undertaken other follow up activities.[8]

- Overall, they thought the structure of the evening was quite effective:

    - the presentations were very good, for the most part

    - there was a good balance between the science and the issues and about the right level of detail in both the presentations and in the table discussions

    - they loved the "hands-on" activity showing nanoscale

    - several people didn't care for the TV clip (thought it was too long, "boring", or not necessary)

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[8] Follow up calls after the South Carolina forums did document that several participants were motivated by the forum(s) (to learn more or consider ethical implications of their work more thoughtfully).

- they really enjoyed the table conversations, and found them very thought-provoking

- they appreciated facilitators/moderators at each table, although there was variation in how good a job the participants thought the moderators did (pointing to the importance of facilitator training).

- Almost everyone mentioned wishing that this format and information could reach a larger audience.

V. Conclusions. Lessons learned and Returns on Investment

Lessons Learned

THE CONVERGENCE PROJECT MODEL

The Convergence Project model represents a significant and multi-faceted undertaking, involving disparate organizations across the country working toward a similar end – namely engaging the public with scientists, engineers, educators, policy wonks, journalists and industry leaders in thinking about and talking about societal and ethical implications of nano science and technology. The project was envisioned as a multi-media community-based endeavor that would bring together radio, television and web-based resources into community discourse. The quality and quantity of discourse about societal implications for nanotechnology did increase as a function of the various project components, but this outcome happened in relation to each component, not in relation to the components in a collective sense. As it played out, the project resulted in radio spots that engaged the public, television programming that engaged the public, a website that engaged the public, and a set of live community-based events and deliberative forums that engaged the public but at best few in the target audience it reached were able to experience all of the lenses on nanotechnology afforded by the project. In other words, publics that heard the E&S radio programs and engaged in web-logs and participated in community outreach activities and attended deliberative forums and watched the Fred Friendly Seminars programs were not necessarily the same publics.

Ultimately, if there is a whole that is the result of the sum of the parts, it is the public at large who had access to and participated in the live and media-based events and materials generated by the project—not the collective products and programs of the project itself. Firm numbers are hard to come by for this kind of multimodal media project, but several hundred stakeholders and members of the public attended a Fred Friendly Seminars taping and/or participated in a NanoFutures Forum and several thousand participated in AAAS activities. In addition, Earth & Sky programs were accessed 60 million times across the globe, hundreds accessed the website and participated in online discussions, and 75 million television viewers had the opportunity to watch the Fred Friendly Seminars broadcasts.

The collaborating partners each worked steadily to produce their products. And there were instances where particular products did overlap (e.g., the Fred Friendly Seminars tapings and video sections integrated into NanoFutures Forum programming). But because there

were so many moving parts associated with this project—many of which were designing materials while the project was also offering programs—the full potential for synergy amongst the various entities was not met. In particular, the media-based programs were being produced while the community events were happening, and integration as originally planned, particularly with the AAAS led outreach, did not happen. In future endeavors of this kind, time-lining should be done carefully to ensure that project components can reinforce one another as designed.

THE "NANOFUTURES FORUMS"

A Model To Support and Promote Minds-On and Active Engagement of Adult Audiences

The NanoFutures Forums engage adult audiences in a "minds-on" experience around nano science and societal/ethical implications. With relatively little information people can have an interesting, engaging, active and lively conversation. Regardless of the setting and particular focus for the event, participants across the forum sites rated the experience worthwhile and educative.

We identify several key factors in terms of the positive results for participants.

- **A clear overview, purpose and context for each forum, from the perspective of the hosting institution AND the project leadership, gave the audience a sense of the goals and content for the event**. Part of this involved selection of clearly researched and defined topics of community interest to the audiences for each series.

- **Drawing panelists from the immediate community who could speak to particular perspectives and illuminate different aspects of the topic (research, policy, academia, business, etc.) grounded the conversations in local contexts**. Giving the panelists opportunities to circulate and talk with table groups during the table discussions also provided touch-points for the group facilitators and participants in terms of clarifying questions and learning more.

- **Involvement of experienced facilitators coupled with the facilitator training prior to each event and the use of carefully designed discussion guides insures the highest likelihood for equitable discussions that include all participants, and an opportunity for individual facilitator styles and strengths to emerge**. This was a crucial component to the success of the table discussion, which engaged strangers who came with different worldviews, values, experiences and levels of knowledge. Insuring inclusion of all of the participating minds is a big task and was thoughtfully planned and insured for from the beginning. Use of structured discussion guides supported the facilitators in terms of promoting full inclusion for all participants, maintaining focus and deepening the conversations.

- **Having time to reflect on a site's first forum before the second benefits the program and participants**. A two-part forum series has benefits. The program has an opportunity to improve and go deeper with ideas and to refine and modify approaches to fit the context, building on the content and processes introduced in

the first forum. Participants who come to both events not only can deepen their own thinking, but can also help establish discourse norms for new participants at the second event.

Entry Point for Participants

A core principle for structuring the forum scenarios and framing the discussion questions was the notion of focusing on what matters most to people in terms of their day-to-day worlds, experiences and issues, rather than beginning with the science of nanotechnology. This is the best entry point for engagement and critical thinking about nanotechnology. Interest in the science may emerge as a function of the conversation around the more critical topics of interest, in the meantime, the audience stays engaged. This principle played out quite well in the NanoFutures Forums. At each event information about the nano science underlying the evening's issues for discussion was made available or presented, but this was secondary to and in the service of policy, societal and ethical issues to be considered in relation to the science. Of all the forums, the final one offered the greatest variety of entry points to the science underlying the discussion topics but during table discussions we heard very few references to the information that was presented or need among the audience to further clarify the science. (See Appendix C for selected excerpts from these table discussions.)

A critically important caveat to the principle, however, is that the forums' foci, scenarios, panel participants and facilitation were so carefully designed that access to and consideration of accurate scientific and societal aspects of nanotechnology was available to participants at the forums and through other project avenues. In other words, resources, experts, and opportunities to continue to explore and question with some guidance even after the forum ended via web and email were made available to participants. This is a critical component of the forums. Without the grounding in the research and reliable information, and without the resources and expertise that the program organizers brought to the event, we doubt a very productive and grounded discourse would have resulted. We base this conclusion on the variety of preconceptions and idiosyncratic connections and hypotheses participants raised in their conversations.

Several factors designed into the forums mediated audience misconceptions. (1) the immediate access to experts in the field that are present at the forums; (2) the opportunities for participants to follow up their conversations with personal contacts of the program leaders/panelists and access web-based resources related to the topics; and (3) the presence of community "stakeholders" in the audiences themselves –audiences that were strategically recruited for included scientists, advocates (of various sorts), and representatives from private and governmental agencies with a strong and informed interest in the topic.

"Who are stakeholders with regard to nanotechnology issues?"

Over the course of the seminars, project leaders broadened their definition of stakeholders from "informal and formal educators, local policy and government officials, scientists, civic and minority organizations, industries and universities" in the proposal to also include the engaged citizens and consumers who participated in project activities—in other

words the publics are stakeholders. In an interview the PI at the end of the project, she stated:

I came to believe that everyone is a stakeholder. We constrained the definition in the way we originally thought about it, that we were going to bring in stakeholders and the public. Everybody is a stakeholder in one way or another. It is really figuring out what their stake is and making sure that the program or forum is touching what those interests are that is the key to truly engaging the public…

Project PI

Planning and Organization for Hosting Institutions

The footwork needed to effectively plan and organize the work with the host site is significant. Effective planning and clear and regular communications between point people at the site and with the project are critical. Each hosting institution had its modes of operations, working culture and expectations. Though with each of the three NanoFutures Forum sites, particular things were learned and subsequent improvements were made from one site to the next, there were challenges in terms of communications and timeframe issues with all sites.

We recommend that a NanoFutures Forum sponsor's guidebook be generated for future efforts. Such a guide could provide an overview for possible goals/purposes for the events, an introduction and overview of the strategy, and a set of planning tasks. Particular arrangements need to be customized based on the institutions, communities and people involved, but big picture aspects of the approach and a reasonable timeframe for when and how the work and activities happen would be helpful to all involved. A suggested calendar for clear and regular communications between point people between the hosting site and the project are important.

Multiple modalities – the Ultimate Model

The final forum in St. Louis was an experiment with using multiple learning modalities in terms of presentations or "input". Demonstrations about nano science concepts by museum staff, a presentation by a local nano researcher/scholar, Fred Friendly Seminars media section to model the approach to discourse and insert a national presence, and the discussion scenario and deliberation challenge were approaches implemented all in one evening. These variations attended to different learning styles, kept people actively engaged, and provided multiple ways to think, learn about and engage with the topic.

Marketing, Collaborations and Audience Recruitment for the Deliberative Forums

Recruiting an effective number of participants (at least 30 in order to support five or six table groups) is dependent on timely and targeted marketing and publicity. Collaborations with other community organizations help to amplify the recruitment effort, but require advance planning and communications. One forum site program coordinator indicated that this was one of the key outcomes from the project from her perspective. We wonder if the variety of "stakeholders" and the sizes of the audiences might have been more robust if the NanoFutures Forums had coincided more effectively with the community outreach efforts, rather than the tapings of the Fred Friendly Seminars.

Aiming for Deliberative Discourse rather than Decision Resolution

In developing and testing the discourse framework using transcripts and documentation of the forums, and in particular from examining the table discussions and reporting out about results of those discussions, we observed that the discussions align more closely with a kind of "deliberative discourse" rather than achieving resolution (deliberation in its highest form, at least in the sociopolitical discourse theory that shaped our framework). Seldom was total agreement achieved; rather groups typically synthesized and reported out on the agreements and disagreements that were achieved. This level of resolution seemed satisfying to the participants. Moreover, as the initial intent of the forums was to generate an understanding of and documentation of stakeholder and public beliefs and concerns, this seems an appropriate outcome.

Return on Investment and Ideas for Future Investments

BUILDING NEW AND REINFORCING ESTABLISHED COLLABORATIONS AND RELATIONSHIPS

For institutions and organizations that have not held public forums with the goal of engaging the public in deliberative discourse focused on science/technology-related societal and ethical issues, the support and opportunity to scaffold forum events in collaboration with experienced organizations (e.g., ICAN) holds promise for bringing a new avenue for public engagement and education of adult audiences. In the case of St. Louis, for example, the ISE was able to forge a new and local collaboration for this purpose. The involvement of a third-party in the effort also provided a new opportunity for cross-department work because it required so many people to staff as facilitators so people had to meet around a common purpose and activity/event. Internally and externally it strengthened some relationships.

One disappointment from the project PI's perspective was that the engagement with one potential partner did not reach its fullest potential. The project components offered a potentially substantive connection with the NISE network, but the potential for integrating the Fred Friendly Seminars, Earth and Sky podcasts, web-based materials and the model for the NanoFutures Forums did not result in a substantive collaboration with NISENet. This was a disappointment to the Convergence project's leadership, which had hoped for a richer integration, and we feel a lost opportunity.

PUBLICATIONS AND DISSEMINATION

Documenting the forums for evaluative purposes gave us a unique opportunity to hear from these publics about the concerns, conceptions, and questions about nanotechnology in relation to health, security and the environment. In each case we were struck with the quality and creativity that emerged in terms of ideas for possible solutions or at least considerations from their perspective. Some participants who were interviewed wondered where the ideas and results from their deliberations would ultimately end up.[9] To date

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[9] Though the project did publish the results of the St. Louis forums on the website, inviting all participants to comment, no comments were received on the material. This may serve as *(footnote continued)*

these ideas have not been gathered and synthesized in a way that could be systematically shared with a broader audience. Though plans for "white papers" were discussed from the beginning, these never came to fruition. Our own work for the project made us appreciate the challenges of documenting and analyzing multiple simultaneous conversations. We recommend that alongside any future funding for such forums, perhaps graduate students be supported to gather and synthesize the outcomes for these forums so that the thoughtful, creative and potentially useful ideas that were produced by the forums find their ways to broader audiences.

FUTURE INVESTMENT

Ultimately, and as discussed throughout this report, we see three key returns on the Nanotechnology: the Convergence of Science and Society investment. (1) A Model for organizing and facilitating deliberative forums that brings external expertise, structures, resources, and processes into organizations and institutions that have a vested interest in engaging the public around science and society issues. (2) A set of media-based materials that provide the public-at-large with information and connections to a broader conversation about nanotechnology and it's relationship to health, security and the environment; and (3) new collaborations that were forged as a function of producing the materials and creating the forums model.

In terms of further investments we recommend: (1) considering other avenues, topics and contexts to apply and improve on the NanoFutures Forum model and supporting the development of a working guide including rationale and how-to's about the approach; (2) creation of opportunities for further promoting and using the Fred Friendly Seminars series and website for informal and formal educational purposes; (3) supporting research as a component to future funding of such public engagement investments that support this kind of work, so that new knowledge about the results of public discourse and deliberation can be captured and perhaps even used to inform policy in a systematic way.

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a good model for a forum outcome in the future. See
http://www.powerofsmall.org/forums/stlouis.html.

Appendices

A. Participant survey results for Small Matters:
November 2006 - May 2008

B. "Nanotechnology: The Power of Small"
Deliberative Forum Evaluation Framework -
A Working Document

Appendix A. Participant survey results for Small Matters: November 2006 – May 2008

Boston Museum of Science Forums (11/6/06, 1/9/07), the California Science Center (1/27/07), South Carolina (4/3/07, 4/24/07), and St. Louis Science Center (5/6/08, 5/28/08)

Survey development and administration

Inverness Research developed short pre- and post surveys for administration immediately before and after Deliberative Forums. Local staff or IR researchers administered the surveys. Most attendees turned in their surveys, for a total of 348 completed surveys. For the Boston forums, 43 surveys were collected in November, and 35 in January. Twenty attendees at the April 3rd forum in South Carolina filled out the survey; 23 responded on April 24. Eighteen completed surveys at the first St. Louis forum, and 25 at the second forum there. We have, then, 164 surveys for Small Matters Deliberative Decision Making Forums, from an estimated 100-120 different individuals. In addition, 184 attendees completed the survey at the CSC partner event.

Survey results

In general, responses have been positive and quite similar across the three Small Matters sites and the partner site. Ratings were generally slightly higher at the second event than at the first.

Among reasons for participating in the forums were an interest in learning more about nanotechnology in general and/or the specific topic that was featured, an opportunity to interact with and hear from experts in the field, curiosity and interest in how science happens and interacts with society, resources for educative purposes, and an opportunity to articulate their thinking and questions with others.

When asked about what they were hoping to gain from attending, prior to the event participants said things like:

> *An understanding of the technology, potential uses/abuses, an opportunity to interact with presenters*

> *An understanding of the issues surrounding nanotechnology and a deeper comprehension of the implications for societal uses and safety*

> *The language to intelligently discuss nanotechnology with others.*

> *I'm hoping to add on to my current knowledge of nanomedicine so that I can pass it on to other friends and relatives.*

> *Learn "what it is" and understand its application in industry and how to protect employees working with this nanotechnology.*

When asked after the event what they valued most about the experience, participants said things like:

I valued all the information presented to me tonight, all the pros and cons and meeting all the great people

Getting non-political/commercial perspectives on the subject

Hearing views of both scientists and public policy makers

The interaction with the participants. It was a great exposure to diverse points of view

Simply learning more

One participant noted:

It sounds like the future of nanotechnology relies on a paradigm shift of thinking—one that requires public trust in the scientific method and is supported by well-informed political climate… an interaction that can be lethal or successful.

Survey results for each site are reported below. First, we present attendee characteristics, then attendee responses to pre- and post-event questions.

ATTENDEE CHARACTERISTICS

Forum audience characteristics varied across sites. In Boston and LA, the typical audience member was a white male who is personally interested in nanotechnology and who may have other ties to the topic. The attendees in South Carolina who completed surveys included a slightly higher proportion of women (67% the first evening, 50% the second) and persons of color (16% the first evening, 29% the second)[10]. More people in the South Carolina audience had prior ties to the topic of nanotechnology. A third of the first DDF attendees had attended The South Carolina Citizen's School of Nanotechnology, and nearly half (43%) of the second DDF audience had. Women were a slight majority in St. Louis.

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[10] Informal observation of the South Carolina audience put the proportion of non-traditional audiences even higher; not everyone completed a survey.

Attendee characteristics

	Boston Nov 6 (n=43)	Boston Jan 9 (n=35)	LA Jan 27 (n=184)	SC April 3 (n=20)	SC April 24 (n=24)	St. Louis May 6 (n=18)	St. Louis May 28 (n=25)
Relationship to the nanotechnology Forum topic (BOS/SC)/ interest in topic (LA)							
researcher/student studying nano or related topic	26%	11%	8%	20%	21%	6%	13%
educator/teacher	24%	14%	14%	15%	29%	11%	21%
nanotechnology industry/business interest	7%	14%	14%	10%	4%	0%	21%
personal interest	67%	77%	81%	40%	46%	72%	42%
community/advocacy interest group member	7%	6%	4%	30%	21%	22%	8%
NISE Network Affiliate	0%	3%	NA	NA	NA	NA	NA
other (e.g., communications technology, law enforcement, reporter)	5%	9%	6%	10%	8%	6%	13%
Gender							
male	62%	56%	55%	33%	50%	44%	41%
female	38%	44%	45%	67%	50%	56%	59%
Racial or Ethnic Group							
African American	5%	13%	3%	16%	25%	0%	0%
American Indian/Alaskan Native	0%	3%	1%	0%	0%	11%	4%
Asian-American	8%	6%	13%	0%	0%	11%	13%
Hispanic/Latino/a	3%	0%	8%	0%	4%	0%	0%
White, not of Hispanic origin	85%	75%	69%	84%	71%	100%	91%
Other	8%	3%	6%	0%	0%	0%	0%

Host sites can play an important, but not the only role in publicizing the forums. A majority of the Boston audience (86% at the second DDF) learned about the Forum through the host site, the Museum of Science. Other outreach efforts in Boston yielded fewer participants (e.g., 14% at the first DDF and 10% at the second DDF belonged to neighborhood groups interested in the topic; a handful came through the ACLU, Port Security, and Families of 9/11 (5% from each the second DDF). Over half of the CSC audience heard about the program through one of two avenues—a Science Center email (31%) or a friend (25%). More attendees came to the South Carolina DDFs through The University of South Carolina and The South Carolina Citizen's School than through other avenues. Perhaps because this was a new kind of undertaking for the South Carolina Science Museum, few attendees (15% for the first DDF, 9% for the second) came because of that connection. Personal connections and emails proved to be important sources in St. Louis.

Avenues for learning about the Forums

	Boston Nov 6 (n=43)	Boston Jan 9 (n=35)	LA Jan 27 (n=184)	SC April 3 (n=20)	SC April 24 (n=24)	St. Louis May 6 (n=18)	St. Louis May 28 (n=25)
ACLU	0%	5%	NA	NA	NA	NA	NA
Families of 9/11	2%	5%	NA	NA	NA	NA	NA
Nano Educators Workshop	14%	10%	NA	NA	NA	NA	NA
Neighborhood groups	20%	14%	NA	NA	NA	NA	NA
Port Security	0%	5%	NA	NA	NA	NA	NA
MOS listserv	NA	86%	NA	NA	NA	NA	NA
Science Center website	NA	NA	8%	NA	NA	NA	NA
Science Center email	NA	NA	31%	NA	NA	NA	NA
At the Science Center	NA	NA	6%	NA	NA	NA	NA
Friend	NA	NA	25%	NA	NA	NA	NA
SC Science Museum	NA	NA	NA	15%	9%	NA	NA
University of SC	NA	NA	NA	15%	30%	NA	NA
Science Café	NA	NA	NA	5%	9%	NA	NA
Citizen's School of Nanotechnology	NA	NA	NA	25%	39%	NA	NA
Email to SLSC members	NA	NA	NA	NA	NA	6%	20%
Email to Academy of Science of St. Louis members	NA	NA	NA	NA	NA	22%	12%
Email from KETC-TV	NA	NA	NA	NA	NA	11%	4%
Email to SLSC trustees	NA	NA	NA	NA	NA	0%	0%
Email to Academy of Science trustees	NA	NA	NA	NA	NA	0%	8%
NPR spot	NA	NA	NA	NA	NA	0%	0%
Other email from SLSC	NA	NA	NA	NA	NA	11%	8%
Other email from Academy of Science	NA	NA	NA	NA	NA	17%	16%
Other media	NA	NA	NA	NA	NA	0%	0%
SLSC website and calendar	NA	NA	NA	NA	NA	0%	0%
Academy of Science website and calendar	NA	NA	NA	NA	NA	0%	4%
Personal contact	NA	NA	NA	NA	NA	28%	36%
Other	NA	NA	30%	20%	22%	0%	12%

Nanotechnology events can attract new audiences to science institutions. 17% of the CSC audience said that this was their first visit to the Science Center. This question was not asked at the DDF sites.

The most important factors in the decision to attend the forums are their attention to topics related to nanotechnology. Secondarily, audiences are attracted by the speakers' expertise, and the opportunity to talk with peers and experts. The multi-event forum format and opportunity to participate online have, to date, been weak draws for the audiences.

How important were each of the following to your decision to participate in tonight's Forum?

(Mean ratings are provided where 1=Not important, 4=Very important)

	Boston Nov 6	Boston Jan 9	LA Jan 27	SC April 3	SC April 24	St. Louis May 6	St. Louis May 28
The topic of nanotechnology	3.6	3.6	NA	3.4	3.8	3.3	3.4
Topic of science behind nanotechnology	NA	NA	3.4	NA	NA	NA	NA
Topic of practical application of nanotechnology	NA	NA	3.4	NA	NA	NA	NA
The focus on societal impacts	3.4	3.2	3.2	3.3	3.3	3.3	3.3
Tonight's topic	NA	3.2	NA	3.2	3.3	3.3	3.2
The speakers' expertise	2.6	2.9	3.2	3.0	2.9	3.1	2.7
The opportunity to talk to peers	2.7	2.8	NA	2.7	3.0	2.4	2.5
The chance to ask experts questions	2.5	2.7	2.4	2.6	2.9	2.4	2.5
The opportunity to participate online	2.1	NA	NA	1.7	1.6	1.8	1.8
The 3-meeting format for the Forums	1.9	2.3	NA	2.1	2.2	1.8	1.8
Experience Nov 7	NA	2.1	NA	NA	NA	Na	NA
The Fred Friendly taping	1.6	1.9	NA	1.8	2.0	Na	NA

A majority of the participants say that they feel comfortable with expressing opinions about science and technology and have strong opinions about the role of the public in science decision-making. Fewer agree that they have strong understandings of societal and ethical issues or the science of nanotechnology. (*See the appendix for comments in response to the open-ended question, "**What are you hoping to gain from attending this series of Forums/this program on Nanotechnology?**")*

Ratings of agreement with the statements on opinions and understandings of science, technology and nanotechnology prior to the project event

(Mean ratings are provided where 1=Disagree strongly, 4=Agree strongly)

	Boston Nov 6	Boston Jan 9	LA Jan 27	SC April 3	SC April 24	St. Louis May 6	St. Louis May 28
I feel comfortable expressing my opinions on science and technology.	3.3	3.3	3.1	3.1	3.3	3.1	3.0
I have a strong opinion about the role of the public in science decision-making.	3.0	NA	2.8	3.2	3.2	2.2	2.4
I have a strong understanding of the societal and ethical issues around nanotechnology (as it pertains to security and privacy.(BOS))	2.5	2.7	2.3	2.8	2.6	2.2	2.3
I have a strong understanding of the science of nanotechnology as it pertains to security and privacy (BOS)/ health and environmental applications (LA).	2.4	2.8	2.2	2.5	2.6	3.0	2.9

POST-EVENT QUESTIONS

Most participants enjoyed the experience, felt comfortable voicing their opinions, gave high ratings to the facilitation, and said they were interested in learning more. Slightly fewer said that they better understood the science of nanotechnology related to privacy and security BOS)/ health and environmental applications (LA/health and human enhancement (SC)/enhancing our personal lives and our environment (SLSC) and/or that their opinions had changed. (*See the appendix for comments in response to the open-ended questions* **"What did you value most about this experience?"** *and* **"What, if anything, have you learned from this Forum that you didn't know before?"**)

Note that ratings were quite similar across events and sites. For Boston and South Carolina, ratings for the second forum were very slightly higher than for the first forum.

Please rate your agreement with the following statements about this event:

(Mean ratings are provided where 1=Disagree strongly, 4=Agree strongly)

	Boston Nov 6	Boston Jan 9	LA Jan 27	SC April 3	SC April 24	St. Louis May 6	St. Louis May 28
I enjoyed the experience.	3.4	3.6	3.5	3.6	3.7	3.6	3.6
All views were encouraged and acknowledged.	3.4	3.6	3.3	3.5	3.5	3.3	3.7
My facilitator modeled and encouraged civil discourse.	3.4	3.5	NA	3.4	3.6	3.4	3.5
I felt comfortable voicing my opinions.	3.3	3.7	NA	3.6	3.6	3.5	3.5
I took an active part in the discussion (BOS&SC)/ question and answer session (LA).	3.3	3.5	1.8	3.4	3.6	3.3	3.6
As a result of this event I am interested in learning more about the role of nanotechnology in security and privacy issues (BOS)/ health and environmental applications (LA)/health and human enhancement (SC)/ enhancing our personal lives and our environment (SLSC).	3.3	3.5	3.3	3.5	3.7	3.5	3.4
I feel more informed about the societal and ethical issues around nanotechnology as it pertains to security and privacy (BOS)/ health and environmental applications (LA)/health and human enhancement (SC)/.	3.1	3.3	3.1	3.1	3.3	3.3	3.3
The facilitation/moderation was skillful and effective.	3.1	3.3	3.5	3.3	3.5	3.2	3.5
The dialogue was well structured around specific topics and/or issues.	3.0	3.3	NA	3.2	3.4	3.2	3.2
There was a good balance of depth vs. breadth in the discussion.	3.0	3.3	3.2	3.4	3.5	3.1	3.4
I feel more informed about the science of nanotechnology as it pertains to security and privacy (BOS)/ health and environmental applications (LA)/health and human enhancement (SC)/ enhancing our personal lives and our environment (SLSC).	2.9	3.3	3.4	3.1	3.4	3.3	3.2
The experience matched my expectations.	2.8	NA	2.6	NA	NA	NA	NA
The speakers' presentations influenced our small group discussion.	2.8	3.3	NA	2.7	3.1	3.1	3.0
My thinking and perspectives were changed as a result of this event	2.5	2.6	2.7	2.9	2.6	2.6	2.6
Some participants or facilitators exercised too much influence in the discussion.	2.1	2.2	NA	2.3	1.7	2.1	1.9
I would be interested in attending additional local events to learn about and discuss issues related to Nanotechnology and societal and societal/ethical issues.	NA	NA	3.3	NA	NA	NA	NA
The video clip influenced our discussion	NA	NA	3.3	NA	NA	NA	3.0

The small group discussion, the topic and the focus on security and privacy contributed most to participant satisfaction in Boston. In Columbia and St. Louis, the overall topic of nanotechnology contributed more to participant satisfaction than did the focus on health and human enhancement. Results were similar in LA, except that the speakers' presentations rated highly (and there were no small group discussions).

Again, ratings were generally slightly higher at the second DDFs than at the first DDFs.

How important were the following in contributing to your satisfaction with this program?

(Mean ratings are provided where 1=Not at all important, 4=Very important to satisfaction)

	Boston Nov 6	Boston Jan 9	LA Jan 27	SC Apr 3	SC Apr 24	St. Louis May 6	St. Louis May 28
The focus on security and privacy (BOS)/health and human enhancement (SC)	3.0	3.5	NA	3.6	3.3	3.3	3.2
The topic of nanotechnology	3.1	3.3	NA	3.5	3.7	3.4	3.5
The small group discussion	3.3	3.1	NA	3.4	3.4	3.2	3.2
The topic of the science of nanotechnology	NA	NA	3.4	NA	NA	NA	NA
The focus on applications of nanotechnology	NA	NA	3.5	NA	NA	NA	NA
The focus on societal and ethical implications	NA	NA	3.1	NA	NA	NA	NA
The speakers' presentations	2.7	3.1	3.3	2.6	3.2	3.3	3.3
My facilitator	2.7	3.0	NA	2.9	3.3	3.3	3.3
The question/answer period	2.4	2.8	2.9	3.1	3.1	2.1	2.9
The video clip from the Fred Friendly Seminar	NA	NA	NA	2.6	2.8	NA	2.8

Appendix B. "Nanotechnology: The Power of Small" Deliberative Forum Evaluation Framework - A Working Document

Measuring the Nature, Quality and Impact of Dialogue and Deliberation

Purposes and possible use of this framework

A variety of "forums"—or opportunities for dialogue around nanotechnology—will be implemented in conjunction with this project. They range from very informal conversations involving few people at any time such as docent conversations with visitors around an exhibit to carefully structured series of meetings with the same audience who attend the filming of a Fred Friendly panel as a centerpiece.

In order to document the forums for this project, and examine their impact, we have created this framework that organizes a set of indicators or dimensions related to the nature and impact of the discussions. A set of questions accompanies each dimension that can be asked of forums of various types. Not all areas of inquiry or questions will be applicable to every forum. And there may be additional questions that could be asked of specific forums.

Inverness Research will use the framework to design protocols for observations, interviews (participant, outreach coordinators, facilitator), focus groups, and participant surveys around events of particular interest for the external evaluation (i.e., events that have a strong relationship with the Fred Friendly seminars). We will also use the framework to analyze aspects of the discourse documented at the forums.

Outreach partners and project staff might use the framework to prepare for interviews with Inverness and/or to design local evaluations or debrief sessions around project-related activities and events that are not being looked at closely by Inverness.

QUESTIONS THAT THE EXTERNAL EVALUATION WILL ADDRESS

- *How effective is the project in meeting its goals for influencing the content and quality of the dialogue around nanotechnology among key stakeholders and the public?*

- *What is the impact of the seminars, in particular on the level and quality of discourse?*

- *To what extent and in what ways does this dialogue inform or influence participants' thinking about nanotechnology?*

- *Do these strategies for public engagement appear to be effective and to be a worthwhile investment?*

POSSIBLE INDICATORS OR DIMENSIONS OF THE NATURE AND QUALITY OF PARTICIPATION, DIALOGUE, DELIBERATION[11] AND IMPACT OF THE FORUMS

1. <u>INCLUSION</u>: Does the event or activity consider the interests, values, and views of the public and/or major stakeholders involved in the area of nanotechnology under consideration? This does not mean that every interest, value, or view need be given equal weight, only that all relevant ones should be considered in the design and conduct of the event or activity.

2. <u>DIALOGUE</u>[12]: Does the event or activity encourage extensive dialogue with participants (public and/or stakeholders) and sometimes dialogue among participants? The aspiration is to prevent misunderstanding of interests, values, and views. Understanding does not necessarily entail agreement. The facilitator is responsible for structuring the dialogue.

*3. **<u>DELIBERATION</u>: Does the event or activity provide an opportunity for extensive deliberation in arriving at conclusions?** The aspiration is to draw well-considered conclusions. Sometimes stakeholders might participate in the deliberations to discover their true interests.*

*4. **<u>IMPACT/EDUCATIVE VALUE</u>: Does the event or activity influence participant thinking and behavior?** Do participants gather more information, talk to others, apply what they experienced to other domains of cutting-edge science, or take other actions? In what ways, if any, does participant thinking change?*

The four sections that follow are organized around each of these indicators and provide sets of questions for consideration. Footnotes offer sources, references and notations specific to particular aspects of this project. Bibliography for main references are given at the end of this section.

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[11] Macoubrie, J. (2003). Deliberative Democracy: Conditions for Deliberation. http://www.ncsu.edu/chass/communication/www/faculty/faculty_profiles/macoubrie/ConditionsforDemoDelib.pdf. Also cited in Macoubrie, House, E. R., Howe, K. R. (2000). Deliberative Democratic Evaluation Checklist. Also ICAN DDF proposal (2006).

[12] The questions around these areas my overlap, as might the dialogue and deliberation processes. For example, some procedures that encourage dialogue might also promote deliberation.

Inclusion

1. ***INCLUSION**: Does the event or activity consider the interests, values, and views of the public and/or major stakeholders involved in the area of nanotechnology under consideration?* *This does not mean that every interest, value, or view need be given equal weight, only that all relevant ones should be considered in the design and conduct of the event or activity.*

What are the primary purposes for the event?

How were the participants (presenters, facilitators, audience) recruited?

Who is participating?

Who is presenting?

Who is facilitating?

Who is in the audience?

> Participation categories
>
> - public: N by age, sex, ethnicity, affiliation, science background
>
> - stakeholders: N by age, sex, ethnicity, stakeholder group[13], affiliation, expertise (legal, social, ethical issues; nanoscience)

Is there any accommodation for audiences with different communication needs (e.g., non-English speakers, hearing impaired)?

Is time and place accessible and convenient for intended audiences?

Whose interests/points of view are represented in the event/activity/exhibit?

If some stakeholders [or points of view] are not represented, what is the reason? Who made the decision and why?

If there are several different activities/events, are the same interests/points of view represented by all of them?

For events that draw on Fred Friendly Seminars:

Which Seminar is involved? What is shown of the Seminar? How? When?

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[13] Stakeholder groups: from proposal—academic, corporate and government scientists; environmental advocates; religious and business leaders; science and technology journalists; government officials and public policy makers; also there are consumers, medical, general interested public, traditionally underrepresented minorities.

Dialogue

*2. <u>DIALOGUE</u>: **Does the event or activity encourage extensive dialogue with participants (public and/or stakeholders) and sometimes dialogue among participants?*** *The aspiration is to prevent misunderstanding of interests, values, and views. Understanding does not necessarily entail agreement. The facilitator is responsible for structuring the dialogue.*

Planning for dialogue

What are the primary purposes for the dialogue?

If there is potential for dialogue, is there some attempt to structure the dialogue?

What training have facilitators had on dialoguing with participants?

Have commitments to rules and procedures been secured in advance (from facilitators, audience)?

Do the facilitators have pre-planned probes or question in mind?

Are resources (projectors, designated recorder) organized for structuring and displaying work?[14]

For events drawing on FF Seminars:

How is event intended to draw upon the seminar?

How is engagement in the seminar expected to contribute to participant impact?

How familiar are the facilitators with the content and issues raised in the seminar?

Participation in dialogue

Who takes an active part in the activity/event/discussion?

In what ways are participants engaged?

- e.g., time allocated to watching media, using exhibit, listening to lecture, discussion and dialogue

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[14] Rowe, G., & Frewer, L. J. (2000). Public participation methods: A framework for evaluation. Science, Technology, & Human Values, 25(1), 3-29, cited in Macoubrie.

Nature of dialogue

What is the content of the dialogue?[15]

To what extent is the conversation around each of the following?

- the science of nanotechnology

- social and ethical issues (medical, environmental, military, legal, etc.)

- policy and regulatory issues

- popular culture notions

- images of nano

- other domains of cutting edge science

- off-topic conversation

(collect examples)

To what extent are exchanges structured carefully around specific issues? (by verbal or written cues)

Whose interests/points of view are represented in the dialogue?

To what extent are various participants actively engaged?

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[15] From the DDF proposal: "explore the important social benefits and potentially controversial societal challenges raised by nanotechnologies... The forums will provide participants with opportunities before, during, and after their dialog and deliberations to learn more about nanoscale science and nanotechnologies, the societal issues that may arise as they come into use, and the regulatory framework and policy areas surrounding them. Meeting 1: brief presentations from relevant experts in the science, social implications, and regulatory framework underpinning the forum topic. Taping: Participants will attend the Fred Friendly Seminar and question and answer session that follows. The Seminar will allow participants to view experts working through a process similar to their own, to hear and consider alternative opinions about the general topic, and to reflect upon their own views in relationship to the public forum issues. A structured, moderated online asynchronous dialog (SMOAD) will follow the initial working session and Fred Friendly Seminar. The SMOAD will provide participants an opportunity to rethink the array of solutions and choices from the first session based on their observance of the FFS Seminar and to deepen the group's understanding of why different individuals advocate different choices and of why disagreements exist within the group." [Final Meeting]

How authentic is the participation?

    - Are participants forthcoming under the circumstances?

    - Are concerns that are put forth by participants acknowledged or addressed?

    - Are the views of all stakeholders secured?

Is there a balance in the points of view/voices in the dialogue?

    - Are there procedures in place to ensure balance in the dialogue?

    - Are there procedures in place to manage dominant participants?

    - Do certain points of view/voices dominate or impede dialogue and deliberation?

    - Is there posturing or disengagement? Are all views encouraged and acknowledged?

Is there a good balance of depth with breadth in participation?

For events that draw on FF Seminars:

    How does the dialogue involve FF seminars? (interwoven, treated as a special topic?)

    What part of the seminar is referenced in the dialogue?

    How does the access to the FF seminar contribute to quality of the dialogue? (e.g., provides vivid situations that elicit conversation, models dialogue style)

    How, if at all, may the dialogue be weakened by the incorporation of the seminar? (e.g., takes time away from dialogue, narrows conversation, not congruent with participant interest and expertise)

Facilitation

Are questions posted?

Based on participants' responses, are there multiple avenues for discussion?

Is the structure of the dialogue suited to participant characteristics?

To what extent are children's and adult voices respected equally?

If there are opposing points of view, are they acknowledged and respected?

To what extent do facilitators model and encourage civil discourse?

    Is receptivity to other views encouraged?

Do some participants or facilitators exercise too much influence?

For events that draw on FF Seminars:

How, and to what extent, do facilitators assist the group in incorporating the seminar content and ideas?

Deliberation

3. __DELIBERATION__: Does the event or activity provide an opportunity for extensive deliberation in arriving at conclusions? *The aspiration is to draw well-considered conclusions. Sometimes stakeholders might participate in the deliberations to discover their true interests.*[16]

Planning for deliberation

Is there intent for deliberation in the planning of this activity?

Is there sufficient staffing so that deliberation can take place?

To what extent, and how are facilitators trained to manage deliberation? (How much preliminary work/planning/consideration is being given to HOW they are going to achieve what they discuss in the DDF proposal.)

Are resources (space, tables, etc.) organized for deliberation?

Are resources (projectors, designated recorder) organized for structuring and displaying work?[17]

Is there a group definition of the task?[18]

Are expectations for the group process/subtasks clear?[19]

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[16] From DDF proposal: Meeting 1: Participants will be broken into small working groups of 8 - 10 people to begin considering the issues before them. A facilitator will work with each group to insure that everyone's perspectives and viewpoints are expressed, to provide structure for the dialog so that the group identifies and analyzes an array of solutions and choices. A reporter from each group will present the group's findings to all the participants. The desired outcome for the first working session is to define possible choices, explore areas of disagreement, and rank choices presented by the groups.
During the first working session, participants will have an opportunity to identify additional information needs, including expert opinion. Information needs will be met by either direct responses from experts in the session or through materials developed after the working session and made available to participants online.
A final in person working session will bring the groups back together to deliberate choices and arrive at decision resolution regarding recommendations for policy direction. The group's recommendations and array of opinions will be summarized and presented to the group as well as relevant policy makers, the local media, and other interested parties
[17] Rowe and Frewer (2000), cited in Macoubrie.
[18] Rowe and Frewer (2000), cited in Macoubrie.

Are participants clear about their roles?

Participation in deliberation

Who is participating and how were participants recruited/invited to participate?

Who actively engages in the deliberation?

Who is facilitating?

Do experts play critical roles where relevant?

Nature and quality of the deliberation

What is the content of the deliberation? To what extent is the conversation around each of the following?

- social and ethical issues (medical, environmental, military, legal, etc.)

- policy and regulatory issues

- commercialization and business

- scientific concepts related to nanotechnology

- other domains of cutting edge science

- off-topic conversation

- other

How extensive is the deliberation?

Is there reflective deliberation? To what extent is the deliberation characterized by each of the levels? [*e.g., comments and exchanges could be recorded and coded by role, demographics and type of statement; minimally, examples will be collected*]

1. Exchange Views (not deliberative)

[e.g., agree, disagree, acknowledge other's view, offer view, raise a topic]

2. Thoughtful Argument (necessary but not sufficient for deliberation)

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[19] Hackman, J. R., & Morris, C. G. (1975). Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. In L. Berkowitz (Ed.), Advances in Experimental Social Psychology (pp. 45-98). Orlando: Academic Press. Also Hirokawa, R. Y., Erbert, L., & Hurst, A. (1996). Communication and group decision-making effectiveness. In R. Y. Hirokawa & M. S. Poole (Eds.), Communication and group decision making (2nd ed.). Thousand Oaks: Sage. Both cited in Macoubrie.

[Agree/disagree and explain; offer criteria for solution; contribute facts]

3. Cognitive Integration (moderately deliberative)

[Agree/disagree, explain, relate to other issue; request information about

other's views; provide information in response to request; accept position,

add new argument and issue]

4. Integrative Decision Resolution (highest level of deliberation)

[Develops integrating solution; changes issue views; agrees on integrated

solution; changes preferred solution]

Are informational issues addressed?

Is new information shared by facilitators?

Is all information accounted for?

Do facilitators introduce important issues neglected by participants?

Does the group reach resolution?

To what extent does the entire group agree with the conclusion?

How well considered is the deliberation?

Is there a careful weighing of solutions? (e.g., engagement in problem analysis, identification of a range of solutions and evaluation criteria, evaluation of solution merit[20])

Does the group's conclusion draw from all of the data in a logical way?

What roles do facilitators play? (e.g., surfacing disagreements, encouraging a wide range of alternatives, perspectives and viewpoints[21]; ensuring that there is broad participation, achievement of specific decision subtasks such as defining common goals.

For events that draw on FF Seminars:

How does the deliberation involve FF seminars? (interwoven, special topic?)

What part of the seminar is referenced in the deliberation?

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[20] Burkhalter et all (2002), cited in Macoubrie.
[21] Fishkin (1991, 1995), Gutmann and Thompson (1996), cited in Macoubrie.

How does the access to the FF seminar contribute to quality of the deliberation? (e.g., models deliberation style, influences conclusions that are drawn)

Idea for rubric-oriented scale: Summary ratings for DDFs only-or for all, with NA option: To what extent does the following statement characterize the deliberation: It offers citizens the opportunity to:

- join together to deliberate

- make choices with others about ways to approach difficult issues

- generate new conclusions based on evidence/date generated by the group

- work toward influencing public decisions and public policy and

- improve public knowledge" (ICAN's DDF proposal).

Impact and Educative Value

4. __IMPACT/EDUCATIVE VALUE: Does the event or activity influence participant thinking and behavior?__ Do participants gather more information, talk to others, apply what they experienced to other domains of cutting-edge science, or take other actions? In what ways, if any, does participant thinking change?

In what ways does the event or activity influence participant <u>thinking</u> about?

- the science of nanotechnology

- social and ethical issues (medical, environmental, military, legal, etc.)

- policy and regulatory issues

- popular culture notions

- images of nano

- other domains of cutting edge science

Overall, to what extent does the event or activity influence participant <u>thinking</u>?

For events that draw on Fred Friendly Seminars:

To what extent and how does the FF Seminar contribute to changes in participant thinking?

To what extent and in what ways does the event or activity influence participant <u>behavior</u>? Do participants

- gather more information

How, about what, for what purpose?

- talk to others

How, about what, for what purpose?

- apply what they experienced to other domains of cutting-edge science

How, about what, for what purpose?

Overall, to what extent does the event or activity influence participant <u>behavior</u>?

For events that draw on Fred Friendly Seminars:

To what extent and how does the FF Seminar contribute to changes in participant behavior?

Main Reference

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