

## 15 Public Engagement with Emerging Issues in Agri-Food Nanotechnology

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### 15.1 Introduction

Internationally, there is increasing investment in both the private and public sectors in *technologically driven* innovations, such as foods developed with novel technologies, improved food safety and food quality initiatives, and improved sustainability in terms of food production, processing, delivery and consumption. As has been discussed in other chapters in this volume, however, societal responses to agri-food nanotechnology may not necessarily be positive. Successful implementation and commercialization of emerging technologies is contingent on societal acceptance of the technology overall, as well as on consumer acceptance of specific applications, particularly at a time when public confidence in technological innovation is generally low—this is particularly true within the agri-food sector, which has been beset by past societal controversies. As a consequence, it is important to identify societal concerns regarding new developments in the area of emerging technologies, possibly to allow the timely opportunity to pre-empt or ameliorate these [1], or to change the trajectory of technology development in line with societal preferences.

In the case of agri-food nanotechnologies, there is potential for profound societal and consumer *benefit* to be associated with its application. Indeed, signs of consumer negativity and distrust in the motives of both industry and regulatory institutions—regarding this and other technologies—are already appearing. At the present time, societal attitudes toward nanotechnology have not yet fully crystallized [2, 3], but this may change as societal debate about the risks and benefits of nanotechnology intensifies and products begin to be made available to consumers. Developing effective public engagement is therefore key to understanding consumer–citizen priorities and preferences for future food production systems and their products. The aim of this chapter is to review different mechanisms for public engagement, to consider their application to the nanotechnologies issues, and to comment on their likely limitations and effectiveness—particularly with regard to the appropriate criteria for their subsequent acceptance by those involved in the process and society more generally.

It is argued that it is important for event sponsors (in particular) to recognize the different aims of consultation and engagement mechanisms, and choose a mechanism according to their specific consultative aims [4]. Furthermore, given that an appropriately selected mechanism (for a given situation) may still be inappropriately applied, it is important that the exercise itself should be independently *evaluated*. That is, the purpose and aims of such exercises should be made explicit by the sponsors, and any exercise conducted should be of appropriate rigor regarding independent evaluation of both process and policy impact (or at least the use of the outcomes) to enable scrutiny by the interested end-user communities, and to facilitate comparisons in time and across different geographic regions and population groups. Public engagement associated with technology development or other technological or societal initiatives (including agri-food nanotechnologies) should recognize that such initiatives affect society over and above product development and commercialization.

## 15.2

### What Is “Public Engagement”?

Perceptions of risk and benefit associated with different applications of food technology, “sustainable” production, or other future foods issues, may have a direct influence on consumer acceptance of specific products. Societal acceptance of emerging technologies is also likely to be contingent on “societal trust” in regulators, regulatory institutions, industry, and other actors in the technology sector under consideration [5]. Citizens’ trust in industrial and regulatory actors with responsibility for consumer protection and optimization of the economic success of the applications of emerging food technologies may influence perceptions of risk and benefit. The occurrence of various food safety incidents associated with existing and emerging technologies, many of which have had international and national consequences for quality of life and economic functioning, has highlighted the need to develop and maintain public confidence in the management of the food supply [6]. A case in point is the negative public reactions to genetic modification in the agri-food sectors, which have had important consequences for commercialization of the technology as well as for international food risk governance [7, 8].

A key element in developing societal trust in the motives of actors involved with developing the products of novel technologies is to ensure that these actors take account of the concerns of interested stakeholders (including the general public), and address these concerns in the process of research and policy formulation, as well as in considering potential commercialization strategies [9]. Activities geared toward involving the public have, in the agri-food sector, ranged from traditional consultations (e.g., quantitative surveys of nationally representative populations) and focus groups conducted in order to evaluate citizen views, through to exercises specifically focusing on citizen involvement in the decision-making process. In other words, there has been a growing trend within many societies to involve a

wider range of stakeholders in policy decisions than has traditionally been the case in the past. Such stakeholders may include the public, or, at least, representatives of the public, as well as consumer, environmental, and industry interest groups, and other interested end-users and stakeholders.

Historically, public policy regarding science and technology has been determined by politicians and policy-makers, often with the aid of expert advice. Decisions resulting from this process have then generally been communicated to the public, under the assumption that the communication recipients will understand and believe the information, and think and behave appropriately in response—that is, as the policy-makers have predicted and think appropriate [10, 11]. In contemporary societies, this model has, to some degree, failed: a loss of trust in decision-makers and their advisors has led to public and stakeholder skepticism in the motives of actors in the policy, regulatory, and industry communities [12], including the potential for societal mobilization against policy directives and associated activities (e.g., the introduction of innovative but controversial food technologies and their specific applications [13–16]).

As a consequence, many actors in the policy community and beyond have shifted to a position where it is assumed that public trust and confidence may be gained and maintained if decision-makers are perceived by society more generally to be actively obtaining broader views associated with policy development and regulatory activities. This activity has been referred to as public (or citizen or stakeholder) engagement, involvement, or participation [17, 18]. Various reasons have been put forward to explain the recent increased popularity of stakeholder involvement [19–21]. Among the assumed benefits of engagement are:

- regaining of societal trust in policy-makers and policy decisions;
- public acquisition of political efficacy;
- enhancement of democracy;
- societal acceptance of decisions associated with policy development and implementation;
- improvement of policy decisions.

It is of interest to note that, despite the assumed existence of these benefits, empirical tests of the societal impact of public engagement are scarce [22].

In order to achieve the goal of “greater participation”, various methodologies have been developed to facilitate public and stakeholder involvement in the policy process. Three broad categories of approach can be identified, as shown in Table 15.1 (adapted from [18]). The first can be described as “public communication”, entailing a unidirectional flow of information from the expert community to the public. Hence public opinion on the matter under consideration cannot influence the policy process. Specific activities included in the communication category are beyond the scope of the present chapter, and are not considered further. The second approach can be described as “public consultation”. This group of approaches utilizes more traditional opinion elicitation methods, where the opinion of the public is gathered and used in policy development or implementation with little or no interaction with sponsors, policy-makers or expert communi-

**Table 15.1** An overview of methodologies applied to facilitate public and stakeholder involvement (adapted from [18]).

Consultation	Participation	Communication
Citizens' panel	Action planning workshop	Cable TV
Consultation document	Citizens' jury	Drop-in centers
Electronic consultation	Consensus conference	Hotline
Focus group	Deliberative opinion poll	Information broadcasts
Opinion poll	Negotiated rule-making	Internet information
Referendum	Planning cell	
Survey	Technology assessment	
Telepolling		
Delphi		
Public hearing		
Expert group		

ties. Information about public opinion is provided to the expert community, after which there is no further public involvement. The information flow is “from the public to the experts” and is often, but not always, confined to a single period of data sampling. A third group of methodologies consists of more innovative methods that actively aim to engage participants in an ongoing dialog with sponsors—“public engagement” or “public participation”. These methods aim to be truly interactive.

Both the consultation and participation methods may potentially involve one, or a combination, of “citizens”, “the public”, “consumers”, “stakeholders” or “experts”. Descriptions of each of the terms included in the table are provided in the glossary given in the Appendix at the end of this chapter.

The issue then arises as to which class of approaches is most useful for engaging with the public under specific circumstances—with recent arguments (as previously discussed) suggesting that more participatory approaches are more appropriate in many current social–political–technological contexts. This is particularly the case with nanotechnology, where increased participation (particularly early in the process, or “upstream”) has been prescribed by a major inquiry into nanotechnologies in the UK conducted by the Royal Society and Royal Academy of Engineering (see reference [23] for a description), and has been encapsulated in the major National Nanotechnology Initiative (NNI) in the USA [9].

### 15.3

#### Evaluating the Effectiveness of Public and Stakeholder Engagement

Rowe and Frewer [22] reviewed the literature on public engagement and found little empirical evidence for the existence of the generally assumed benefits—with only a few studies having critically examined engagement exercises (in any context, over and above agri-food nanotechnologies) to see what they have achieved and

whether they have delivered the benefits proposed. Of course, this does not *necessarily* mean that such benefits have not been obtained, but this does indicate that this issue has not been the focus of empirical investigation.

A major problem in collating evidence to support the assumed benefits associated with public and stakeholder engagement is a lack of theoretical perspectives about *how* to evaluate engagement exercises. In addition, it should be recognized that there are practical difficulties in attempting to conduct such evaluations, whether these are of expert consultations or public engagement types [18, 21, 24]. A key element in doing this effectively concerns defining what is meant by an “effective” exercise—a complex issue that is open to debate and dispute. In spite of this, some consensus regarding best practice in evaluation is beginning to emerge in the literature. For example, two recent evaluation frameworks [25, 26] essentially agree upon a dichotomy of effectiveness requirements. These are that an engagement exercise should be perceived as being *fair* by those participating (as well as outside observers), and that the process itself should be competently enacted in a manner allowing appropriate interactions and exchanges of knowledge and/or information between those involved.

In addition to identifying and using appropriate evaluation criteria, it is generally recognized that evaluation of public and stakeholder engagement should be done independently, particularly as the underpinning assumptions of the associated benefits of applying such exercises may be erroneous, and those conducting engagement often have a positive expectation of the process they have promoted and run. Indeed, it has been argued that, under some circumstances, engagement may not result in the assumed benefits for the policy process or society in general [27–30]. Caution may particularly be called for where engagement involves the public, and under circumstances where the policy topic is highly complex [31], as is the case with emerging technologies applied in the agri-food sector.

Less-than-rigorous application of method and (in the case of public engagement) lack of independent evaluation may act as a barrier to the uptake of public consultation conclusions in policy measures and subsequent debates—possibly correctly so, if the outputs are somehow flawed (e.g., have been derived through a faulty process). Rigorous evaluation of participation exercises is thus important to enable other researchers and end-users to have access to credible research findings, to enable scrutiny by interested end-user communities, to facilitate comparisons in time and space as well as across different cultural and geographical regions [32], and to avoid repetition and redundancy in research activities.

Initiatives must be deployed to collect the data on public acceptance and knowledge following more classical methods to facilitate opinion sampling over multiple countries and participant groups, to be able to make any claims of the generalizability of results from small group involvement (participation being characterized by limited participant numbers) to the larger public in affected regions. An important issue in the global or international context (the level at which innovations in food technology may apply) is the acquisition of data that can distinguish between those attitudinal factors which are invariant over cultures and people, and those which are prone to be influenced by cultural factors and historical contexts. Policy,

regulation, and strategic development of technology innovation can then be harmonized internationally, or “fine-tuned” to the needs of specific countries or regions. At the present time, stakeholder and public participation in the governance and strategic development of agri-food (nano)technology is fragmented. It is essential that ongoing activities are reviewed and harmonized in order to avoid duplication of effort and inappropriate allocation of resources. The peer-review process is important in this regard—while also being useful in increasing transparency of policy impacts, as well as in identifying gaps in ongoing activities and developing best practice in stakeholder and societal dialog regarding existing and emerging societal concerns.

The one-way stream of information *from* the public *to* the expert community is still a more frequently utilized method compared to “genuine” public engagement, despite frequent references to the *need* to engage the public in the development of, for example, agri-food nanotechnology or other emerging food technologies. While the notion of public engagement has become salient in the minds of researchers, policy-makers, and decision-makers in industry, there is little concerted or considered use of the various available methodologies. It may be that conducting and publishing evaluations of engagement exercises may aid in convincing those using these traditional approaches to try novel methods.

Finally, the value of public engagement in terms of its assumed advantages also needs to be assessed. Key questions include the following.

- Does public engagement increase trust in policy-makers and industry, and in political and regulatory processes more generally?
- Is public engagement justifiable in its own right, as a means of enhancing the democratic process?
- Are the public more likely to accept decisions associated with policy development and implementation following public engagement or public consultation, and how does lack of consensus across different groups of those consulted influence this process?
- How and in what way are policy decisions improved following public consultation or engagement.
- Is there already adequate information available regarding public opinion, concerns, and values associated with either nanotechnology or sustainable chemistry?

#### 15.4

##### Public Engagement Examples

As noted, nanotechnology has been viewed through a similar lens to genetic modification [1], with one of the lessons emerging from prior debate being that of the difficulty of *communicating* technology benefits to a cautious (and indeed

skeptical) public. Furthermore, it has been noted that using *consultative* approaches, such as surveys, are of little use in revealing the ways in which people will interpret and understand novel and complex technologies when the issue of interest is one about which people know little [33]—as has been shown to be the case with nanotechnologies. Proponents of nanotechnology, as well as interested social scientists, have thus sought more interactive public engagements using *participative* approaches.

There have, consequently, been a growing number of participative exercises used on nanotechnology issues, though relatively few have made it into the academic press. One of these was “Nanjury UK”, the first citizens’ jury on nanotechnology in the UK (see the Appendix at the end of this chapter for a description of this general method). This has been described by Pidgeon and Rogers-Hayden [3]. Burri [34] reports on a similar approach (a “citizens’ panel”) held in Switzerland, while Evers and D’Silva [35] discuss another citizens’ panel held as part of a Flemish technology assessment project (albeit on nano-applications in the medical, not agri-food, domain).

Meanwhile, Pidgeon *et al.* [33] have described the first comparative US–UK public participation experiment, which comprised four concurrent half-day public *workshops* debating energy and health nanotechnologies. One interesting result from this study was that participants focused on benefits rather than risks and, in general, had a high regard for science and technology. Rather than the country in which the exercise was run, it was application *context* that was the most significant source of attitudinal differences, with energy applications viewed in a substantially more positive light than applications in human health and enhancement in both countries (where agri-food application would fit in this analysis is an empirical question). The authors also reported that more subtle differences were present in views about the equitable distribution of benefits, corporate and governmental trustworthiness, the risks to realizing benefits, and in consumerist attitudes. It is arguable that more profound cross-cultural differences may be observed under circumstances where cultural or economic differences are more profound, but this has not been subject to empirical test as far as can be ascertained.

What is notable is the general lack of rigorous evaluation of these and other initiatives. However, some research has attempted to consider the qualities of such participative processes and what they achieve. Powell and Kleinman [36], for example, drew on in-depth interviews with participants of a *consensus conference* (see the Appendix at the end of this chapter) in the USA on nanotechnology to consider how citizen participants felt the consensus conference experience had affected their *knowledge and efficacy* related to participation in nanotechnology issues; which aspects of the conference they thought shaped their knowledge and efficacy; and whether they felt motivated to engage in future participatory mechanisms related to nanotechnology issues. They concluded that, even if consensus conferences have little or no *influence* on policy or policy-makers, they may empower citizens by improving their perceived abilities to participate meaningfully in technoscientific issues.

Similarly, Besley *et al.* [37] explored interpersonal discussion following participation in a novel program of citizen engagement about nanotechnology (using a process they called “citizen schools”—a program of lessons and engagement between scientists and public lasting several weeks, and therefore considerably more prolonged than the majority of participative approaches). Participants answered closed- and open-ended questions about their discursive behavior in a post-engagement survey. Respondents reported moderate levels of post-engagement discussion and appeared to say positive things about both nanotechnology and the experts who contributed to the engagement program. Respondents also reported primarily talking about nanotechnology in terms of scientific progress while using a range of fairness and competence frames to discuss experts and the program.

On the negative side, Hamlett and Cobb [38] collected data from a small set of public deliberations on nanotechnology to test the concern that group deliberations may bias toward the original majority preferences because of cognitive and affective errors in decision-making, such as deference to the numerical majority opinion held within a group, and they found some evidence for this polarization hypothesis. Indeed, Rogers-Hayden and Pidgeon [39] have also emphasized that the kinds of conversations that emerge from public engagement and other approaches to understanding public attitudes may not lead to harmonious development of nanotechnologies (as perhaps hoped by proponents), but may open up differences in visions—although they point out that this is necessary if public participation is to move “upstream”, beyond mere consultation to encompass a “co-creation of nanotechnology for sustainability” ([39] p. 1010).

## 15.5

### Recommendations for Conducting Public Engagement and Public Consultation Exercises

In this chapter different ways have been discussed in which the public may be engaged in the current debate about agri-food nanotechnologies. The multitude of methods available have been briefly reviewed, and the different intentions and characteristics of these noted (see the Appendix at the end of this chapter). The trend toward more “public participation” has been described, and some examples drawn from different areas of application of nanotechnology. In particular, the issue of “evaluation” has been raised, highlighting the need for researchers to seriously consider the processes and consequences of their engagement methods. From this, a number of recommendations for conducting such approaches can be identified.

- 1) The goals of the exercise must be clearly defined at the outset. Often, participative processes are framed in such a way that encourages participants to believe that their views will have real impact upon an issue, when this is not truly the sponsors’ intent, and once participants realize this, they can feel aggrieved—as can external observers and stakeholders. If an exercise is simply

being conducted to collect views, then a simple consultative approach—such as a survey or focus groups—would be better. If the intent of an exercise is more than this—to give other stakeholders (which may include the public) some real say and ownership of the problem issue, then participative approaches seem suitable. (Evers and D’Silva [35] note that it is often unclear how regulatory actors can actually proceed from the output of such exercises, and perhaps this needs to be clearly specified at the outset.) Being clear on the aims of a process can also help to inform the appropriate criteria for evaluating that process (see point 3).

- 2) There are many different methodologies available to facilitate consultative and participatory processes, which are of direct utility in understanding science and society issues. From the available literature (both refereed and non-refereed), the approach favored by academics working in this area tends to be the *survey* and *focus group* for consultation, and the *consensus conference*, *citizens’ jury* and (in the area of ethical impact) *technology assessment* in the context of deliberative processes and public engagement. This may, to some extent, reflect the fact that these methods are established and accepted within the academic and policy communities, rather than because they are inherently better or more suited to the purposes to which they are put.
- 3) It is important to consider the timing of a public engagement event. There has been a view developing that engagement with the public (in particular, public *participation*) should occur early in the process of developing novel technologies—so-called “upstream engagement”. Rogers-Hayden and Pidgeon [23] discussed some of the promise and perils of moving public debate upstream, however, concluding that there is a risk of merely replacing the perceived deficit in public understanding of science with a perceived deficit in public engagement with science—so caution is needed.
- 4) It is essential that public engagement exercises are systematically evaluated against appropriate criteria by independent evaluators (i.e., evaluators who are not in any way involved in the development of the exercise or the sponsoring organization). An example of such evaluation criteria has been provided by Rowe and Frewer [26].
- 5) In order to ensure that the results of a public consultation or public engagement exercise meet the rigorous standards required by peer review, publication in a peer-reviewed journals is desirable. This also ensures that the results of the research are available to other researchers, and helps to prevent duplication of effort and allocation of resources to similar activities.

It is important to note that, while a public engagement activity may provide indicators of emerging public concerns and preferences, it will not provide data that will facilitate systematic comparison of emerging concerns and preferences across different segments of the population (e.g., demographic groups, regional groups, or groups of individuals with specific preferences or attitudes to technology or food

production). The results of the public consultation need to be taken together with existing knowledge about determinants of individuals' perceptions of risk–benefit already available in the published literature, to validate and explain identified patterns. Ultimately, such qualitative processes can be useful in informing the development of a survey instrument for collecting quantitative data regarding attitudes toward (for example) nanotechnology.

## Appendix

### Glossary (from [18])

**Action planning workshop** An action planning workshop is an intensive workshop of one or two full days in which representatives of the involved parties join together to review the current status of the issues, set the future goals and write a detailed action plan for the next steps to be taken.

**Citizens' jury** A citizens' jury is a mechanism of participatory action research that draws on the symbolism, and some of the practices, of a legal trial by jury. The "jury" is made up of people who are usually selected "at random" from a local or national population. The jurors cross question experts they have called to provide different perspectives on the topic. The jury then collectively produces a summary of their conclusions, typically in a short report.

**Citizens' panel** Citizens' panels involve a broadly representative sample of the local population, who have agreed to take part in consultation activity. They can involve between 500 and 3000 people. Panel members are then asked to complete surveys on a regular basis. This can involve the whole panel, or particular target groups within the total panel.

**Consensus conference** A consensus conference is a chaired public hearing with an audience drawn from the public and with active participation of 10–15 lay people and a corresponding number of different experts. The experts may be from different disciplines and/or from different schools within a discipline. The conference may last several days, plus the time for preparation. The purpose is to produce an informed debate on a limited subject presented in the form of six or seven main questions.

**Consultation document** This is a document that identifies an issue and proposes one or several ways to deal with the issue. These proposals are then offered as concrete ideas to the view from the public and are open for comments and adjustments. If multiple proposals are offered, the preference of the public for one of the proposals can be asked for.

**Deliberative opinion poll** Deliberative polling combines small-group discussions involving a small numbers of participants with random sampling of public opinion. Citizens are invited to take part at random, so that a large enough participant group will provide a relatively accurate, scientific representation of public opinion.

**Delphi** The Delphi method is a systematic interactive forecasting method for obtaining forecasts from a panel of independent experts. The carefully selected experts answer questionnaires in two or more rounds. After each round, a facilitator provides an anonymous summary of the experts' forecasts and reasoning from the previous round. In subsequent rounds, participants are encouraged to revise their earlier answers in light of the replies of other members of the group, which is assumed to facilitate consensus-building. The process is stopped after a predefined stop criterion (e.g., number of rounds, achievement of consensus, stability of results).

**Drop-in centers** Drop-in centers are places in the community to which the interested public can go without prior appointment. The public receive information on the status and future directions of different issues (e.g., town planning), but may also comment and provide feedback on plans in such a center.

**Electronic consultation** This refers to an exchange between government and citizens using the Internet. Electronic consultation represents a specific form of online deliberation. Online consultation consists in using the Internet to ask a group of people their opinion on one or more specific topics, allowing for trade-offs and dialog between participants. Generally, electronic consultation is used to identify or access options, or to evaluate ongoing activities. This enables governments to draft more citizen-centered policy.

**Focus group** A focus group is a form of qualitative research in which a group of people are asked about their attitude toward a product, service, concept, advertisement, idea, or packaging. Questions are asked in an interactive group setting, where participants are free to talk with other group members. Focus groups can be used for gaining access to various cultural and social groups, selecting sites to study, sampling of such sites, and raising unexpected issues for exploration.

**Hotline** This is a direct telephone number that people can ring to ask questions and give comments, or to put forward views on a specific issue.

**Negotiated rule-making** Negotiated rule-making is a process in which an advisory committee made up of disparate interest groups negotiates the terms of a rule or issue between each other.

**Opinion poll** An opinion poll is a survey of opinion from a particular sample. Opinion polls are usually designed to represent the opinions of a population by asking a small number of people a series of questions and then extrapolating the answers to the larger group within confidence intervals.

**Planning cell** Planning cells might be defined as a non-partisan, *ad hoc*, randomly selected, single-issue, short-term micro-parliament. The planning cell is presented with an issue, discusses it, and drafts recommendations and the assessments.

**Public hearings/inquiry** A public hearing or inquiry is an official review of issues ordered by the government. A public inquiry differs from more general inquiries or reviews in that evidence submitted to the inquiry is heard in a public

environment. Interested members of the public and organizations may not only make (written) evidential submissions, as is the case with most inquiries, but also listen to oral evidence given by other parties.

**Referendum** A referendum is a direct vote in which an entire electorate is asked to either accept or reject a particular proposal.

**Survey** Surveys are used to collect quantitative information about items in a population on a certain issue. A survey may focus on opinions or factual information depending on its purpose. Most surveys involve administering questions to individuals. When the questions are administered by a researcher, the survey is called a structured interview or a researcher-administered survey. When the questions are administered by the respondent, the survey is referred to as a questionnaire or a self-administered survey.

**Technology assessment** Technology assessment is the study and evaluation of new technologies. It is based on the conviction that new developments within, and discoveries by, the scientific community are relevant for the world at large rather than just for the scientific experts themselves, and that technological progress can never be free of ethical implications. Technology assessment explicitly recognizes the fact that scientists normally are not trained ethicists themselves and accordingly ought to be very careful when passing ethical judgment on new findings, projects, or work in progress.

**Telepolling** Telepolling is a way of administering an opinion poll (see definition of opinion poll) by means of telephone interviews.

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