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Governance of Nanotechnology in the Netherlands – Informing and Engaging in Different Social Spheres

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Abstract

Nanotechnology has provided a new window of opportunity to reframe state-science-society relationships. In particular the notion of upstream public engagement has been put forward. But while public engagement is seen as indispensable in the governance of science and technology (S&T) there still is a need to reflect on why, how, for who and by whom public engagement has to be organised. This paper describes a wide range of activities that were organised in the Netherlands to bring a public perspective into the development of nanotechnology. Our study shows that in order to better understand the complexities of the governance of science and technology, a new research perspective is needed. By reflecting on the relationship between informing and engaging, on the interaction between engagement processes within the societal, scientific and political sphere, and on organisational and institutional constraints, we present an outline of such a new research perspective. As well, we identify key themes for comparative research in governance of S&T within different countries.

Keywords: Governance of Science and Technology – Nanotechnology – Public Engagement – Social Spheres

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Introduction

The rise of nanotechnology in the aftermath of the biotech controversy has stimulated an active debate about the governance of science and technology (S&T). Politicians, business and science communities wanted to avoid nanotechnology becoming 'the next GM'. This political climate created opportunities for new governance concepts, which sponsored more proactive and participatory approaches to potential societal issues related to nanotechnology. In particular a lot of attention has been paid to the role of public engagement in the governance of S&T. Mixed opinions about its relevance and legitimacy have led to attempts to develop a more comprehensive view on the role of engagement (cf. Chilvers 2010; Gavelin, Wilson & Doubleday 2007).

This paper seeks to contribute to that research effort by analysing the way in which information and engagement processes shape the governance of S&T. Our approach is explorative, reflective and has a broad scope. Instead of evaluating a specific, one-off, public engagement event, we aim to identify and describe – over a time period of a decade – all kinds of activities that were organised to bring a public perspective into the development of nanotechnology. 'Public perspective' signifies all sorts of ethical, social and regulatory issues, which go beyond 'narrow' innovation and economic aspects of S&T development. We use this concept to trace activities in the governance of nanotechnology in the Netherlands: how the public and political agenda has been developed over time, which issues have been addressed in what way, and by which actors.

In order to connect to the ongoing discussion about (public) engagement, we have structured our explorative analysis in clear reference to important shifts in the framing of state-science-society relationships. The next section distinguishes six different types of activities that may play a role in the governance of S&T. The third section describes the ensemble of activities that was organised to bring a public perspective into the emerging field of nanotechnology in the Netherlands. Based on our case description we outline a new research perspective by identifying several relevant research themes in the governance of S&T.

Activities to bring a Public Perspective into Science and Technology

Intellectual and political framings of the relationships between the state, science and society enable and constrain the types of activities that are organised to bring a public perspective into the development of S&T. This section distinguishes six different types of activities within two dimensions: (1) activities may be aimed at either informing or engaging people; (2) activities may be aimed at influencing the societal, S&T or political sphere (see Table 1). Both dimensions relate to discussions on and experiences with the governance of S&T. This section introduces the two dimensions and the related six types of activities.

Informing and Engaging

The first dimension relates to the well-known distinction between the public understanding of science (PUS) approach and the public engagement with science (PES) approach. The United Kingdom is instructive, since this country experienced a late, but rapid paradigm shift from the PUS to the PES approach at the beginning of this century. Since the early 1970s, thoughts in the United Kingdom about the relationship between science, society and the state had been shaped by the public understanding of S&T vision (cf. Durant 1999). According to

this so-called *information deficit model*, scientists are knowledgeable experts, and the 'public' is characterised as having inadequate knowledge (Wynne 1995). Around the start of this century, the public understanding of S&T approach was severely criticised and the public engagement in S&T approach began to impact the policy discourse in the UK (Miller 2001). An influential House of Lords report, with the telling title *Science and Society* (House of Lords Select Committee on Science, Technology 2000), even dismissed the public understanding of S&T approach as a "rather backward-looking vision", and acknowledged that science had to involve itself in a dialogue with the public. Somewhat later in the context of nanotechnology, policy makers and the science community began to make rhetorical commitments to the term 'upstream public engagement' (Wilsdon & Willis 2004). For example, the Royal Society and Royal Academy of Engineering (RS-RAE) called for "a constructive and proactive debate about the future of nanotechnologies [to] be undertaken now – at a stage when it can inform key decisions about their development and before deeply entrenched or polarized positions appear" (RS-RAE 2004: xi).

Table 1: Overview of the types of activities aimed at informing or engaging people in order to integrate ethical and social aspects into the societal, S&T and political sphere, respectively

	Societal sphere	**S&T sphere**	**Political sphere**
Informing	*Aim*: One-way communication to inform lay citizens *Label*: Public understanding of science	*Aim*: ELSI-research to timely signal problems and inform researchers to stimulate development of desirable solutions *Label*: classical ELSI-research, upstream reflection	*Aim*: TA research to timely inform MPs *Label*: Classical parliamentary TA
Engaging	*Aim*: Two-way communication between citizens, experts and policy makers; TA to stimulate the public debate on science and technology *Label*: Participatory TA, public dialogue, upstream public engagement	*Aim*: Engaging scientists in a two-way dialogue with citizens and stakeholders to identify problems, and stimulate the development of desirable solutions *Label*: Constructive TA, real-time TA, upstream public engagement	*Aim*: TA to timely engage MPs in the political debate on science and technology *Label*: Participatory parliamentary TA

The 'new' public engagement with S&T vision builds further on experiments with participatory technology assessment (TA) methods, pioneered by parliamentary TA organizations in, for example, Denmark and the Netherlands. At the end of the 1970s, in both countries the fierce nuclear energy debate had challenged existing relationship between science, technology, society and politics (Jamison et al. 1990). Public demonstrations put public authorities under pressure and created a legitimacy crisis of the State. As a result, controversies over technologies began to be perceived as a problem between the government, the parliament and the wider public, and public engagement activities regarded as a legitimate add-on to representative democracy (Van Eijndhoven 1997). During the 1980s and 1990s, a class of methods to involve a broad variety of actors in technology assessment were developed, which is normally referred to as 'participatory TA' (Joss & Bellucci 2002). This involvement has taken various forms, like citizens' juries, scenario workshops, and consensus conferences (cf. Slocum 2003).

Informing and Engaging in Different Social Spheres

In literature and many policy documents, the word 'public' in the public understanding of science and public engagement with science often refers to informing the general public and engaging societal stakeholders and citizens in the public debate on S&T, respectively. There is a clear need, however, to link these activities to the political sphere (informing policymaking and political debate) and S&T sphere (impacting research agendas). For example, in the UK it was stressed that upstream engagement processes needed to be linked to the political process, "by asking MPs to debate with constituents, allowing time for debate in Parliament and ensuring that all ministers (and not just the science minister) discuss the issue" (Wilsdon & Willis 2004: 58) and inform research priorities, "rather than government, scientists or other experts deciding what questions should be answered" (Wilsdon & Willis 2004: 59). In addition, as we saw, public engagement activities build on earlier experiences with stimulating engagement in policymaking and political debate. Also various informing and engaging activities guided towards the R&D process have been organised, as is illustrated by the experience in the United States with research on ethical, legal and social issues (so-called ELSI-research) closely connected to large-scale R&D programmes (see subsection: *The Science and Technology Sphere*).

Accordingly, we want to map the activities that aim at informing or engaging actors from three relevant social spheres: societal, S&T and political sphere. These three spheres – or poles as Callon et al. (1992) names them – can be distinguished both by the actors constituting them as well as by the nature of their production. The societal sphere corresponds to the universe of the citizen, both as a user of technology and as someone who experiences the benefits and risks of technological change. Actors within this sphere are civil society organisations, like employer organisations, trade unions, environmental organisations, but also individual and groups of citizens. Within the science and technology sphere, certified scientific knowledge as well as technological artefacts are being produced. The main actors within this sphere are scientists and technologists, working within universities, public or private research centres, or high tech firms. The political sphere relates both to the parliament, its procedures, its culture and routines, and the members of parliament (MPs), as well as to the machinery of the government, including the civil servants working there. In this sphere, public policies are developed, politically decided upon and implemented.

The Societal Sphere

Above we have listed important shifts in state-science-society relationships in the UK and US. These shifts have been influential at the international level, but taken up differently in various national contexts. The case study in the next section discusses activities in the Netherlands. In contrast to the US and UK, the Dutch policy discourse about governing the relations between citizens, scientists and the state did not experience a shift in thinking in terms of informing about S&T to engaging with S&T at the start of the century. At the time, the Netherlands already had some sound experience with state-initiated forms of public debate and citizen participation (Van Est et al. 2002). In the early 1980s, already, the Dutch government had initiated the Broad Societal Debate around Energy Policy (BMD). Around the turn of the century, the Dutch Parliament asked the Government to organise 'broad societal debates' on cloning (1998-1999), xeno-transplantation (2000-2001), and GM-food (2001-2002). These public debates are concerned with informing the general public about societal aspects related to S&T and engaging experts, stakeholders and lay people in the societal debate in order to stimulate such debate. Moreover, these state-initiated debates are all characterised by a broad variety of activities, ranging from information activities, local debates and science theatre, to public panels and focus groups.

These experiences with government-initiated public debates, however, did not lead to a shared vision within Dutch society on how to organise public involvement on a regular basis. Over the years, the meaning of public participation has changed, constantly challenged by new types of developments (Van Est 2011a). Public participation in the mid1980s mainly referred to the involvement of organised civic society groups, and up to now, expert and stakeholder participation presents a widely accepted phenomenon in Dutch society. At the beginning of the 1990s, and in response to the upcoming ethical debate around biotechnology, the meaning of public engagement was broadened to include individual citizens. By the end of the 20th century, the government even came to equate public engagement with citizen participation.

This became apparent during the GM-food debate '*Eten en Genen*' in 2001. At the time, the government perceived that the GM-food debate had become a trench war between industry and environmental non-governmental organisations, and considered an attempt at bringing these various interest organisations together a useless exercise. The government chose to focus its efforts on the 'general public'. The existing engaged civil society organisations (CSOs) were merely positioned as sources of information for the 'general public'. The Dutch government thus narrowed the meaning of public engagement towards involving 'pure' and 'rational' citizens, thereby side-tracking engaged civic organisations (cf. Gutteling et al. 2006; Laurent 2011; PAGANINI Project 2007). The government received a lot of criticism for the way it framed and organised the debate, and the environmental CSOs boycotted the state-initiated debate. This shows that public engagement in S&T is a social and political construct (cf. Irwin 2001, 2006; Stirling 2008).

The Political Sphere

The information deficit model did not only concern so-called lay citizens, but also Members of Parliament (MPs). The aim to timely inform MPs about the developments in science and technology and their potential societal aspects forms the rationale of the classical approach to parliamentary technology assessment (TA), and this has led to the establishment of parliamentary TA organisations in various countries (cf. Van Est & Brom 2012). In the 1960s in America, a TA movement began that aimed to subject technological development to democratic scrutiny. In 1972, this idea led to setting up the Office of Technology Assessment (OTA). In the UK, the Parliamentary Office of Science and Technology (POST) was established in 1989 to serve both Houses of Parliament. Parliamentary TA is built on the promise that the timely indication of probable beneficial and adverse impacts of technology will enable decision-makers to steer and regulate technological change in an anticipatory fashion.

Even in countries where parliamentary TA is institutionalised, the involvement of MPs in social issues around technology cannot be taken for granted. Maybe the French OPECST (Office Parlementaire d'Evaluation des Choix Scientifiques et Technologiques) is the one exception to this rule, because the French MPs themselves do the assessments, supported by the staff of OPECST. Classical parliamentary TA works with an information-based model of politics, which assumes that MPs can deal with most political questions as long as they are adequately informed. This assumption has been proven to be problematic in practice (Decker & Ladikas 2004). To improve the impact a participatory model of communication was developed, in which issue framing and identification of information needs results from interaction between, in this case, TA practitioners and MPs. For example, the Danish Board of Technology developed a Future Panel method to involve MPs in thinking about the future. The Rathenau Instituut, the Dutch parliamentary TA organisation, organised various hearings

and expert workshops in cooperation with the First and Second Chamber of the Dutch Parliament.

The Science and Technology Sphere

Stimulating research on the ethical, legal and social implications of technology – so-called ELSI-research – also fits the public understanding of (social aspects of) S&T approach. ELSI-research is designed to identify, at an early stage, the impact of science and technology and thus avoid future social, environmental, and health problems. It is also intended to stimulate the development of socially desirable solutions, for example, embedded in the design of the technology itself or in regulatory practices. The first ELSI-research programme was established in the United States in 1990 as part of the Human Genome project. Concern with the impact of new gene technologies led the United States to set up the ELSI programme of the Human Genome project, as "a new approach to scientific research by identifying, analysing and addressing the ethical, legal and social implications of human genetics research at the same time that the basic science is being studied. In this way, problem areas [would] be identified and solutions developed before scientific information is integrated into health care practice" (National Human Genome Research Institute 2008). ELSI-research was guided by faith in upstream reflections, organised in close contact with the R&D process, as a way to identify and avoid problems, and signal and stimulate the development of desired solutions (Van Est 2011b).

Ten years later, so-called *real-time technology assessment* was promoted and publicly funded in the United States. With respect to nanotechnology, real-time TA was positioned as "the necessary and logical next step to ELSI", which had been criticised for not been well-integrated into either the science policy process or the R&D process (Guston & Sarewitz 2002: 94). Real-time TA aimed at "integrating social science and policy research with natural sciences and engineering research from the outset", and as such providing "a mechanism for observing, critiquing, and influencing social values as they become embedded in innovations" (Guston & Sarewitz 2002: 94). Real-time TA was inspired by the Dutch tradition of constructive TA, which aims "to broaden the design of new technologies" through the "[f]eedback of TA activities into the actual construction of technology" (Schot & Rip 1997: 25). Constructive TA is guided by the political idea that social impacts of technology should not be anticipated and accommodated from *outside* the innovation process, but rather *within* science and technology development itself (Schot & Rip 1997).

Bringing a Public Perspective into the Development of Nanotechnology in the Netherlands

In this section we discuss how activities and debates with regard to nanotechnology have been unfolding in the Netherlands. Our description draws to an extent on personal knowledge of the authors, who have been closely involved in discussions about (the governance of) nanotechnology in the Netherlands as TA practitioners working for the Rathenau Instituut (cf. Hanssen et al. 2008; Van Est & Van Keulen 2004; Van Est & Walhout 2010). Here our objective is to reflect on the various initiatives in the societal, political, and S&T spheres from the perspective of informing versus engaging as discerned in the previous section. Instead of discussing a single public engagement event such as the societal dialogue on nanotechnology in the Netherlands, we have taken a long-term and comprehensive perspective to describe a whole ensemble of activities that were organised over the last decade in the Netherlands to integrate a public perspective into the development of nanoscience and technology. This approach enables us to identify which

types of activities have (not) been organised, the relationship between informing and engaging, the interaction between engagement processes within different social spheres, and to take a look at how organisational and institutional inertia in the governance of S&T was overcome.

Agenda-Setting and Policy Development

In the Netherlands, nanotechnology was established as a distinct field of scientific research in the early years of the 21st century. A foresight study (Ten Wolde 1998) conducted by the Dutch Study Centre for Technology Trends (STT) between 1996 and 1998 laid the foundation of a national research agenda. The study showed the importance of nanotechnology for electronics, materials, molecular engineering and instrumentation, and also recommended to pay due attention to nano-safety issues and set up research in that area. The STT informally approached the environmental organisation Natuur & Milieu (Nature & Environment) and the Rathenau Instituut, so as to organise a debate on the societal aspects of nanotechnology. However, both organisations didn't see sufficient opportunity and priority to do so at that time.

This changed in 2003. The Canadian Action Group ETC (Action Group on Erosion, Technology and Concentration) had picked up on concerns about nanotechnology in the US and called for a moratorium in the publication "The Big Down" (ETC 2003). This report and the response of the UK's Prince Charles received worldwide attention. In the European Parliament, the Greens organised a debate for which the ETC group was invited. In the UK, the Royal Society and Royal Academy of Engineering (RS-RAE) set up a Working Party, which in 2004 published their famous report (RS-RAE 2004). To the Rathenau Instituut this signalled that nanotechnology had reached the European political agenda. A political entry point for the institute was the advice to the Dutch government (Koeman et al. 2004) being prepared by an expert committee of the KNAW, the Dutch Royal Academy of Sciences. The Rathenau Instituut wanted to broaden the discussion both in terms of content as well as actors, and published an initial agenda for a public discussion about nanotechnology (Van Est, Malsch & Rip 2004).

The report by the Rathenau Instituut put forward the notion that nanotechnology developments should be understood in the broader context of NBIC-convergence (the convergence of nanotechnology, biotechnology, information technology and cognitive science). However, the institute acknowledged that nanotechnology would be the term to which policy makers, politicians and the public could meaningfully relate. The institute organised a first workshop in February 2004 on the issue of nano-safety. This meeting brought together policymakers responsible for physical safety affairs, CSOs and representatives of the Dutch nano-field for the first time. Over the course of 2004 a series of workshops followed, each focusing on the societal issues related to different application areas. The debate about nanotechnology was brought to the attention of MPs at the end of 2004 through the organisation of a large public meeting together with the parliamentary Theme Commission on Technology Policy.

Meanwhile the nano-scientific community had acquired funding. A large national research programme, NanoNed, was set up which ran from 2005 till 2010, with an overall budget of 235 million euro. The research agenda of NanoNed contained a Technology Assessment programme (see subsection: *Enhancing Reflexivity in Nanotechnology Research*). Despite the STT's advice, risk research was not taken up. At the same time international discussions about nano-safety increased, especially after a report by Swiss Re (2004) linked the scientific uncertainty about human and environmental risks to legal and economic reality. Dutch MPs asked the government how it would follow up on the KNAW advice. The government initially

answered that several explorative studies (De Jong, Roszek & Geertsma 2005; The Health Council of the Netherlands (Gezondheidsraad) 2006; Roszek, de Jong & Geertsma 2005) had been commissioned by several ministries, on the basis of which, if necessary, policy could be formulated. However, several MPs compelled the government to come up with a comprehensive policy for nanotechnology (Parliamentary Documents 2005).

At the end of 2005, the government announced it would prepare a green paper. The Cabinet View on nanotechnologies (Rijksoverheid 2006) was strongly inspired by an elaborate advice from the Dutch Health Council (Gezondheidsraad 2006). This green paper set the scene for establishing a national strategic research agenda (SRA), which included societally relevant fields such as water and energy, developing a risk governance policy, identifying and monitoring social and ethical issues, and involving stakeholders as well as organising a public dialogue. The Cabinet View had been prepared by an interdepartmental working group ION (Interdepartementaal Overleg Nanotechnologie), which had been set up to coordinate activities across the various departments and to position the Netherlands in international contexts.

ION is the institutional result of the agenda-setting activities from the years before. Writing the Cabinet View required integrating the different strands of public policy as well as distributing responsibilities across ministries. For example, the Ministry of Environmental Affairs got the lead in risk governance (see subsection: *Dealing with Risks*), while the Ministry of Economic Affairs became responsible for organising a societal dialogue (see subsection: *Societal Dialogue on Nanotechnology*). More importantly, these agenda-setting activities influenced the position of the government with regard to nanotechnology as such. In 2003, nanotechnology was not visible at all in the public and policy domain. Over the years, engagement in the political domain developed around a number of reports. These reports both resulted from and further drove the policy agenda-setting process because the governmental demand for these reports mobilised organisations like the Health Council, and the (policy) recommendations within these reports often contained policy advice that guided further governmental action.

Enhancing Reflexivity in Nanotechnology Research

In the early 2000s, the three main nanotechnology centres in the Netherlands created the national research consortium NanoNed. Under the leadership of its chairman David Reinhoudt, NanoNed decided to include a Technology Assessment research programme already in 2002 (Rip 2009). This choice reflected the international trend of integrating ELSA-research into large research programmes, like the US National Nanotechnology Initiative (US NNI). TA NanoNed was guided by the approach of constructive TA, and led by Arie Rip, one of the founding fathers of this TA approach. In a certain division of labour with the Rathenau Instituut that addressed the political domain, TA NanoNed aimed to bring a broad public perspective into the development of nanotechnology by closely interacting with ongoing R&D activities.

In the activities of TA, NanoNed pursuing the overall objective of 'Bridging the gap between innovation and ELSA', an intricate relation between informing and engaging, can be identified as well. Engaging scientists in constructive TA activities required developing sophisticated socio-technical scenarios that could convincingly speak to the scientific practice in NanoNed (Te Kulve & Rip 2011). These scenarios were used in strategy articulation workshops, stimulating participants to broaden the scope of design choices. By 2011, a follow-up TA programme was included in the research programme NanoNextNL, which succeeded NanoNed (Rip 2010). In both programmes, TA was implemented as research programmes

conducted by PhD-students. Attempts for establishing Centres for Nanotechnology and Society like in the US NNI have not been made.

Dealing with Risks

By the time the Cabinet View was published in 2006, it had become increasingly clear that adjusting the regulatory framework for assessing the safety of nanomaterials would at least take a decade. It was commonly thought that the research needed for adjusting safety assessment as well as regulatory change itself preferably had to be coordinated at the European and international level. Accordingly, Dutch government officials and advisory bodies took part in international working parties and scientific committees (expert coordination). However, as long as safety assessment and regulation had not been settled on the international level, a national strategy was required to address issues of precaution in occupational health and product safety (involving stakeholders). The Health Council called for a risk governance scheme as developed by the International Risk Governance Council (Renn 2005). According to the Cabinet View, a recently adopted national strategy for managing physical risks (Parliamentary Documents 2006) already provided an appropriate risk governance scheme. In this subsection we discuss how engagement with safety issues developed.

Following up on the Cabinet View, the government prepared an Action Plan on Nanotechnologies (Rijksoverheid 2008), which further specified policy instruments and allocated budgets. Prior to the Action Plan, first oversight initiatives were set up by the Dutch Food and Consumer Product Safety Authority (VWA), which prepared a first overview of possible nanoproducts already on the market (VWA 2007). The Confederation of Netherlands Industry and Employers (VNO-NCW) was asked to provide an overview of nanotechnology manufacturers.

In preparing the Action Plan, another important policy design question concerned the organisation of both stakeholder engagement and public dialogue. To address this issue, the Rathenau Instituut interviewed Dutch CSOs and involved them in a round table meeting (Van Est & Walhout 2007). The CSOs argued that participatory activities should not delay governmental action on nanosafety issues. While the Rathenau Instituut was writing up these and other findings (Hanssen et al. 2008) it had close contacts with the ION working group, and in particular with the civil servants responsible for the societal dialogue. In the Action Plan it was decided to address nanosafety in a stakeholder platform, while other questions, like ethical issues, would be addressed in a public dialogue (discussed in subsection: *Societal Dialogue on Nanotechnology*).

The Ministry of Environmental Affairs set up a stakeholder platform (the 'Klankbordgroep Risico's Nanomaterialen') according to a well-known format: representatives of the government, industry, regulatory bodies and CSOs meet three or four times a year and inform each other about their activities. In this way, the government can test first reactions to its policy development, while others gain insight in national and international developments, for example European Commission initiatives. Paradoxically, the ultimate objective of the stakeholder platform – devising joint positions that can be put forward in international settings e government that any lack of government initiative in addressing versight and regulation to be settled at the European level.

Occupational health, however, was seen as a more urgent issue. As a direct follow-up of the Cabinet View, the Ministry of Social Affairs and Employment asked the Social Economic Council (Sociaal Economische Raad, SER) for advice on this matter. In the SER, employer organisations and labour unions come up with joint advice to the government. The SER-

committee presented its advice in early 2009, specifically addressing the question of how precaution should be understood and proposing oversight measures, guidance to best practices and preliminary exposure limits (SER 2009). In its response, the government indicated that the proposed measures were either to be arranged at the European level (oversight) or not feasible (scientific underpinning of exposure limits). MPs, however, wished not to be held back by the time-consuming European process and forced the government to come up with oversight measures and preliminary exposure limits. Moreover, parliament requested that fifteen per cent of the budget spent on the strategic research agenda for nanotechnology would be allocated to risk research (Parliamentary Documents 2009a). During the funding negotiations for NanoNextNL, the succeeding research programme of NanoNed in 2010, the envisioned national risk research was threatened to be removed from the national research agenda. Backed up by the request of parliament, several ministries prevented this from happening.

In summary, the organisation of stakeholder engagement with safety issues was far from being straightforward. Both policy development and stakeholder engagement in the stakeholder platform were, to a great extent, constrained by the dynamics of the overarching European regulatory framework. When the same threat occurred to the outcome of the SER-committee on occupational safety, the Dutch parliament stood up and changed directions and preliminary exposure limits on the work floor were established in 2011. In contrast, governmental initiatives for information exchange and sharing best practices at the national level (a national knowledge centre, pilot projects in different sectors) were arranged rather smoothly.

Anticipating Social, Ethical and Legal and Social Issues in the Context of NBIC-Convergence

Social change and ethical issues constitute another cluster of challenges for the governance of nanotechnology. In the subsection *Enhancing Reflexivity in Nanotechnology Research*, we briefly described TA NanoNed, which addressed these issues within the S&T domain. For policy development, two cross-cutting design questions on process and content were at stake. The Health Council had called for a 'broad committee' for monitoring nanotechnology developments and identifying ethical issues. Such a committee was announced in the Cabinet View. Ethical issues identified by the committee could feed into the public dialogue, but which issues to be discussed depended on the range of issues and time-span to be covered. In the international debate, a number of ethical issues were associated with the broader phenomenon (and/or agenda) of NBIC-convergence: the synergistic combination of nanotechnology, biotechnology, information technology, and cognitive sciences and technologies. For example, human enhancement has been a recurring theme in discussions about nanotechnology. Although such an issue clearly should be part of monitoring activities and ethical reflection, it is less obvious how it specifically relates to nanotechnology and how its sometimes speculative features should be part of public dialogue.

Policymakers from the ION working group on ethical and legal issues were addressing these questions. At the same time, the Rathenau Instituut had further explored NBIC related developments in ambient intelligence, persuasive technology, synthetic biology and neurosciences. The institute actively sought to link issues in these areas to policymakers involved in strategy building with regard to new technologies. This resulted in close contacts with the ION working group and a number of expert meetings on neurosciences and legal issues, human enhancement, and robotics (resp. Rathenau Instituut 2007, 2009, 2011) together with the Ministries of Justice and of the Interior and Kingdom Relations. These ministries also commissioned a survey on the impact of converging technologies on future

security applications (Teeuw & Vedder 2007). Converging technologies were further discussed as part of the parliamentary trend analysis on biotechnology by the regulatory advisory committee on genetic modification (The Netherlands Commission on Genetic Modification (COGEM) 2010) and as part of the strategic knowledge agenda of the national government (Strategieberaad Rijksbreed 2010). All these activities were shaping knowledge agendas for policy, but at a rather explorative level.

In contrast, discussions about synthetic biology, a prime example of converging technologies, did reach the parliament and did result in institutional take-up. In 2005 and 2006, the COGEM and Rathenau Instituut explored the emerging field of synthetic biology (COGEM 2006; De Vriend 2006). The parliamentary debate that followed the publications of the Rathenau Instituut resulted in studies by the Royal Academy of Sciences (KNAW), the Health Council (Gezondheidsraad 2008) and COGEM (2008). COGEM and the Rathenau Instituut have formally taken up responsibility to monitor the (international) developments and debate in synthetic biology.

The Rathenau Instituut took the kick-off meeting of the societal dialogue (see the next subsection) as an opportunity to launch a book (Swierstra et al. 2009) that linked the explorations on NBIC-convergence back to the debate on nanotechnology. In response, an MP posed the question whether a societal dialogue on converging technologies was needed. According to the Minister of Economic Affairs (in charge of the societal dialogue) a debate on nanotechnology was sufficient at that moment in time, since it would allow for discussion on concrete applications (Parliamentary Documents 2009b). A similar position was taken by the committee that organised the societal dialogue.

Societal Dialogue on Nanotechnology

The National Societal Dialogue (Maatschappelijke Dialoog Nanotechnologie), which started in 2009 and was closed early 2011, was the main initiative for informing and engaging actors in the societal sphere. In March 2009, the 'Commission Societal Dialogue Nanotechnology' (CSDN) was created and assigned the task of implementing "a broad discussion in which viewpoints and opinions could be expressed by all kind of stakeholders and publics" (Rijksoverheid 2009). The CSDN, which covered a broad range of expertise and affinity for different groups in society, created a three-step process of providing information, raising awareness and facilitating bottom-up dialogue activities. This approach was thought to be necessary because at the start almost half of the Dutch people (46%) indicated they had never heard about nanotechnology (CSDN 2010). The CSDN had a budget of 4.5 million euros and selected 35 projects after an open call for proposals. Experts of scientific institutes, CSO employees and media professionals were responsible for these projects, and they used a broad spectrum of media and (internet) tools to engage a variety of audiences. The CSDN secretariat featured the web portal Nanopodium, which disclosed descriptions of the various projects and meetings of the CSDN, and offered information and opinions about nanotechnology.

CSO participation in organising activities within the societal dialogue was modest: only eight out of 35 projects. The necessary expertise for running ad hoc projects on a short term and in a professional manner was not always at hand within (smaller) CSOs. They also lacked the ability to monitor nanotechnology developments adequately (Hanssen et al. 2011). Still, the Dutch societal dialogue showed that available project funding has been a key condition to mobilise and integrate different perspectives into the dialogue project portfolio by involving small CSOs. For example, the broader context of NBIC-convergence was the subject of two smaller projects organised by a religious think tank, which has a network in medical ethical

reflection. Similarly, the perspective of peace and international development was included in a series of sub-projects.

The CSDN evaluated the results of the societal dialogue and presented an Agenda for Nanotechnology to the Dutch government as input for policymaking (CSDN 2011). Notwithstanding the intended focus on societal and ethical questions, risk issues concerning (personal) health and the environment got most attention. The CSDN concluded that public perceptions of the innovation potential of nanotechnology were primarily positive, provided there is an adequate system for risk research, assigning permits and nano-oversight. In the various projects, participants made clear that information on nanotechnology is crucial to them and demonstrating an operating framework for nano-risk governance would increase the public acceptance of nano-applications. The dialogue increased public awareness of nanotechnology; at the end of the dialogue only 36% of Dutch people indicated they had never heard of nanotechnology (CSDN 2011).

An interesting question is to what extent the societal dialogue resulted in what was intended. In the Cabinet View of 2006, the government announced to “enter into dialogue”. Two years later, this was changed in the Action Plan to a dialogue in which the government would hold an independent position. The CSDN formulated its recommendations mainly in terms of how to organise further dialogue. In its response, the government emphasised a need for open information and knowledge exchange. Responsibility for further dialogue and engagement was, however, left to initiatives of knowledge institutes, companies and CSOs. According to the government, public opinions with regard to dealing with risks confirmed the actual policy. Regulatory issues and challenges would be addressed by the actions and instruments as set out by the Action Plan of 2008, although the government as well observed that progress in a number of these issues (like settling a definition for nanomaterials or setting up oversight schemes) depended on the European regulatory process. Ethical and social issues in the context of NBIC convergence were considered insufficiently bound to specific products or scientific developments. Hence the government did not see reason to start engagement activities for these issues (Parliamentary Documents 2011).

Discussion and Conclusion

Our case description shows how each of the six different types of activities identified in the second section can be found in the case of nanotechnology in the Netherlands (see Table 2). TA NanoNed and later TA NanoNextNL were set up to inform and engage the S&T sphere. Many organisations were involved in informing the political sphere and various activities were set up to engage policy makers and MPs in the political debate on nanotechnology. Bringing a public perspective into nanotechnology in the Netherlands thus meant more than organising the Societal Dialogue on Nanotechnology, which, by the way, only started in 2009. In 2003, the societal debate on nanotechnology was just about nonexistent in the Netherlands. The debate had to be built up from the bottom (Van Est & Van Keulen 2004). However, the (upstream) engagement of citizens, but also nano-scientists, civic society organisations, policy makers and politicians, is not self-evident. The governance challenge is not only to integrate a public perspective by stimulating public debate on nanotechnology, but also by stimulating actors from the S&T and political sphere to become involved in the societal debate on nanotechnology.

Informing and Engaging are Intertwined

While the public engagement model seems to favour engaging over informing in the societal sphere (see the second section), our case study shows that both informing as well as

engaging activities play important, complementary roles. Already in the mid1980s, "Dutch policy makers saw the public understanding of science model and the public engagement in technology model as complementary" (Van Est 2011a: 643). Information and engagement activities *always* go hand in hand. Asking for information or advice is not neutral, but deeply political, as it forces both the organisation that asks for information and the organisation that is asked for information to define their political positions in the public sphere. For example, the government commissioning the Health Council to come up with an advice on nanotechnology was an important political event. In this case, the demand for information forces the Health Council to become involved and define its institutional position with respect to nanotechnology.

Table 2: Overview of the types of activities that were organised over the last decade in the Netherlands to bring a public perspective into the development of nanotechnology

	Societal sphere	**S&T sphere**	**Political sphere**
Informing	• Rathenau study (Van Est et al. 2004) • Societal Dialogue Nanotechnology (2009-2010)	• Foresight study STT (1998) • TA NanoNed (2005-2010) • TA NanoNextNL (2011)	• Rathenau study on nanotechnology (Van Est et al. 2004) • Expert Committee Royal • Gezondheidsraad (2006) • Cabinet View on Nanotechnologies (Rijksoverheid 2006) • Dutch Food and Consumer Product Safety Authority (VWA 2007) • Action Plan on Nanotechnologies (Rijksoverheid 2008) • Rathenau study on nanodialogue (Hanssen et al. 2008) • Advice by Social Economic Council (SER 2009) • Agenda for Nanotechnology by Commission Societal Dialogue Nanotechnology (CSDN 2011)
Engaging	• Rathenau workshop on nanotoxicity (2004) • Series of Rathenau workshops (2004) • Stakeholder platform Sound Board Group Risks Nanomaterials • Rathenau workshop with CSOs (Hanssen et al. 2008) • Societal Dialogue Nanotechnology: CSO participation in 8 out of 35 projects (2009-2010)	• TA NanoNed (2005-2010) • TA NanoNextNL (2011)	• Rathenau workshop on nanotoxicity (2004) • Series of Rathenau workshops (2004) • Public meeting "Small technology – Big consequences" organised by Rathenau & parliamentary Theme Commission (2004) • Parliamentary debates (2004-2011) • Stakeholder platform Sound Board Group Risks Nanomaterials • Parliamentary round table hearing organised together with the Rathenau Instituut (Parliamentary Documents 2009a). • Social Economic Council (SER 2009)

Moreover, by formally asking for advice from the Health Council, the government obliges itself to react on that advice and, consequently, define its own position and communicate it to society. In turn, this is the starting signal for another round of engagement. The action-reaction law not only counts for physics, but also for politics.

Timely informative studies may drive the political agenda-setting process by legitimising political action and setting up particular engagement processes. The availability of information is not self-evident, but often needs to be generated by study. But money is required to do these studies. So an important part of the initial agenda-setting process is to politically allocate public money to generate information. Engagement processes may also generate valuable information, and can sometimes from a scholarly point of view be seen as qualitative types of research. Extracting information from engagement processes and communicating them, and integrating them into the societal or political debate on nanotechnology, requires a huge effort. An important lesson to be drawn from our case study is that engagement processes require custom-made information, as the dynamics in the various spheres differ. To engage nano-scientists, TA NanoNed required developing sophisticated sociotechnical scenarios that could convincingly speak to the scientific community. The same counts for the engagement of MPs, policy makers and citizens. One big added value of the Societal Dialogue was that it created a momentum and a budget to develop information on the societal aspects of nanotechnology that was accessible to the general public.

Weak Connections between Different Social Spheres

Parliamentary TA activities aimed at influencing the political decision-making process are sometimes criticised for working in isolation from society and science (Sarewitz 2005). In turn, public engagement activities aimed at the societal and S&T sphere are regularly criticised for being isolated from the political decision making process (cf. Hanssen 2009; Hennen 2002; Van Est 2011b). These comments suggest that activities aimed at informing or engaging one social sphere should also connect to or impact another sphere. Lyall, Papaioannou and Smith (2009) even warn for the "'soft' wrapping of governance without the underpinning of 'hard' government'" (pp. 270). In other words, they caution that activities organised to engage the societal or S&T sphere should not be at the expense of activities in the political sphere. These scholarly comments bring up two questions: (1) to what extent were the various engagement spheres connected to each other? And (2) to what extent were activities aimed at engaging the societal and S&T sphere at the expense of activities in the political sphere?

In the case of nanotechnology in the Netherlands, the three spheres of engagement are only weakly connected. On the one hand, the political sphere impacts the societal and S&T spheres, by deciding upon the national strategic research agenda and the organisation of a Societal Dialogue. Moreover, MPs and nano-scientists were involved in the Societal Dialogue on a personal basis. But on the other hand, the Societal Dialogue had little impact on the policy making process and the R&D agenda, and activities within TA NanoNed had little influence on either the public or political debate. Guston and Sarewitz (2002) criticised ELSI-research and claimed that real-time TA would be able to integrate its results into both the political and S&T sphere (see subsection: *The Science and Technology Sphere*). Interestingly, the Dutch TA NanoNed has never claimed an ambition to influence the political sphere. Something similar can be said about the Societal Dialogue. The task of the Commission Societal Dialogue Nanotechnology (CSDN) was to 'implement a broad societal discussion' and not so much to influence the political sphere. The Dutch case shows an institutional division of labour between activities aimed at bringing a broader public

perspective into the various social spheres. TA NanoNed focused on the S&T sphere, the CSDN (between 2009 and 2011) focused on the societal sphere, and the ION, Rathenau Instituut, Health Council and other organisations focused on the political sphere.

However, with respect to the second question, activities aimed at engaging the societal or S&T sphere were not at the expense of activities aimed at the political sphere. Dutch CSOs argued that the Societal Dialogue should not delay governmental action on nano-safety issues, and the Rathenau Instituut put forward that argument in the debate on how to politically position and organise the Societal Dialogue. In *Ten Lessons for a Nanodialogue* (Hanssen et al. 2008) the Rathenau Instituut advised the government that any lack of government initiative in addressing the risk issue would only undermine the legitimacy of the broader societal debate about nanotechnology. Moreover, the government was advised to differentiate between the risk issue and the broader societal debate about nanotechnology, and to adopt different roles and different types of dialogue for these distinct issues. The advice to distinguish between and, thereby, disconnect different spheres of engagement, fed into the Action Plan on Nanotechnology, partially due to close interaction between the Rathenau Instituut and ION.

Overcoming Organisational and Institutional Constraints

Timing has always played a central role in the discourse on the governance of S&T. Activities need to be *timely* organised in order to be effective in bringing a public perspective into the development of S&T. Over the last decade, the need for timely information and engagement processes has been expressed most clearly and boldly by the word 'upstream'. Our comprehensive longitudinal case study clarifies that 'upstream' information and engagement processes are not self-evident. On the organisational level these activities require capacity, awareness, willingness to get involved (organisational agenda-setting), expertise and money. When new issues come up there is often a lack of awareness and information. In addition, most organisations have an existing agenda, which is already loaded, and they will therefore often choose to wait and see which way the wind will blow. In the TA NanoNed programme, such a situation in S&T development was characterised as *waiting games* (Te Kulve 2010), which may cause severe institutional inertia and even deadlock.

To overcome such an institutional deadlock there is a need for organisations that take the lead, for example by putting the cat among the pigeons, like the ETC Group did by publishing *The Big Down* (ETC Group 2003) and others that follow up on those activities (like The Greens which organised a conference on nanotechnology in the European Parliament). In the Netherlands, the research community took the lead in setting up a TA programme as part of NanoNed. TA NanoNed, however, primarily assumed responsibility for bringing a public perspective into the R&D process, and not in the societal or political sphere. With respect to the political and societal spheres, the Rathenau Instituut has played an important pro-active mediating role. This organisation has the institutional task to stimulate the public and political debate, and has the budget, organisational culture, capacity and independence to play such a role. The Dutch parliament, too, played a decisive role in counteracting several waiting games, for example, by pushing the government to come up with an integral policy plan on nanotechnology, and to develop preliminary exposure limits on the work floor.

For organisations such as the National Institute for Public Health and the Environment (RIVM) it is much harder to set the agenda, since their work programme first needs governmental approval. Still, the involvement of organisations such as RIVM, VWA and Health Council is crucial for further institutionalisation of the debate on nanotechnology. Besides organisations that can act as first movers and institutions that can exercise political power, such as parliament, many expert organisations are needed to generate information,

which can legitimise further action. In the Netherlands, the work of organisations like the Health Council and RIVM has been crucial in developing an agenda and legitimising further steps.

Conclusion : The Need for a New Research Perspective

This paper studied the ensemble of activities that were organised to bring and integrate public perspectives into the development of nanotechnology in the Netherlands over a long period of time. Our study suggests that in order to better understand the complexities of the governance of S&T, a new research perspective is needed. By reflecting on (1) the relationship between informing and engaging, (2) the interaction between engagement processes within the societal, S&T and political sphere, and (3) the organisational and institutional constraints, we presented the outline of such a new research perspective. As well, we identified three key themes for comparative research in the governance of S&T within different countries.

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