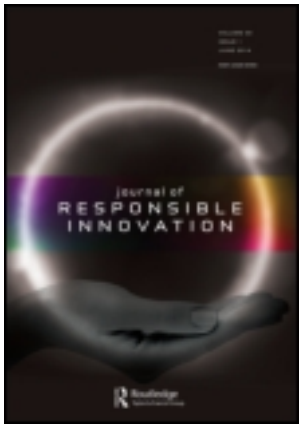

Journal of Responsible Innovation
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tjri20

Where are the politics in responsible innovation? European governance, technology assessments, and beyond

Michiel van Oudheusden[a]

[a] Université de Liège, SPIRAL, Boulevard du Rectorat 7, boîte 29, B31, 4000 Liège, Belgium

Accepted author version posted online: 13 Jan 2014.Published online: 24 Feb 2014.

To cite this article: Michiel van Oudheusden (2014) Where are the politics in responsible innovation? European governance, technology assessments, and beyond, Journal of Responsible Innovation, 1:1, 67-86, DOI: 10.1080/23299460.2014.882097

To link to this article: http://dx.doi.org/10.1080/23299460.2014.882097

Journal of Responsible Innovation, 2014
Vol. 1, No. 1, 67–86, http://dx.doi.org/10.1080/23299460.2014.882097

RESEARCH ARTICLE

Where are the politics in responsible innovation? European governance, technology assessments, and beyond

Michiel van Oudheusden*

Université de Liège, SPIRAL, Boulevard du Rectorat 7, boîte 29, B31, 4000 Liège, Belgium

(*Received 16 November 2013; accepted 5 January 2014*)

Responsible innovation (RI) is founded on the idea that present modes of innovating with science and technology fail because they insufficiently take into account societal needs and values. Hence, proponents of RI solicit society's opinions in an attempt to render science and technology developments, institutions, and policies more socially responsive. This article asks how the RI concept is taken up and elaborated, based on accounts developed on the European Union policy level and on a Flemish, technology assessment level. It finds that, notwithstanding important differences between these two deliberative frameworks, neither one leaves much room for politics, understood as the constitution and contestation of power. Rather, these frameworks largely ignore questions about the politics in and of deliberation, the authoritative allocation of values, and the institutional uptake of deliberative engagements. The article's aim is to provide constructive criticism of the RI paradigm by rendering these political issues explicit and proposing ways of taking them into account.

Keywords: innovation; normativity; politics; power; responsibility; technology assessment

1. Introduction

In recent years, policy-makers, as well as various industry representatives, civil society organizations, and scientists, have called for the integration of societal and ethical considerations into science and technology research and development (R&D). They have done so for various reasons: to anticipate problems linked to the development of technologies; to create flexible and adaptive governance systems that better manage scientific and social uncertainties; and to give citizens a voice in science policy-making, among others. These calls, and the motivations that sustain them, build on a widely shared conviction among policy-makers, scientists, and academics that scientific expertise today faces a problem of legitimacy. Although science and technology are central to our lives and provide innumerous benefits, scientists are under increased pressure to justify their research activities and their knowledge claims to broader society (Lövbrand, Pielke Jr., and Beck 2011). This pressure emanates from past and present public controversies over nuclear power plant accidents, food scares, widespread environmental pollution, and various other disputes dating back decades. It also coincides with the present-day crisis of modern structures, as governments cannot democratically control important scientific decisions and actions that directly bear on society, and the status of scientific knowledge is very much in

*Email: michiel.vanoudheusden@ulg.ac.be

question (Beck 1993). The analyses of the problem of modernization, as it is described here, are not new. Nor are many of the proposed remedies, which policy-makers and scholars of science and technology present today, and which include (but are not limited to) anticipatory governance, technology assessment (TA), and upstream public engagement.

This article describes and examines what is arguably the latest major remediating concept to have gained widespread policy and academic currency, at least in Europe: responsible research and innovation (RRI), or simply responsible innovation (RI).[1] Much like the aforementioned notions, RI denotes an orientation toward anticipation, inclusiveness, responsiveness, and reflexivity concerning science and technology and innovation processes more broadly (Owen, Macnaghten, and Stilgoe 2012). As a closer examination of more or less established RI definitions reveals, RI is founded on the idea that present modes of innovating with science and technology fail because they insufficiently take into account societal needs and values. Whereas, science and technology have long been identified as a major source of economic and social development (Schumpeter 1939; Kondratiev 1978); their contribution to social well-being is no longer taken for granted (Pellizzoni 2012). Scholars in the increasingly influential field of science and technology studies (STS) criticize science and technology innovation policies for neglecting fundamental ethical principles or normative baselines for acceptable risks and precautionary measures. From this policy-critical point of view, scientific innovation processes are inadequate because they elicit public unease and pre-empt debate on the need, direction, and desirability of innovation at large. What is therefore needed is a shift in thinking and acting in terms of risk and regulation to the prior social shaping of science and technology through 'innovation governance' (Felt et al. 2007).

In line with these suggestions and commitments, proponents of RI solicit society's opinions in an attempt to render science and technology developments, institutions, and policies more socially responsive. Solicitation typically takes the form of broad consultations involving as many relevant stakeholders as possible, in ways that enhance inclusiveness, transparency, and deliberation, and that promise greater benefits to society than economic growth and technological advance only (Wynne 2001). As RI is very much a policy innovation project in the making, its boundaries are not yet determined or fixed; rather, they are continuously expanded and redrawn. Accordingly, RI proponents may include STS scholars, as well as policy-makers, civil society organizations, scientists, industry representatives, and also citizens. Given its uncertain, open-ended character, perhaps the best way of understanding RI today is as an emerging discourse on how to properly enact a democratic governance of innovation (Stilgoe, Owen, and Macnaghten 2013).

This article asks how the RI concept is taken up and elaborated based on accounts developed on the European Union (EU) policy level and on a local, more scholarly grounded, TA level in Flanders, Belgium. It finds that, notwithstanding important differences between these two deliberative frameworks, neither one leaves much room for politics, understood as the constitution and contestation of power. Rather, these frameworks largely ignore questions about the *politics in deliberation* (e.g. how actors craft RI through strategic use of argument and other advantage-seeking techniques), as well as the *politics of deliberation* (e.g. how RI privileges a process definition of democracy at the cost of participatory and representative perspectives). In addition, these frameworks forsake questions about the authoritative allocation of values (as in formalized, representative politics) and the institutional uptake of deliberative engagements more broadly. The article's aim is to render these issues explicit in an attempt to develop more politically sensitive and critical RI practices.

While in recent years, STS scholars have developed critically reflexive analyses of the role that politics and power play in deliberative processes, these analyses are not sufficiently taken into account in action-oriented STS approaches. In fact, a longstanding criticism of such

approaches is that although they concern themselves with political and normative issues in science and technology, and despite their understanding that science is not a neutral, disinterested enterprise, they fail to critically engage with their *own* norms and politics (Radder 1992; Fuller 2000; Genus 2006; Pestre 2008). With a few notable exceptions (e.g. Bora and Hausendorf 2004; Loeber 2004a), there is also a general lack of empirical consideration of how participatory science is enacted in practice (Abels 2007). An important aim of this article is therefore to sensitize practitioners and interested others to the growing body of literature that highlights the political and normative dimensions in STS. These dimensions include the need to establish quality criteria for good science and technology participation (Rowe and Frewer 2000), consideration of how dialog and engagement processes construct particular publics, such as citizens (Michael and Brown 2005; Lezaun and Soneryd 2007; Turnhout, Van Bommel, and Aarts 2010), the use and effects of framing in participatory practice and how 'participation' is crafted and conditioned by the exercise of political power (Stirling 2006; Wynne 2006; Kerr et al. 2007), as well as more general reflections on how and why to evaluate engagements between scientists, citizens, and others (Guston 1999).

Although the article does not elaborate each of these topics, it may contribute to enhancing awareness among RI practitioners of how several of the above concerns play out in real-world deliberative science and technology spaces. Following Delgado, Kjølberg, and Wickson (2010), 'engagement practices' in science and technology (whether deemed deliberative, participatory or public) always elicit tensions and resistance. In the cases presented in this article, the tensions pertain to how the terms of engagement are set and enacted rather than theorized to occur, the potentially conflicting aims embedded in RI and TA missions and methods, and the ambiguous relationship between deliberative, participatory, and representative modes of 'doing' engagement, among others. By attending to these concerns, the article opens a space for 'collective self-criticism, imagination, and the disposition to learn from trial and error' among proponents of innovation governance (Barben et al. 2008, 992). At best, the analysis it offers may lead to alternative conceptions of deliberation and governance, which can then be considered, weighed, and assessed against each other. At the very least, it should encourage reflection on the challenges of governing innovation and careful consideration on how and why challenges emerge, and what can and should be done about them.

The article is structured as follows. First, I present and situate RI in academic and policy traditions to better understand where RI comes from and what it purports to be. I draw connections with other schools and traditions, such as anticipatory governance, to indicate that proponents of RI typically present RI along *procedural* lines rather than *political* ones; that is, they emphasize the importance of *talk*, *deliberative argumentation*, and *due procedure* without attending to questions of *power*, *ends*, *and authority* that play out in, and through, RI processes. Contrary to this dominant procedural reading of RI, I contend that RI is normative in character and purpose, as RI advocates contest, and seek to transform, contemporary sociotechnical regimes. Hence, the politics of RI demand to be explored and have to be accounted for (Wesselink and Hoppe 2011; Owen, Macnaghten, and Stilgoe 2012), which I do in Section 2. In Section 3, I give a more situated account of how RI is enacted in the Flemish TA practice 'Nanotechnologies for Tomorrow's Society' (NanoSoc). The NanoSoc project sought to integrate societal concerns into ongoing technology R&D and render nanoscientists and -technologists aware of the social and ethical dimensions of nanotechnology development. I draw critical attention to the lack of consideration for politics in the NanoSoc project and the consequences this lack has for NanoSoc, TA, and RI discourses and practices. The analysis serves to open a space for a more politically robust RI practice that is cognizant, and even appreciative, of politics in a broad sense, and thus attends to the workings of power in and through RI (Foucault 1982).

2. Introducing RI

Although no single, authoritative description of RI exists and the RI concept is rapidly evolving, von Schomberg (2011a, 9), a notable and often-cited proponent of RI, provides a more or less concise working definition:

> Responsible Research and Innovation is a *transparent*, *interactive process* by which societal actors and innovators become mutually responsive to each other with *a view to the (ethical) acceptability*, *sustainability and societal desirability* of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society). (Emphasis added)

From this definition, we learn that: (1) RI is an interactive process that actively solicits society's opinion about innovation processes and (2) the aim of RI is to render innovation more ethically acceptable, sustainable, and socially desirable.

Although other definitions offer different emphases from von Schomberg's, RI is typically presented as an inclusive, interactive procedure that, ideally, produces more effective policy outcomes.[2] Consider in this light the rather lengthy definition of RRI provided in 2013 by an Expert Group to the EU's Directorate General for Research and Innovation:

> Responsible Research and Innovation (RRI) refers to the comprehensive approach of proceeding in research and innovation in ways that allow *all stakeholders that are involved* in the processes of research and innovation at an early stage (A) to obtain relevant knowledge on the consequences of the outcomes of their actions and on the range of options open to them and (B) to *effectively evaluate both outcomes and options* in terms of societal needs and moral values and (C) to use these considerations (under A and B) as *functional requirements for design and development* of new research, products and services. The RRI approach has to be a key part of the research and innovation process and should be established as a collective, inclusive and system-wide approach. (Sutcliffe 2011, 55–56; emphasis added)

As in von Schomberg's definition, we discern in the Expert Group's characterization a similar concern with due process, inclusiveness, and functionality.

Last, consider the following description of RI provided by the EFC (2012), an EU-based philanthropic organization that works directly for EU policy-makers:

> Building on the success of Science in Society projects in engaging the general public and civil society in debates around science, RR&I aims to go one step further and *engage all societal actors* – from researchers through policy makers, to citizens, businesses, etc. – *to work together throughout the research and innovation process* in order *to ensure that the results meet the needs of the world we live in*. (http://www.efc.be/news_events/Pages/From-Science-in-Society.aspx, Emphasis added)

Each of these definitions is linked to European policy processes and values and is drawn upon in the academic and policy literature (Stilgoe, Owen, and Macnaghten 2013). If we were now to approach RI as a frame package (Entman 1993), we would find that these more or less recognized RI definitions explicitly or implicitly convey a problem definition, moral evaluation, and treatment recommendation. These framing components can be summarized as follows:

- *Problem definition*: The introduction of science and technology into society fails when this process and the values it stands for conflict with societal values.[3]
- *Moral evaluation*: Societal needs and values need/deserve to be heard.
- *Treatment recommendation*: The scientific, policy, and industry communities must solicit society's opinions by listening to what society has to say about science and technology innovations.

In other words, RI offers an evaluation of a given sociotechnical context that RI proponents believe is problematic, or even irresponsible. It is this normative, evaluative character of RI that concerns us, rather than the specific wordings in definitions, as RI urges reconsideration of the existing technoscientific order and its modes of production. I turn to this normative orientation and what it entails shortly. First, I embed RI in a longer constructivist-deliberative governance tradition in order to gain a richer understanding of the RI agenda.[4]

2.1. *Where have we heard this before? RI in context*

The terms RI and RRI have a history stretching back to other innovation-related concepts and frameworks that emerged over a decade ago both in the USA and in Europe.[5] As proponents of RI readily acknowledge, the RI conception of technological change builds on social constructivist studies of science and technology, such as anticipatory governance, upstream public engagement, and TA. Thus, it is not surprising to find in a RRI Report for the Directorate General Research and Innovation of the European Commission, the 'action tank' MATTER an explicit link to 'anticipatory governance':

> RRI is about trying to get better at anticipating problems, taking into account wider social, ethical and environmental issues and being able to create flexible and adaptive systems to deal with these unintended consequences. This is sometimes called 'Anticipatory Governance'. (Sutcliffe 2011, 3)

Explicit references to anticipatory governance are equally found in von Schomberg (2011a, 2011b), as are the notions of (early) TA and public engagement, which is hardly surprising given von Schomberg's background and involvement in TA, predominantly in the Netherlands.

At the heart of RI then, lie concepts that resonate with understandings, assumptions, and motivations that have been developed in academic and policy circles over the years, and that have been articulated in various outlets. Let us now consider how notions like anticipatory governance connect to other programmatic science–society discourses that have emerged in the past decades, and to particular technologies, such as nanotechnologies. The aim here is not to be exhaustive but to relate concepts in ways that reflect how they are mobilized in academic and policy literatures, and to explore their normative content.

In their assessment of new and emerging technologies like nanotechnologies, Barben et al. (2008, 979) contend that there is now a widespread understanding, both in the USA and in Europe, that nanotechnologies constitute 'an emerging set of science-based technologies with the collective capacity to remake social, economic, and technological landscapes'. Due to its novelty, complexity, uncertainty, and publicity, 'nanotechnology represents 'postnormal science' (Funtowicz and Ravetz 1993)', which requires 'the engagement of a variety of potential users and stakeholders in the production of knowledge (Gibbons et al. 1994), as well as new organizations that span the boundary between knowledge production and public action'.

Although Barben et al. write from the context of nanotechnologies specifically, their assessment equally applies to other sciences and technologies. I single out their argumentation, as it frames sociotechnical governance as an institutional response to a perceived crisis in the government of science and also explicitly relates concepts and techniques in the (sociological) literature, notably 'postnormal science' (Funtowicz and Ravetz 1993) and 'socially robust knowledge', as introduced by Gibbons et al. (1994). Both of these concepts inform contemporary research and policy worldwide (Hessels and Van Lente 2008, 743, 758; Turnpenny, Jones, and Lorenzoni 2011, 288). In addition, as I clarify below, the TA project NanoSoc is a deliberative experiment in support of what Barben et al. call anticipatory governance of nanotechnologies, and is therefore also grounded in postnormal conceptions of science in society.

Following Funtowicz and Ravetz (1990, 66), postnormal science denotes a science situation where normal puzzle-solving is obsolete, as new sciences like oncology and epidemiology, for instance, can never evoke a dogmatic consensus that 'enforces adherence to a closed set of rules for puzzle-solving'. Accordingly, Funtowicz and Ravetz (1994, 198) state the case for participatory science and the democratization of expertise: '[a]s the policy process becomes a dialogue, post-normal science encompasses the multiplicity of legitimate perspectives and commitments, and provides new norms of evidence and discourse'. They strongly recommend that stakeholders with interest in the (scientific) issue under investigation take part in the process of quality assessment of information and, possibly, in the actual research procedure with the aim of introducing into technical decision-making social and political value considerations (Funtowicz and Ravetz 1994, 205).

Similarly, although different in scope and arguably less programmatic in character, Michael Gibbons and his co-authors argue that new kinds of knowledge generation are in the making that will have profound implications for how we understand science in the future (Gross 2006). The authors maintain that contrary to traditional science, which is investigator-initiated and discipline-based, contemporary science is context-driven, problem-focused, and interdisciplinary. New modes of organizing science are emerging, which are more egalitarian and have broader social relevance. The authors label the former kind of science Mode 1, and the latter kind Mode 2 science.

In more recent work, Gibbons, along with Nowotny and Scott (2001), also derive implications for the quality control of science. They propose the notion of 'socially robust knowledge' as a way of dealing with conflict and uncertainty in modern societies. The aim of science, they write, should be to produce knowledge for public ends, as science that is socially detached is too fragile to meet various social pressures.

I do not further expound on the concepts of postnormal science and socially robust knowledge in this article. My purpose is merely to indicate that RI builds on earlier constructivist analyses and frameworks that intend to *open up* science and technology to (public) debate and reflection.[6] More importantly, these theories propose a problem analysis and remedy that is fairly similar to what we find in RI concepts and accordant tools today. Because they purport a different sociotechnical order *to be*, they are *normative* in character; that is, they hint at a more inclusive, democratic, and equitable science–society relationship than is presently the case. They also imply specific arrangements of power and technique, which typically rest on a vision of true democracy as a deliberative, cooperative, and broad way of dealing with social conflicts, and the conviction that social learning is morally superior to political bargaining, to give but a few examples. Like anticipatory governance, public engagement, and deliberative strands of TA, RI should therefore be ascribed a normative orientation and political function, as RI invokes standards and moral principles for actors to follow, (re)distributes roles and responsibilities among them and (re)directs contributions toward particular outcomes.[7] This normative orientation also helps to explain why advocates of RI are primarily concerned with democratically interfering in scientific practice and with developing the right procedures for involvement (see Nahuis and Van Lente 2008).

2.2. *Where are the politics?*

Having briefly introduced the RI concept, and having connected RI to other constructivist-deliberative strands and traditions, let us now open RI to criticism and to 'politicization', in an attempt to remedy its shortcomings. I single out three political critiques of RI, so to speak. The first deals with the lack of consideration within the RI framework for the politics *in* deliberation; the second with how RI privileges a process definition of democracy at the cost of representative

perspectives, i.e. the politics *of* deliberation; and the third with how RI forsakes questions about the authoritative allocation of values.

2.2.1. *The politics* in *deliberation*

From a concern with instigating sociotechnical change, RI proponents seek to bring multiple publics and their 'knowledges' into science and technology decision-making. Hence, they call for 'transparent, interactive processes' and for 'the involvement of all stakeholders' in sociotechnical governance. However, RI proponents have little to nothing to say about the politics and power that play out *in*, *and through*, deliberative governance processes. How do actors 'co-create' outcomes? How do they deliberate? On whose terms is participation (i.e. deliberation) established, and why? What, in fact, is 'public' about the 'public interest', 'public expectations', and 'the public', and whose definition of the public counts?

In the EC's RRI report, the authors do raise questions about how responsibility in innovation gets apportioned and distributed. They also ask what collective responsibility means 'in a world that is characterized by chance, complexity and emergence' (EC 2013, 55). These questions are distinctly political in nature; however, they are relegated to one of the annexes to the report. Furthermore, they are simply raised rather than addressed. Similarly, the second (two-page long) chapter of the report, which purportedly addresses the question of RI 'operationalization' in the European Research Area, fails to specify how RI can be successfully applied on the EU level and in member states (EC 2013, 23–24).

In von Schomberg's (2011a, 8) TA-like rendition of RI, the importance of due process through 'a deliberative extension of the science–policy interface' is posited rather than specified and developed. Although von Schomberg (2009) proposes an array of tried and tested governance instruments, including 'codes of conduct and various deliberative assessment mechanisms within and outside the policy context', we are still left with the question of how responsibility is assigned and how deliberation is effectuated in practice, particularly in circumstances when interests, values, and stakes collide rather than align. As critics of deliberative democracy point out, any work of collective crafting is constituted through acts of power, such as control and exclusion (Mouffe 1999). Thus, we must always ask how (deliberative) process and outcomes are constituted in real-life settings rather than assuming, or project, an inclusive weighing of interests. For the same reason, we must ask questions that pertain to the distribution of power, such as: Who is involved in designing solutions and who is left out? Who is a relevant actor and who is not? When is a solution sufficiently 'robust'? While many RI advocates appeal to process criteria for participation (e.g. fairness), there is little to no empirical evidence of how deliberation at hand is accomplished in RI settings. How are outcomes actually negotiated in interaction? How is procedure in fact done? To convincingly answer these questions, it is necessary to pay sustained, micro-level empirical attention to the concrete, situated interactions between participants in an RI setup (Abels 2007; Van Oudheusden 2011a).

2.2.2. *The politics* of *deliberation*

Second, and closely related to the previous point, the mere act of positing a common good reflects a politically motivated choice. As Wesselink and Hoppe (2011) argue in relation to postnormal science, including wider publics (e.g. citizens) in science is not a politically neutral thing to do, yet 'postnormalists' typically frame interaction between scientists and wider society as cogitation rather than as a process that involves the strategic use of power and influence. This framing ignores how a deliberative context is 'by definition coloured by the ideology and worldviews of the underlying concept of democracy and political legitimacy' (Mayer 1997, 9). Clearly, in an RI

context, deliberative modes of truth making – reasoning, reciprocity, mutual learning, and fostering transdisciplinarity – have legitimacy, which potentially undermines traditional expertise and representation (Abels 2007). To give an example, from a TA point of view, 'expertise' is a negotiated attribute (Nahuis and Van Lente 2008); hence, expertise is not considered to be the prerogative of scientists or other formally recognized experts but of publics more broadly. In deliberative engagements, this extension of the notion of expertise very often elicits tensions between formally recognized experts and lay persons over what constitutes evidence and who is entitled to speak, when, why, and on behalf of whom or what (Eden 1996; Cook, Pieri, and Robbins 2004; Van Oudheusden and De Zutter 2012).

Second, RI is clearly motivated by a concern for integrating social and ethical concerns into science. Thus, it would appear that participants who do not endorse deliberation or a commitment to deliberation and do not prioritize social and ethical concerns (not to mention environmental concerns) over economic ones are placed on asymmetrical footing even before deliberation has officially begun. The point is not to argue that advocates of RI should forsake their political commitments and preferences. Rather, they must acknowledge the inherent political bias in the way the RI agenda is set up, as scientists, politicians, civil society representatives, and citizens may resist dialog on the deliberative terms set by initiators of deliberation. Furthermore, the same, or other, actors may contest the RI premise that existing democratic institutions are unsuitable to tackle contemporary complex sociotechnical problems (Gethmann 2002).

2.2.3. *The authoritative allocation of values*[8]

While it is acknowledged that deliberative processes can in some instances impact on traditional, representative decision-making, elected representatives are publicly mandated to enforce policy decisions; whereas, deliberative democrats lack an official decision-making mandate.[9] In the case of RI specifically, it remains to be seen how grand responsibility principles, such as gender, equality, responsibility, and so on, which are, for instance, invoked in von Schomberg's voluntary codes of conduct, can effectively be enforced. Even if we were to assume for a moment that deliberation effectively leads to better policies and better policy-making, it remains to be seen how those outcomes can be made to count in the science and policy arenas. Hence, those in favor of deliberation should learn to wield political influence and strategies in order to effectuate more visible, short- and middle-term impacts, rather than insisting only on the importance of long-term policy planning and thinking (Wesselink and Hoppe 2011). They would also do well to take into account the observation found in numerous political studies that power elites (i.e. policy-makers) are disinclined to cede formal power to third parties, such as institutions and citizens, as these elites 'owe their position to representative democracy' (Loeber 2004b).

To ground the above points of criticism in a practical RI setting, I next describe and discuss the Flemish TA project 'NanoSoc'. Although the NanoSoc project was launched well before the EU's RI agenda and grew out of the Flemish innovation context specifically, the project aligns with von Schomberg's working definition of RI, as it built on his conceptions of responsibility in research and innovation (NPD 2005) and drew on related TA frameworks.[10]

3. RI in practice: NanoSoc

'NanoSoc' materialized in 2006 in response to a concerted call from Flemish policy-makers, industries, and R&D directors to develop new forms of collaboration in which all social actors stimulate technology innovation and R&D receives broad public support (Goorden et al. 2008a, 171; Goorden et al. 2008b). Contrary to most programs funded by the Flemish Institute for the Advancement of Innovation through Science and Technology (IWT), social scientists

(TA researchers) coordinated the project from the start, rather than technologists or natural scientists. A year before the project officially took off, project leaders had taken preliminary steps to enroll nanotechnologists and -scientists at two different Flemish research institutes, acquire the necessary funding, and lay the groundwork for a deliberative research methodology. Upon developing their research framework, they built on their prior experiences with new science and technology developments (e.g. in the area of biotechnologies). They also took inspiration from contemporary TA approaches, such as constructive TA (Schot and Rip 1997), real-time TA (Guston and Sarewitz 2002), interactive TA (Grin, Van de Graaf, and Hoppe 1997), and public engagement – four approaches that seek to publicly assess technology before R&D are locked in and applications appear on the market (Macnaghten, Kearnes, and Wynne 2005). NanoSoc initiators thus sought to open scientific practice to societal influence and debate. They conceived of the emergence of new and potentially disruptive technologies like nanotechnologies as an opportunity for societies to come up with new, more robust science policies and programs.

In line with the aforementioned TA frameworks, the logic behind NanoSoc was one of 'co-responsibility' toward innovation, as both technology promoters (scientists and technologists, as well as businesses and industrialists) and technology demanders (civil society, nonscientist citizens, etc.) had to take into consideration one another's needs and concerns if the project was to have general social relevance (Goorden et al. 2008a, 175). Co-responsibility equally implies that scientists have responsibilities not only to their profession but also to society as a whole, particularly in face of the increasingly tight coupling between science and industry. As NanoSoc was both transdisciplinary and interactive by design, those involved deliberatively constructed answers to perceived challenges, roles, and principles, and did so in an attempt to integrate scientific, social, ecological, and other concerns into strategic research agendas.

NanoSoc also drew on postnormal conceptions of science and built on the frameworks of RI and anticipatory governance as a means of 'handling the demands of postnormal science' (Barben et al. 2008, 986). As the project's initiators argued, innovation actors (scientists, engineers, policy-makers, and others) today confront three forms of uncertainty: strategic uncertainty, research complexity, and public ambivalence (Goorden et al. 2008a, 164–167). The first two kinds of uncertainty relate to the goal-searching nature of nanotechnology. Because nanotechnology can be applied in different ways, nanotechnology R&D can be steered in multiple, even diverging, directions, depending on which kinds of sciences are involved and which theories and visions are mobilized in the process. Similarly, because nanotechnology serves both as an enabling technology for other technologies and also converges with other technologies such as biotechnology, the scope of 'nano' path formations is extremely wide. Accordingly, nanotechnology research is conducted in a heterogeneous manner with research managers dedicating substantial resources to research initiatives that are fragmented and often lack coherence.

In addition, various interests are at play in nano R&D, which often remain implicit and are insufficiently understood even by technology promoters themselves. Contrary to a range of other technologies, nanotechnologies are not driven by a shared public expectation or political justification, nor are they associated with any particular promise. Rather, because nanotechnology is still in its infancy, a multitude of middle-range and more speculative, long-term visions are developed. These visions include both inflated promises (e.g. nanotechnology as the 'next revolution') and doomsday scenarios (e.g. self-replicating 'nanobots' that are out to destroy humanity). As Grünwald (2004, 54) argues, longer range visions linked to 'nano' are ambivalent in nature: 'positive visions could be re-interpreted as negative ones at the same time, hopes of some people may be fears of others, or judgments may vary over time'. Hence, for NanoSoc initiators the question was one of 'streamlining' efforts in nanotechnology in ways that reduce the above complexities, or at least allow actors to manage them constructively together (Goorden and Deblonde 2011, 4).

3.1. *The case for co-responsibility*

Based on its scope and aims, it can be argued that NanoSoc carried the notion of RI a step further than we have seen thus far. Rather than appealing to abstract principles only (e.g. sustainable development) as embedded in (European) codes of conduct, the project instigated an ongoing, deliberative role-principle dialog on technoscientific responsibility that implicated wider society and scientists on the work floor, ultimately with the aim of developing an interactive methodology for socially responsible nanotechnology development.

As NanoSoc operated on the understanding that technology innovation is a co-responsible enterprise to which both the enactors of science and technologies (i.e. technology developers and promoters, such as scientists, engineers, and product managers, who seek to realize new technologies) and comparative selectors (regulative authorities, pressure groups, citizen-consumers) contribute, it was designed to engage a multiplicity of actors in a mutual learning process, including nanoscientists, stakeholders, and citizens.[11] To initiate prospective reflection and future-oriented debate, participants were asked two overarching questions: (1) Which nanotechnology trajectories (developments) are likely or possible? and (2) Which trajectories are worthwhile or desirable for a future society? Thus, participants looked first for which future nanotechnology trajectories they deemed probable, to then discuss which trajectories were worth elaborating and refining. The first question was addressed in an exploration stage and a visioning stage; the second in a normative stage and a design stage.

I do not expound on these stages in this article. Suffice it to say that NanoSoc can be read both as a situated enactment of, and precursor to, *TA-driven RI*, as the project sought to provide participants and innovation actors with incentives to systematically reflect on the embedding of technology in Flemish society. As mentioned above, the more specific focus was on rendering scientists aware of societal needs in relation to nanotechnologies and having scientists at the two nanotech institutes involved in NanoSoc consider how to integrate these needs into nascent R&D strategies.

3.2. *Again: where are the politics?*

Given the close connections between NanoSoc and the RI framework at large, it is instructive to draw parallels between the criticisms of RI presented earlier and the NanoSoc process. Hence, in this section, I again raise the question, 'where are the politics?', but do so specifically in relation to NanoSoc. As earlier, I focus on the politics *in* deliberation, the politics *of* deliberation, and the authoritative allocation of values.

3.2.1. *The politics* in *deliberation*

In the NanoSoc project description (NPD 2005), the scientist/technologist is presented as 'part of the community of 'seekers' who do research to find solutions for a common problem'. Similarly, in a 2008 NanoSoc publication, we read that each actor in NanoSoc 'contributes his/her (incomplete) views and perspectives and confronts them with those of others' with the aim of achieving creative solutions to sociotechnical challenges (Goorden et al. 2008a, 164). As these quotes indicate, the central premise of the NanoSoc project was that decisions, policies, and assessments would benefit in quality from the inclusion of as many viewpoints as possible; thus enabling factors that previously escaped technical decision-making to be captured and integrated into science and technology policy (Cass 2006, 9).

While it is of course always possible that participants work together on a shared project in good faith, little to nothing was said about how various stakes and interests may collide, or how differences between actors are resolved (or conversely, suppressed). It was simply

assumed that the involvement of more actors and issues in science would lead to better science policy and enhance scientific quality. This assumption leaves open the questions as to what 'better' practice and 'quality' in science amount to and how the definitions of these terms are ultimately established.[12] Yet, from the project's outset to its official closure, various project participants, as well as actors more tangentially involved in NanoSoc (e.g. nanotechnologists' colleagues and employers, citizens, and policy-makers), often invoked a deficit understanding of participation in science and technology, predicated on the assumption that publics are ignorant of scientific facts, and therefore, need scientific education. This deficit understanding contrasts with repertoires conventionally deployed by TA practitioners, which construct publics as credible participants in the process of knowledge construction, and underline the need of bringing in various kinds of expertise (scientific, sociological, lay) in scientific practices and decision-making (Epstein 1995). The problem was not that definitions conflicted or that disagreement about deliberative aims and means persisted, but that these conflict dynamics were not picked up and acted on in NanoSoc. Rather than inquiring into how deliberation evoked different, if not divergent, expectations and responses, NanoSoc initiators repeatedly appealed to cooperation and collaboration on behalf of all participants as a means of handling nanotechnology challenges and concerns. As described elsewhere, and as project initiators themselves acknowledge, these appeals did not prove effective (Van Oudheusden and De Zutter 2012).

In short, because cooperation and collaboration were taken for granted, NanoSoc participants had free reign to construct their own versions of deliberation without engaging in reciprocal exchanges or probing their own assumptions, as the spirit of deliberative inquiry demands. This general lack of consideration for the politics *in* deliberation rendered NanoSoc vulnerable to strategic game playing and to various forms of 'noncommunicative' behavior on behalf of those involved, as some participants, for various reasons, resisted interaction on deliberative terms. As a consequence, participation in NanoSoc became impracticable and even undercut the deliberative process, which initiators sought to sustain.

Thus, although NanoSoc provided each participant with ample room to articulate and develop her own conception of deliberation, appeals to collaboration, sharing, reciprocity, and unconstrained dialog remained problematic because there were no checks and balances that regulated power-in-interaction. Inviting participants to engage in respectful dialog does not guarantee that they will contribute their thoughts and ideas, or do so in a fair manner, even when prompted. True to the spirit of deliberation, actors in a TA cannot be forced to commit ideas and resources; thus, there is no mechanism to control disruptive behavior. I therefore urge deliberative TA practitioners to develop such mechanisms to ensure more trustworthy and legitimate deliberative processes. These measures should go well beyond the usual calls for facilitation by 'neutral' facilitators, which are usually based on a desire of having participants get along with one another.[13] Instead, TA practitioners (or other researchers) could deploy a range of data-driven techniques (e.g. audio and video recordings of deliberation) in order to discern and analyze recurring patterns of interaction between participants. These analyses could be fed back into deliberative processes as a means of attending participants to the rationalities at work in deliberation and subjecting their interactions to social control. In conjunction with such techniques, admittedly arduous, one may think of semi-structured interactions with participants before, during, and after deliberative engagements centered on the question of what is at stake for them and how they perceive the stakes of others, as well as whether they perceive the deliberative process to be useful and legitimate. While it may be impractical for TA practitioners to delve into each and every response to these questions, it should be possible to extract recurring themes and subject these to collective discussion so that deliberative aims and procedures can be revised along the way.

Taking these lines of reasoning a step further, participants could also be asked whether and where they see domination (i.e. coercion or repression) at work in deliberation. Following Foucault (1988, 18), relations of power cannot be dissolved in communication; hence, participants should be allowed to engage in games of power as a means of channeling and regulating it (Flyvbjerg 1998). When, and if, these games transgress into repression or other forms of political violence, TA practitioners must ask why these transgressions occur. To my mind, this question is even more important than the need to restrain disruptive conduct, as a collective exploration of the interests of all parties in a TA impinges on the nature of deliberation itself. Because the question is needs-centered (rather than process- or outcome-centered), it opens a possibility of rethinking and recrafting deliberative engagement in a manner that is more likely to enhance the legitimacy of deliberative TA among all involved parties.

In sum, TA practitioners would do well to take the rationalities of conflict and power as the point of departure rather than commitments to sharing and dialog. While collaboration and consensus seeking are of course a vital and genuine element of deliberation, the legitimacy of deliberation also depends on how the collision of stakes and interests is managed.

3.2.2. *The politics* of *deliberation*

A second tension worth attending to is the lack of a democratic theory in NanoSoc (and deliberative TA practice at large). The NanoSoc process was designed to broaden both the range of actors and issues in scientific decision-making and assessment. As it included citizens and societal 'stakeholders' in public debates on nanotechnologies, it necessarily democratized the debate in ways that potentially undercut the artificial separation between scientific practice and policy-making (Martin and Richards 1995, 525). Yet, one does not find the notion of democratization in NanoSoc sources. This oversight is because NanoSoc initiators invoked deliberation purely on substantive grounds; i.e. they framed public participation in science as a means of achieving qualitatively better science policies, not as a way of bringing the sciences into democracy. Similarly, although initiators invoked procedural norms for all project participants to adhere to, they left unspecified how their normative, procedural vision of participation draws on deliberative ideals and democratic theory. Thus, deliberative TA practitioners in NanoSoc did not articulate or develop the principle of democracy to which they implicitly adhere (see Genus 2006).

There are at least two good reasons why it would greatly benefit processes like NanoSoc if TA practitioners were to articulate such a principle. First, invoking deliberation on democratic, rather than on substantive grounds only, urges TA initiators to make explicit the normative standards against which participatory process is designed. Rather than operating on the assumption that participants in a TA will adhere to implied norms, such as reciprocity, fairness, and transparency, in their interactions, the success of a TA would be defined with respect to whether and how these deliberative democratic criteria were met in practice. Accordingly, the achievements of TA process would be measured against a standard of democratic legitimacy instead of against the end of achieving better technoscientific outcomes or policies only.

Second, as explicitly stating the terms of deliberation brings the process itself into focus (rather than the inputs and outputs of participation), project participants would be more symmetrically positioned to negotiate the terms of their engagement upfront. Thus, rather than having to simply accept, or experience, the deliberative rationale underlying TA, participants would ideally be provided with an opportunity first to discuss with one another the basic project approach (i.e. deliberative, collaborative, interdisciplinary inquiry). The potential advantage of opening discussion on these issues for TA practitioners is that they can urge other parties at the table to acknowledge the importance of mutual learning and experimentation with new forms of sociotechnical

governance, rather than narrowing deliberation down to instrumental imperatives only, such as influencing policy-making and educating citizens about science.

In short, by making explicit the democratic norms and deliberative design criteria that (already) inform TA processes like NanoSoc, it becomes possible to conceive of TA as a democratic sociotechnical practice that is both attentive to the political micro-realities of deliberation (e.g. strategic action, disruptive behavior) and explicitly puts up deliberation itself for discussion in project practice. It would also force TA practitioners to operationally define each term of 'good deliberation' (e.g. reciprocity), so that the process can be appraised more or less independently from the outcomes it generates.[14]

A next, related, recommendation would be to urge TA practitioners to clearly distinguish deliberation from participation. In many TA practices, the two concepts are simply lumped together to characterize different kinds of 'participatory TA', including discursive (Döbert 1997), public (Van Eijndhoven and Van Est 2000), and interactive TA (Grin, Van de Graaf, and Hoppe 1997). Yet, following Mutz (2006, 3), deliberation and participation represent different, probably incompatible democratic political cultures. Whereas, deliberative democrats seek to encourage rational–critical debate in which participants effectively listen to the other side and probe their own assumptions for the sake of mutual learning and building understanding between various parties and interests; participatory democrats cultivate political activism. That is, they mobilize like-minded individuals and groups as partisans in order to impact policy. Whereas, deliberative democrats emphasize respect for differences of opinion and tolerance; participatory democrats seek to arouse passion for their cause, thus discouraging mutual listening and dissent in practice.

Although Mutz writes in the context of the contemporary USA, her message is relevant for European TA and RI. As mentioned earlier, in the NanoSoc project nanoscientists, industry representatives, and relevant others conceived of NanoSoc primarily as a vehicle for impacting policy processes. In this understanding, impact is achieved by aligning the different interests of parties involved in a TA into a common interest and making that common interest heard in the policy arena. TA researchers, on the other hand, would often stress that a mutual exploration of viewpoints is more important than what participation produces in terms of substantive outcomes – thus underlining the conditional status of results and the importance of due process. One could argue that different conceptions of democracy are at play here (deliberative, participatory, and representative), which has implications for how participants to TA value, and deal with, dissent. At the very least then, Mutz's differentiation between participation and deliberation should encourage TA practitioners and advocates of RI to reflect on process design and the – potentially conflicting – rationales that sustain it. Her distinction can also help practitioners to articulate and develop, in more precise wordings, the aims they seek to instigate through deliberative or participatory processes and how these in turn relate to the system of representative democracy at large.

3.2.3. *The authoritative allocation of values*

Although no formal follow-up study was conducted that assessed the institutional impacts of the NanoSoc project, it is fair to say that NanoSoc had no tangible effect on strategic science decision-making in the two R&D centers involved in the NanoSoc process. NanoSoc initiators themselves acknowledge this conclusion as a 'shortcoming', even if some nanoscientists showed great enthusiasm for the project throughout its duration and continued to do so after the project was officially terminated (Van Oudheusden and De Zutter 2012). A possible reason for the lack of institutional impact is that NanoSoc initiators insisted on the so-called substantive or quality argument for deliberation, i.e. the conviction that decisions, policies, and assessments benefit in quality from the inclusion of as many viewpoints as possible, thus enabling factors that previously escaped technical decision-making to be captured and integrated into science and technology policy

(Cass 2006, 9). A too strong emphasis on producing 'better' substantive outcomes comes with the risk of overlooking, and ignoring, the importance of instrumental rationales (e.g. supporting preconceived, often short-term policy commitments) for policy- and strategic decision-makers.

Second, NanoSoc specifically targeted nanotechnologists and their strategic research agendas rather than science and technology policy-making at large. The choice to single out scientists in laboratories was motivated both by such programmatic concerns as the urge to make scientists more reflexive and responsible, as well as practical constraints of time and money. It is not hard to grasp the inherent limits of focusing exclusively on one level or one community of decision-making. Such concentrated efforts are likely to be a lot more effective when they are strategically combined with other RI or RI-related activities and integrated into full-fledged research programs that comprise research and systems analysis, science policy assessments, public value mapping (Bozeman 2005), midstream modulation (Fisher 2007), future studies, organization studies, scenario planning, vision assessments (Grin and Grünwald 2002), and other anticipatory governance initiatives.

It is on these latter notes that I conclude my comparison between deliberative TA approaches like NanoSoc and RI conceptions more broadly. Arguably, as a policy paradigm, RI fares better than deliberative TA, as the former is motivated by substantive considerations, as well as normative and instrumental ones (Owen, Macnaghten, and Stilgoe 2012; EC 2013, 23). It is particularly important that RI promises and delivers tangible, instrumental short-term policy impacts so that RI is not lost on policy-makers. I also stress the importance of tying TA and RI into formal, representative policy processes. As the NanoSoc case indicates, targeting scientists and scientific communities in R&D labs is insufficient to effectuate real policy change, as larger decisions are made elsewhere. The advantage of RI is that it speaks through established policy voices (such as von Schomberg's) and ties into strategic EU policy programs, such as the EU's 2020 Vision for a European Research Area. Advocates of RI should strategically exploit this advantage if they are serious about molding the science–society relationship to match their normative vision. However, like deliberative TA, the way RI is theorized to occur is problematic. Proponents of deliberation and RI repeatedly fail to consider their own politics and fail to present deliberation as a political activity, imbued as it is with ongoing processes of contestation and subversion that do not necessarily lead toward mutually gratifying outcomes (Van Oudheusden 2011b). The rather naive conception of deliberation as a constructive, mutually responsive enterprise that harmonizes scientific and social interests and values needs to be made more political if RI is to make headway as a strategic orientation and durable policy commitment in the years to come.

4. Conclusion

This article asks how responsible innovation (RI) is presented and elaborated, based on general definitions of RI on the EU policy level, and on a close examination of RI through a local, Flemish, TA level. It argues that RI is best understood as a normative–political orientation that seeks to alter the present sociotechnical order through deliberative public engagement processes in science and technology. RI is therefore steeped in the philosophy of deliberative democracy and in social constructivist approaches of science. To the extent that RI accords with broader technology and innovation agendas (e.g. a neoliberal language of governance) and effectively harmonizes contending interests, RI could develop into a new form of 'governmentality'; that is, a strategy to intervene in science and technology in order to rationalize actions and actors (Rose 1999, 28).

Because RI proponents act to change the world, so to speak, they engage in politics in a broad sense. Yet politics, as well as power, are not sufficiently theorized or acknowledged within the RI framework. It is therefore necessary to open RI and RI enactments to political critique, with the aim of remedying the shortcomings of RI. This article proposes: (1) making visible how actors

involved in deliberation actually negotiate the terms of their engagement rather than assuming that deliberation improves the quality of decisions and enhances democracy; (2) opening up discussion among all involved parties on the politics of deliberative engagement, including the process norms that govern interaction (e.g. reciprocity) and the substantive biases inherent in RI (e.g. ethical concerns outweigh economic concerns); and (3) acknowledging that contemporary conceptions of RI are institutionally weak and that RI has only a limited institutional problem-solving capacity, as deliberative outcomes cannot be enforced in the policy arena.

The various shortcomings in the RI frame provide an opportunity to propose an alternative frame that counters the overtly one-dimensional presentation of RI as an ethical, inclusive, and responsive endeavor:

- *Problem definition*: RI is too much about talk, argumentation, and due process.
- *Problematization*: Failing to consider how RI processes are imbued with politics renders RI politically weak.
- *Treatment recommendation*: Make RI more political by attending to the politics in and of RI, and the institutional uptake of RI.

Whether or not RI advocates will find this reframing of RI along more politically sensitive criteria compelling is an open question, intricately bound up with the questions of how, when, where, and why to engage in politics. Although advocates of RI must work within the dominant policy framing of science and technology as an area distinct from politics, ethics, law, etc., there is a risk in accommodating these facile distinctions. For one, the seemingly non-political talk of responsibility and innovation obscures how political acts of inclusion and exclusion play out through RI discourses, processes, and tools. Questions as to how policy-makers and deliberative practitioners draw boundaries, for instance, should always remain in focus. If not, a situation may arise in which RI proponents avoid critically examining their own commitments and do not even consider whether these work. Second, the non-political character of RI is hard to sustain on substantive grounds, even if we adopt a narrow definition of politics as partisan politics. In some countries and regions (notably in Flanders, but also in the USA; see Laporte 2013), RI-associated institutes such as TA offices are explicitly associated with political parties on the left side of the political spectrum and/or with a political preference for more participatory or deliberative modes of decision-making (Van Oudheusden et al. 2013). In such cases, presenting RI to policy-makers as a politically neutral tool risks trivializing and undermining the very policy changes RI advocates seek to instigate. Adopting a more politically laden language of agendas, interests, impacts, and power may be an unconventional and provocative choice of policy strategy, but may ultimately be more fruitful.

Whichever political options proponents of RI decide upon, it is essential that these options are discussed and critically considered within the RI community. This article attempts to serve as a useful starting point for such a debate. It does not urge advocates of RI to agree with each and every observation raised, but to take the spirit of critical self-inquiry to heart. It thereby provides a strategic opportunity for building into RI agendas a permanent capacity for critical self-reflection on the norms, assumptions, and aims that inform these agendas, in ways that resonate with TA attempts at building reflexivity into ‘innovation governance’.

Acknowledgments

I am grateful to two anonymous reviewers for their constructive comments on an earlier version of this paper. I have also benefited from discussions with Pierre Delvenne, Nathan Charlier, and Tsjalling Swierstra; as

well as Stevienna de Saille and other participants who attended a workshop on RI at the Ecole des Mines in Paris on 12–13 September 2013.

Notes

1. Throughout this article, I use the term RI, unless when citing, or referring to, authors who explicitly use the term RRI. The first term is more compelling than the second, as RI potentially encompasses all kinds of aspirations and processes, including social innovations, system innovations, corporate responsibility, etc. that exceed and extend the context of *science- and technology*-driven research and innovation.
2. I leave open the question as to what 'effective policy outcomes' entail. It is more important to note that RI is *integrative* in scope and character, as it is motivated not only by instrumental imperatives, but also by normative and substantive ones. I return to this point and the distinctions between these RI imperatives in Section 3 of this article.
3. See, for instance, the EC's 2013 Report on Strengthening Options for RRI, where it is explicitly stated that the development of science and technology fails due to the relative lack of societal acceptance of science and technology research: '(…) there are many examples in which the outcomes of research has [*sic*] been contested, *because* social and ethical aspects have not been adequately taken into consideration in the development of innovation' (emphasis added) (EC 2013, 3).
4. In what follows, I deliberately speak of *deliberative* governance (and *deliberative* TA approaches) rather than *participatory* governance, as deliberation and participation are distinctly different in scope, aims, and character. I expound on this difference in Section 3 of this article.
5. See Owen, Macnaghten, and Stilgoe (2012) for an overview and a brief contextualization of RI-related notions.
6. Like postnormal science and related frameworks, RI views scientific knowledge as a *social construct* rather than as a historical or epistemic given. Hence, RI directs our attention toward the context(s) of scientific knowledge rather than to scientific truth in an absolute sense. For more on (social) constructivism as the dominant science policy paradigm, see Jasanoff (2003); for more on constructivist studies of science, including the Social Construction of Technology approach, see Pinch and Bijker (1984).
7. As Mills (2013) of the Nuffield Council on Bioethics writes, 'As a movement with a practical mission, RI has to come up with a *normative programme* that responds to the perceived procedural failure of markets and the epistemic failure of governments to manage innovation effectively for social good' (emphasis added).
8. The understanding of politics as the authoritative allocation of values for society is of course derived from Easton (1965).
9. Studies that measure the impacts of deliberation on policy-making produce mixed results. It is perhaps most accurate to state that 'scholars do not know how deliberation affects policy options' (Barabas 2004), although some case studies suggest that policy-makers respond to, and anticipate, changes in public opinion (for an overview of these studies, see Stokes 1998, 125). Either way, the effects of deliberation on policy-making are perceived to be soft and intangible, and thus hard to measure using traditional statistical measurement.
10. For a concise overview of the various STS-inspired literatures on which project initiators drew, see Goorden and Deblonde (2011, 55–57). Von Schomberg (2011a, 7) in turn refers to the NanoSoc project as a 'public engagement project' that promisingly combines foresight and deliberation.
11. The distinction between enactors and comparative selectors is derived from Rip and Te Kulve (2008, 52).
12. The assumption that bringing in more voices (and issues) in science ultimately leads to better policies is implicit in Habermasian models of communicative rationality, where deliberation is presented as the rational weighing up of arguments and counterarguments, and the various parties have in mind a common good. Power, force relations, and antagonism appear to reside elsewhere, outside the deliberative process. This is not to say that NanoSoc initiators denied conflict between actors; rather, they asserted that actors negotiate their different interpretations until they arrive at a solution that more or less satisfies the various parties (see Klein and Kleinman 2002).
13. For a thoughtful reflection on deliberative facilitation and how to rethink the role of facilitators, see Forrester (1999, 76–81).
14. For a similar argumentation in relation to deliberative science and technology governance, see Lövbrand, Pielke Jr., and Beck (2011).

Notes on contributor

Michiel van Oudheusden is a postdoctoral researcher at the University of Liège in Belgium, where he coordinates a research project on technology assessment, science, and technology innovation. His research focuses on how science, technology, and innovation regimes in the regions of Flanders and Wallonia coevolve and on the interrelationship between politics and innovation more generally. He was previously engaged in a Flemish technology assessment on nanotechnologies, which served as a case study for his PhD investigation into deliberative engagement in science and technology. He co-organizes technology assessment workshops in the Walloon parliament and is a founding member of the Belgian Science and Technology Studies Network.

References

Abels, G. 2007. "Citizen Involvement in Public Policy-Making: Does It Improve Democratic Legitimacy and Accountability? The Case of pTA." *Interdisciplinary Information Sciences* 13 (1): 103–116.

Barabas, J. 2004. "How Deliberation Affects Policy Opinions." *American Political Science Review* 98 (4): 687–701.

Barben, D., E. Fisher, C. Selin, and D. Guston. 2008. "Anticipatory Governance of Nanotechnology: Foresight, Engagement, and Integration." In *The Handbook of Science and Technology Studies*, edited by E. J. Hackett, O. Amsterdamska, M. Lynch, and J. Wajcman, 979–1000. Cambridge, MA: MIT Press.

Beck, U. 1993. *Die Erfindung des Politischen*. Frankfurt, Germany: Suhrkamp Verlag.

Bora, A., and H. Hausendorf. 2004. *Participation and the Dynamics of Social Positioning (PARADYS): Final Report to the European Commission*. Contract No. HPSE-CT 2001–00050. Bielefeld.

Bozeman, B. 2005. "Public Value Mapping of Science Outcomes: Theory and Method. A Monograph of the Public Value Mapping Project of the Center for Science, Policy, and Outcomes". http://archive.cspo.org/products/rocky/Rock-Vol2–1.PDF

Cass, N. 2006. "Participatory-Deliberative Engagement: A Literature Review," Working Paper, Lancaster University.

Cook, G., E. Pieri, and P. T. Robbins. 2004. "'The Scientists Think and the Public Feels': Expert Perceptions of the Discourse of GM Food." *Discourse & Society* 15 (4): 433–449.

Delgado, A., K. L. Kjølberg, and F. Wickson. 2010. "Public Engagement Coming of Age: From Theory to Practice in STS Encounters With Nanotechnology." *Public Understanding of Science* 20 (6): 826–845.

Döbert, R. 1997. "Rationalitätsdimensionen von partizipativer Technikfolgenabschätzung." In *Diskursive Technikfolgenabschätzung*, edited by S. Köberle, F. Gloede, and L. Hennen, 200–213. Baden-Baden, Germany: Nomos.

Easton, D. 1965. *A Framework for Political Analysis*. Englewood Cliffs: Prentice-Hall.

EC (European Commission). 2013. Options for Strengthening Responsible Research and Innovation. Brussels: Directorate-General for Research and Innovation Science in Society, European Commission (EUR25766). http://ec.europa.eu/research/science-society/document_library/pdf_06/options-for-strengthening_en.pdf

Eden, S. 1996. "Public Participation in Environmental Policy: Considering Scientific, Counter-Scientific and Non-Scientific Contributions." *Public Understanding of Science* 5 (3): 183–204.

EFC (European Foundation Centre). 2012. "From Science in Society to Responsible Research and Innovation." http://www.efc.be/news_events/Pages/From-Science-in-Society.aspx

Entman, R. M. 1993. "Framing: Toward Clarification of a Fractured Paradigm." *Journal of Communication* 43 (3): 51–58.

Epstein, S. 1995. "The Construction of Lay Expertise: AIDS Activism and the Forging of Credibility in the Reform of Clinical Trials." *Science, Technology & Human Values* 20 (4): 408–437.

Felt, U., B. Wynne, M. Callon, M. E. Gonçalves, S. Jasanoff, M. Jepsen, P.-B. Joly, et al. 2007. *Taking European Knowledge Seriously. Report of the Expert Group on Science and Governance to the Science, Economy and Society Directorate*. Brussels: Directorate-General for Research, European Commission.

Fisher, E. 2007. "Ethnographic Intervention: Probing the Capacity of Laboratory Decisions." *NanoEthics* 1 (2): 155–165.

Flyvbjerg, B. 1998. "Habermas and Foucault: Thinkers for Civil Society?" *British Journal of Sociology* 49 (2): 210–233.

Forrester, J. 1999. *The Deliberative Practitioner. Encouraging Participatory Planning Processes*. Cambridge, MA: MIT Press.
Foucault, M. 1982. *The Subject and Power. Michel Foucault: Beyond Structuralism and Hermeneutics*. 2nd ed., edited by Hubert L. Dreyfus and Paul Rabinow. Chicago: University of Chicago Press.
Foucault, M. 1988. "The Ethic of Care for the Self as a Practice of Freedom." In *The Final Foucault*, edited by J. Bernauer and D. Rasmussen, 1–20. Cambridge, MA: MIT Press.
Fuller, S. 2000. "Why Science Studies Has Never Been Critical of Science. Some Recent Lessons on How to Be a Helpful Nuisance and a Harmless Radical." *Philosophy of the Social Sciences* 30 (1): 5–32.
Funtowicz, S. O., and J. R. Ravetz. 1993. "Science for the Post-Normal Age." *Futures* 25 (7): 735–755.
Funtowicz, S. O., and J. R. Ravetz. 1990. *Uncertainty and Quality in Science for Policy*. Dordrecht: Kluwer Academic Publishers.
Funtowicz, S. O., and J. R. Ravetz. 1994. "The Worth of a Songbird: Ecological Economics as a Post-Normal Science." *Ecological Economics* 10 (3): 197–207.
Genus, A. 2006. "Rethinking Constructive Technology Assessment as Democratic, Reflective, Discourse." *Technological Forecasting and Social Change* 73 (1): 13–26.
Gethmann, C. F. 2002. "Participatory Technology Assessment: Some Critical Questions." *Poeisis Prax* 1: 151–159.
Gibbons, M., C. Limoges, H. Nowotny, S. Schwartzman, P. Scott, and M. Trow. 1994. *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London: Sage.
Goorden, L., and M. Deblonde. 2011. *Navigating in Nanospace. Presentation of an Integrated Roadmap*. Final Report NanoSoc. Antwerpen, Belgium: Universiteit Antwerpen, 70 pp.
Goorden, L., M. Van Oudheusden, J. Evers, and M. Deblonde. 2008a. "Nanotechnologies for Tomorrow's Society: A Case for Reflective Action Research in Flanders, Belgium." In *Presenting Futures. Yearbook of Nanotechnology in Society*, edited by E. Fisher, C. Selin, and J. Wetmore, Vol. 1, 163–182. New York: Springer.
Goorden, L., M. Van Oudheusden, J. Evers, and M. Deblonde. 2008b. "Lose One Another … and Find One Another in Nanospace: 'Nanotechnologies for Tomorrow's Society: A Case for Reflective Action Research in Flanders (NanoSoc)." *NanoEthics* 2 (3): 213–230.
Grin, J., and A. Grünwald (Eds.). 2002. "Vision Assessment: Shaping Technology in 21st Century Society." *Poeisis & Praxis* 1 (2): 165–166.
Grin, J., H. Van de Graaf, and R. Hoppe. 1997. Interactieve Technology Assessment. Een eerste gids voor wie het wagen wil [Interactive Technology Assessment: A Guide]. Den Haag, The Netherlands: Rathenau Instituut.
Gross, M. 2006. "Beyond Expertise: Ecological Science and the Making of Socially Robust Restoration Strategies." *Journal for Nature Conservation* 14 (3–4): 172–179.
Grünwald, A. 2004. "Vision Assessment as a New Element of the FTA Toolbox," EU-US Seminar: New Technology Foresight, Forecasting & Assessment Methods, Seville, May 13–14.
Guston, D. H. 1999. "Evaluating the First U.S. Consensus Conference: The Impact of the Citizens' Panel on Telecommunications and the Future of Democracy." *Science, Technology, & Human Values* 24 (4): 451–482.
Guston, D. H., and D. Sarewitz. 2002. "Real Time Technology Assessment." *Technology in Society* 24 (1–2): 93–109.
Hessels, L. K., and H. Van Lente. 2008. "Re-Thinking New Knowledge Production: A Literature Review and a Research Agenda." *Research Policy* 37: 740–760.
Jasanoff, S. 2003. "Technologies of Humility: Citizens Participation in Governing Science." *Minerva* 41 (3): 223–244.
Kerr, A., S. Cunningham-Burley, and R. Tutton. 2007. "Shifting Subject Positions: Experts and Lay People in Public Dialogue." *Social Studies of Science* 37 (3): 385–411.
Klein, H. K., and D. L. Kleinman. 2002. "The Social Construction of Technology: Structural Considerations." *Science, Technology, & Human Values* 27 (1): 28–52.
Kondratiev, N. 1978. "The Long Wave in Economic Life." Translated by W. Stolper. *Lloyds Bank Review* 129, 41–60.
Laporte, T. 2013. "Managing Increasing Relative Ignorance: Potential for and Pitfalls of Participatory Practices and the Role of Institutions in a New Technology Assessment." Paper presented at the workshop on technology assessment, its potential and limitations, University of Liège, Liège, March 7.
Lezaun, J., and L. Soneryd. 2007. "Consulting Citizens: Technologies of Elicitation and the Mobility of Publics." *Public Understanding of Science* 16 (3): 279–297.

Loeber, A. 2004a. "Method and Practice of Interactive Technology Assessment. Learning from a Dutch Analytic Experiment on Sustainable Crop Protection." Paper presented at the Joint 4S/EASST conference, Paris, August 25–28.

Loeber, A. 2004b. "Practical Wisdom in the Risk Society. Methods and Practice of Interpretive Analysis on Questions of Sustainable Development." PhD diss., University of Amsterdam, Amsterdam, The Netherlands.

Lövbrand, R. Pielke Jr, and S. Beck. 2011. "A Democracy Paradox in Studies of Science and Technology." *Science, Technology, & Human Values* 36 (4): 474–496.

Macnaghten, P., M. Kearnes, and B. Wynne. 2005. "Nanotechnology, Governance, and Public Deliberation: What Role for the Social Sciences?" *Science Communication* 27 (2): 1–24.

Martin, B., and E. Richards. 1995. "Scientific Knowledge, Controversy, and Public Decision Making." In *The Handbook of Science and Technology Studies*, edited by S. Jasanoff, G. E. Markle, J. C. Petersen, and T. Pinch, 506–526. Thousand Oaks, CA: Sage.

Mayer, I. 1997. "Debating Technologies. A Methodological Contribution to the Design and Evaluation of Participatory Policy Analysis." PhD diss., University of Tilburg, Tilburg, The Netherlands.

Michael, M., and N. Brown. 2005. "On Doing Scientific Citizenships: Reflections on Xenotransplantation's Publics." *Science as Culture* 14 (1): 39–57.

Mills, P. 2013. "Why Does Responsible Innovation Need Public Ethics?" http://blog.nuffieldbioethics.org/?p=606

Mouffe, C. 1999. "Deliberative Democacy or Agonistic Pluralism?" *Social Research* 66 (3): 745–758.

Mutz, D. 2006. *Hearing the Other Side: Deliberative Versus Participatory Democracy.* Cambridge, MA: Cambridge University Press.

Nahuis, R., and H. Van Lente. 2008. "Where Are the Politics? Perspectives on Democracy and Technology." *Science, Technology, & Human Values* 33 (5): 559–581.

Nowotny, H., P. Scott, and M. Gibbons. 2001. *Re-Thinking Science, Knowledge and the Public in an Age of Uncertainty.* Cambridge: Polity.

NPD. 2005. Nanotechnologies for Tomorrow's Society Project Description, 50 pp. www.nanosoc.be

Owen, R., P. Macnaghten, and J. Stilgoe. 2012. "Responsible Research and Innovation: From Science in Society to Science for Society, with Society." *Science and Public Policy* 39: 751–760.

Pellizzoni, L. 2012. "Strong Will in a Messy World. Ethics and the Government of Technoscience." *NanoEthics* 6 (3): 257–272.

Pestre, D. 2008. "Challenges for the Democratic Management of Technoscience: Governance, Participation and the Political Today." *Science as Culture* 17 (2): 101–119.

Pinch, T., and W. Bijker. 1984. "The Social Construction of Facts and Artefacts: or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other." *Social Studies of Science* 14 (August): 391–441.

Radder, H. 1992. "Normative Reflexions on Constructivist Approaches to Science and Technology." *Social Studies of Science* 22 (1): 141–173.

Rip, A., and H. Te Kulve. 2008. "Constructive Technology Assessment and Socio-Technical Scenarios." In *The Yearbook of Nanotechnology in Society, Volume 1: Presenting Futures*, edited by E. Fisher, C. Selin, and J. Wetmore, 49–70. New York: Springer.

Rose, N. 1999. *Powers of Freedom*. Cambridge, MA: Cambridge University Press.

Rowe, G., and L. Frewer. 2000. "Public Participation Methods: A Framework for Evaluation." *Science, Technology & Human Values* 25 (1): 3–29.

Schot, J., and A. Rip. 1997. "The Past and Future of Constructive Technology Assessment." *Technology Forecasting and Social Change* 54 (2–3): 251–68.

Schumpeter, J. 1939. *Business Cycles*. New York: McGraw Hill.

Stilgoe, J., R. Owen, and P. Macnaghten. 2013. "Developing a Framework for Responsible Innovation." *Research Policy* 42 (9): 1568–1580.

Stirling, A. 2006. "Resolving Environmental Conflicts: Combining Participation and Multi-Criteria Analysis." *Land Use Policy* 23 (1): 95–107.

Stokes, S. 1998. "Pathologies of Deliberation." In *Deliberative Democracy*, edited by J. Elster, 123–139. Cambridge: Cambridge University Press.

Sutcliffe, H. 2011. *A Report on Responsible Research and Innovation for the European Commission*. http://ec.europa.eu/research/science-society/document_library/pdf_06/rri-report-hilary-sutcliffe_en.pdf

Turnhout, E., S. Van Bommel, and N. Aarts. 2010. "How Participation Creates Citizens: Participatory Governance as Performative Practice." *Ecology and Society* 15 (4): 26. http://www.ecologyandsociety.org/vol15/iss4/art26/

Turnpenny, J., M. Jones, and I. Lorenzoni. 2011. "Where Now for Post-Normal Science?: A Critical Review of Its Development, Definitions, and Uses." *Science, Technology, & Human Values* 36 (3): 287–306.

Van Eijndhoven, J., and R. Van Est. 2000. "The Choice of Participatory TA Methods." In *Public Participation in Science: The Role of Consensus Conferences in Europe*, edited by S. Joss and J. Durant, 209–234. London: Science Museum with the Support of the European Commission Directorate General XII.

Van Oudheusden, M. 2011a. "Opening 'Participation' Through Participatory Technology Assessment: The Case of Nanotechnologies for Tomorrow's Society." PhD diss., University of Antwerp, Antwerp, Belgium.

Van Oudheusden, M. 2011b. "Questioning 'Participation': A Critical Appraisal of Its Conceptualization in a Flemish Participatory Technology Assessment." *Science and Engineering Ethics* 17 (4), 673–690.

Van Oudheusden, M., N. Charlier, B. Rosskamp, and P. Delvenne. 2013. "Broadening the Knowledge Base of Science, Technology, and Innovation Policies Through Flemish and Walloon Technology Assessments." Paper presented at the 2013 PACITA Conference on Technology Assessment and Policy Areas of Great Transitions, Prague, March 13–15.

Van Oudheusden, M., and H. De Zutter. 2012. "Contesting Co-Inquiry: 'Noncommunicative' Discourse in a Flemish Participatory Technology Assessment." *Science Communication* 34 (1): 83–113.

Von Schomberg, R. 2009. "Organising Collective Responsibility: On Precaution, Code of Conduct and Understanding Public Debate." Keynote lecture at the first annual meeting of the Society for the Study of Nanoscience and Emerging Technologies, Seattle, WA, September 11.

Von Schomberg, R. 2011a. "Prospects for Technology Assessment in a Framework of Responsible Research and Innovation." In *Technikfolgen abschätzen lehren: Bildungspotenziale transdisziplinärer Methoden*, edited by M. Dusseldorp and R. Beecroft, 1–19. Wiesbaden: Vs Verlag, in print.

Von Schomberg, R. 2011b. *Towards Responsible Research and Innovation in the Information and Communication Technologies and Security Technologies Fields*. Brussels, Belgium: European Commission. http://ec.europa.eu/research/science-society/document_library/pdf_06/mep-rapport-2011_en.pdf

Wesselink, A., and R. Hoppe. 2011. "If Post-Normal Science Is the Solution, What Is the Problem?" *Science, Technoogy, & Human Values* 36 (3): 389–412.

Wynne, B. 2001. "Creating Public Alienation: Expert Cultures of Risk and Ethics on GMOs." *Science as Culture* 10 (4): 445–481.

Wynne, B. 2006. "Public Engagement as a Means of Restoring Public Trust in Science? Hitting the Notes, but Missing the Music." *Community Genetics* 9 (3): 211–220.