

Practicing Responsible Innovation in NanoNextNL

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Abstract. Responsible Innovation (RI) is articulated as an integrative concept for a collective ambition: anticipating and addressing societal aspects in research and innovation. The emerging discourse on RI, however, also marks a challenge beyond ‘integration’ in single projects, which is the ‘mainstreaming’ of concrete approaches across large research programs. Arguably, this will bring particular governance conditions to the fore that have to be addressed when pursuing the mainstreaming of RI as an integrative activity. In this chapter we report from an exploratory analysis of the integration and underlying conditions of Risk Analysis and Technology Assessment (RATA) in NanoNextNL, a large Dutch research and innovation program. In our findings we highlight the learning processes that occurred along the process of implementing this encompassing ambition in practice. We argue that such learning processes are inherent to attempts for mainstreaming RI at (research) program level, and suggest that governance strategies and arrangements should be set up in a way to facilitate learning—about what has to be integrated, as well as how to organize this effectively.

Keywords. Responsible Innovation, governance, integration, learning.

Introduction

‘Every researcher in this field has to consider the consequences’. With this statement Dave Blank (2011), chairman of the executive board of NanoNextNL, marked the ambition set for the large public-private research consortium that had just begun its work. The statement as well as what happened afterwards reflect a transition in science systems towards, at least rhetorically, demonstrating societal relevance and responsiveness to societal concerns. Considering the place and impact of science and technology in society is becoming mainstream, also for science and technology promoters. Perhaps more importantly, the statement also reflects ideas that science and technology promoters (have to) take responsibility themselves. In the same interview, Blank (2011) states that outsourcing the consideration of societal aspects to a couple of experts would be nonsensical.

In this chapter we discuss the ambition set for NanoNextNL as exemplary for the current calls for Responsible (Research and) Innovation. The notion of Responsible Innovation (RI) pulls together various normative orientations for the outcomes, processes and directions of research and innovation. These can range from anticipating

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risks, addressing societal challenges, involving publics and taking care of moral concerns, to fostering gender equality and global equity or ensuring open access. But whether RI definitions pull all these orientations together in terms of a responsive stance towards societal concerns (von Schomberg, 2013), care for the future (Stilgoe et al., 2013) or inclusive and collaborative processes (Rome Declaration, 2014), they all position RI as a forward looking and collectively exercised virtue.

For this chapter we are, however, not so much interested in definitions of RI as such, but rather in the challenges faced when trying to put such ideas into practice. According to Rip (2014), the emergence of the RI discourse, both reflects and contributes to shifts in the ‘division of moral labour’ between those who feel responsible for ‘promotion’ of scientific and technological developments (typically scientists, corporate actors, also governments and intermediaries such as research councils) and those who exercise ‘control’ (typically regulators, civil society organizations, customers). But these shifts will not go without struggle. While some social scientists and policy makers think of RI not only as an integrative approach, but also as a characteristic (which should become) mainstream in the governance of research and innovation, it is far from self-evident that the new responsibility conceptions voiced under the banner of RI are equally understood and institutionalized. Therefore, we approach RI initiatives as adding to the list of ‘experiments’ in the governance of research and innovation (Stilgoe, 2012), exemplifying the tentativeness of many current governance approaches to new and emerging sciences and technologies (Kuhlmann et al., forthcoming).

One strand of experiments has been the practicing of ideas about participation and deliberation by public and stakeholder dialogues and consultations. These ideas have become fairly mainstream, no matter the differences in the quality of activities and ongoing discussions about their legitimacy and effectiveness. Another strand consists of the various methods and approaches to modulate research and development (R&D) practices (such as Constructive Technology Assessment (CTA), laboratory engagement, Value Sensitive Design—see Fisher (2015) for a discussion on ‘socio-technical integration approaches’). These mainly have been local experiments. Our case—NanoNextNL—reflects a combination of two other strands: professional formation of (early career) researchers and the inclusion of parallel research activities in large, publicly funded research programs, which have to identify (at least) and address (if envisioned) societal aspects at stake for the kind of research and innovation these programs are contributing to.

One of the main critiques to ‘parallel research’, most notably with regard to the Ethical, Legal and Social Aspects (ELSA) research in the Human Genome Project, has been that it functions as an add-on, lacking impact on the research itself or on political decision making. In our case however, the integration of Risk Analysis and Technology Assessment (RATA) in a national research and innovation program, did start from integrative aims, connecting to notions of Responsible Development and Risk Governance. In NanoNextNL, RATA has not only been defined as a research program with substantial budget (~18%) allocated to it, but also as an integrated (professional activity for all PhD researchers) and integrating (through inter program collaborations) activity. This renders RATA NanoNextNL as an attempt to mainstream ideas of RI on a scale that is quite uncommon. By mainstreaming of RI we refer to the ambition to turn considerations of safety and societal embedding into a concern for all projects in the program, respectively the program as a whole, rather than an approach limited to specific projects. Together with the high ambitions as set by the chairman of

NanoNextNL, we therefore consider the integration of RATA in NanoNextNL as a highly interesting ‘experiment’ (although most of the actors involved probably would frame it as ‘implementation’) to learn from, since high ambitions also raise the question under which conditions these can be realised.

In the next section we will first discuss what it is that we can learn and how. Section 2 discusses frame conditions for the integration of RATA in NanoNextNL. In section 3 we discuss the actual integration process. Section 4 closes with lessons that can be drawn from our case for the governance of RI.

1. Learning from *de facto* governance

Our case study and approach builds on the conceptual and empirical work developed in the research project Res-AGorA.² The aim of this project is to build a governance framework for RI. This is no straightforward task, since RI is still a fairly open concept, articulated in a diffuse policy discourse, which is likely to remain so for some time. An important starting point for the project, therefore, has been to learn from a range of existing cases, exhibiting situations in which actors have attempted to navigate research and innovation in ways they thought to be responsible (whether or not labeled as RI). What can be learned from these cases, from a governance perspective, is how actors, in their specific setting, interpret and construct responsibility claims in relation to the governance instruments applied. This can be conceived as learning from *de facto* governance: we analyze governance ‘as practiced’, in a *dynamic interplay* of ‘actors and factors’ rather than foregrounding *structural elements* of (formal) arrangements, mechanisms and instruments.³

Part of *de facto* governance are the histories and aggregative effects (Rip, 2010) on which actual governance dynamics build. The inclusion of RATA as a separate research theme in NanoNextNL is a case in point: including parallel research is a, by now, rather common approach to anticipating societal issues in research and innovation. However, as will turn out, ideas and ambitions for RATA also have been reinterpreted in light of new developments. For example, the statement of NanoNextNL’s chair, cited above, appeared in a Dutch newspaper on the occasion of the closing event of a series of national dialogue activities about nanotechnology. At that time NanoNextNL was about to kick-off and just had been required by the Dutch government to comply with the *European Code of Conduct for Responsible Nanosciences and Nanotechnologies Research* (hereafter referred to as the EU-CoC). This code, adopted by the European Commission as a recommendation to the member states in 2008 and stating principles on, for example, clarity of meaning, safety and sustainability, had been rather critically received. As we will show, against this background the program office of NanoNextNL decided to subsume the requirement to comply to the EU-CoC in the activities for the integration of RATA. It is exactly these kind of moves we want to understand and account for in our ‘learning for governance’.

² See <http://res-abora.eu>: the research heuristic on which we build is discussed in Walhout et al. (2014). The case study report on RATA in NanoNextNL can be downloaded from the Res-AGorA website.

³ In the Res-AGorA research heuristic governance is defined as ‘the dynamic interrelation of involved (mostly organized) actors within and between organisations, their resources, interests and power, fora for debate and arenas for negotiation between actors, rules of the game, and policy instruments applied helping to achieve legitimate agreements’ (Kuhlmann, 2001; Benz, 2006; Braun, 2006)

To this end, we will structure our investigation of governance dynamics and conditions in two steps. The starting conditions for the integration of RATA discussed in section 2 concern aspects of RATA as the governance arrangement under study (purpose, history and relation to other relevant governance mechanisms) and characteristics of the ‘actor landscape’: who are the actors involved, how do they frame the aim of integrating RATA and the problem it has to address, and from which position and power. Section 3 describes the actual integration process by focusing on places and spaces of interaction and negotiation, dominant problem framings and the construction of responsibilities.

Being researchers in the RATA research theme ourselves, we draw on our roles as ‘observing participants’ as well as on document analysis, interviews and feedback from key individuals, often figuring in the analysis below and documented in an internal case study report for the Res-AGorA project. Part of the observations also draw on interviews conducted by Colette Bos, a fellow PhD researcher in NanoNextNL, documented in a co-authored publication (Bos et al., 2014). Where our discussion primarily reflects statements or feedback obtained from conversations with actors other than formal interviews, we have indicated this in footnotes.

2. Frame conditions

2.1 Situating RATA in NanoNextNL

NanoNextNL is a Dutch national R&D program on micro and nanotechnology, involving 130 partners covering universities, research centers, multinationals, small and medium enterprises (SMEs) and medical centers, running from 2011 till 2016. The program is explicitly positioned as an innovation program, succeeding the earlier national program NanoNed, which was mainly research oriented. The funding scheme for NanoNextNL is administered by the Ministry of Economic Affairs, financed from national gas revenues and meant for strengthening the national knowledge infrastructure. The research grants provided by this scheme require 50% matching money from the participating partners in a public-private partnership and a substantial effort to create application potential, measured in key performance indicators for ‘valorization’.⁴

A core group of nano-scientists had already started with the design of the research program of NanoNextNL in 2005. At that time both promises and concerns about nanotechnology became part of the political discussion and the Dutch government pushed for including ‘risk research’ in the research agenda. This was framed as an essential part of the government’s policy on the responsible development of nanotechnology (Cabinet, 2006). While over time the nanotechnology program was increasingly positioned as an innovation program with a significant share of application oriented research, paying attention to risks was seen as essential for successful innovation by the nanoscience community as well, as presented in the Strategic Research Agenda (SRA) which sketched the main topics to be included in the NanoNextNL programme (Nederlands Nano Initiatief, 2008).

⁴ Valorisation is a policy term used by the Dutch government, following up on the European Lisbon strategy to improve the (economic) utilisation of scientific knowledge. Interpretations of this notion vary from ‘societal relevance’ to ‘commercialisation’.

Nonetheless, the risk research theme was threatened to be skipped from the research agenda when the SRA for nanotechnology had to merge with the micro-technology proposal to strengthen the economic potential of both, thereby increasing chances for funding. Drop-out of risk research was prevented by the political warrant of allocating at least 15% to risk analysis, as set in a parliamentary debate on nanotechnology (Parliamentary Papers, 2009). In addition, the Ministry of Agriculture demanded to include a Technology Assessment (TA) program as had been the case in NanoNed, but now serving the Ministry's wish to include research on consumer attitudes and acceptance. After a quick composition of the TA program, the RATA theme was back in the agenda again for granting the funding in 2010.

Just like the other themes in the research agenda, RATA has been organized as a collection of mainly PhD-research projects, structured and performed according to the academic and institutional setting in which each project is located. For RATA the projects have been organized in three programs, covering human health risks (assessment, detection, exposure, bio-availability and toxicity); environmental risks (methods and tools, fate, modelling, accumulation & ecotoxicity and integration) and the TA part (dynamics of nanotechnology developments and their societal embedding, society's response, governance and regulation, governance of responsible development and ethics).⁵ As in the other themes, these research topics reflect the specific expertise and interest of the participating knowledge institutes and university departments, as represented during the composition of the research agendas for RATA.

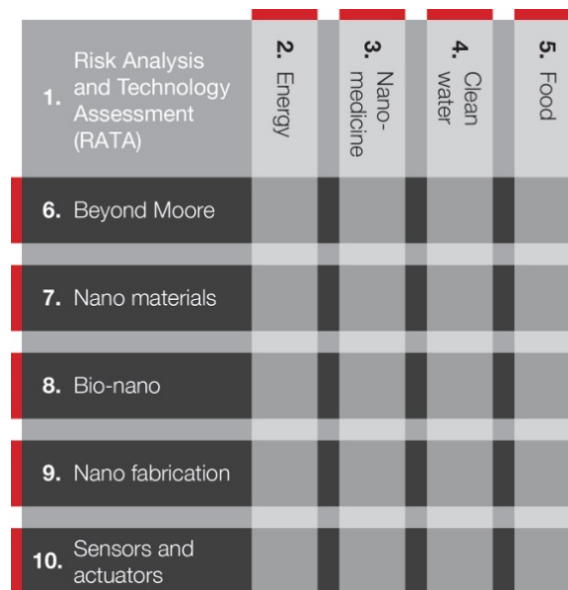


Figure 1. NanoNextNL research program.

However, as illustrated by Figure 1, as a special theme, RATA has been positioned as a cross-cutting theme, designed to interact with all other research themes. Moreover, in moving from the SRA of 2008 to the submitted research proposal in 2010, the

⁵ Available at: <http://www.nanonextnl.nl/themes/risk-analysis-and-technology-assessment.html>

committee preparing the proposal renumbered the research themes and deliberately placed RATA as number one. This particular move has occurred against the backdrop of increasing political and public attention towards nanotechnology. A number of leading Dutch nanoscientists, among those the chairman of NanoNextNL, participated in national dialogue events. In this context the listing of RATA as the first theme was meant to demonstrate the commitment of NanoNextNL to address risks and societal impact.⁶ In addition, the Dutch government included compliance to the EU-CoC as a funding requirement. Both the EU-CoC and the public dialogue had strengthened the awareness that considering the many uncertainties with regard to safety and societal impact, the responsibility born by the entire nanoscience community would have to go beyond the inclusion of a RATA research theme. This was translated in the final grant decision letter (Ministerie van Economische Zaken, 2011) as the requirement that every PhD thesis delivered by NanoNextNL should discuss potential risks.

2.2 The actors involved

NanoNextNL is managed by an Executive Board, supported by a program office and a business director. The program office is located at Stichting Technologie en Wetenschap (STW), a former funding agency of the Ministry of Economic Affairs and now part of the national research council, the Nederlandse organisatie voor Wetenschappelijk Onderzoek (NWO). STW has experience in coordinating public-private partnerships in research and had run the program office for NanoNextNL's predecessor NanoNed as well. Supervision and feedback is organized by a supervisory board, with members of the main partners, and an international advisory council, consisting of nanoscientists from public research labs as well as industry representatives. The Dutch national institute for public health and the environment, the RIVM, has been charged with a supervision role for RATA by the government.

The business director and executive board members have a natural science or engineering background. They have played an important role in establishing the research agenda and represent a number of key organisations in the NanoNextNL consortium. All executive board members can be expected to be aware of discussions in media, parliament and public dialogue activities. Moreover, the chairman, as well as the executive board member responsible for RATA (a food scientist), have been actively participating in these discussions. Overall, the executive board publicly acknowledged the importance of RATA, including its potential to boost credibility, and framed the position of RATA as instrumental to the commercial potential of the research in NanoNextNL.

The management of RATA consists of the RATA program officer, the RATA theme coordinator, a toxicologist employed by an institute with a central role in the regulatory science policy interface in the Netherlands, and the RA and TA program directors coordinating the research on human health and environmental risks (Risk Analysis) and societal embedding of nanotechnology (Technology Assessment).

The composition, implementation and integration of RATA in NanoNextNL has been mainly a program-internal affair. Next to RATA, NanoNextNL publicly has committed itself to continue dialogue with stakeholder groups and citizens (in following up on the government funded societal dialogue activities). The program

⁶ According to Dave Blank (chairman of NanoNextNL) at MicroNanoConference 2010.

office has been following up on this commitment by participating in the European FP7 projects EST-Frame, NanoDiode and a new European project, Seeing Nano. In addition, STW, which hosts the program office, is involved in a couple of annual communication and outreach activities. The obligation to have each PhD thesis pay attention to potential risks is actually controlled by the executive agency of the Ministry of Economic Affairs, the Netherlands Enterprise Agency (RVO), as the main actor to which the management of NanoNextNL has to demonstrate the progress of NanoNextNL.

While the RATA theme was designed to produce knowledge products in its own right, the main ‘target group’ of the integration ambition are the research projects in the other NanoNextNL research themes. These projects are mainly organized as PhD research projects, supervised by a principal investigator (PI) from a university or other knowledge institute, acting as the project leader, and a co-PI from industry, SME or start-up.

However, interviews with PhD researchers and PIs from the solar panel program (energy theme) and sensor program (sensors and actuators theme) show that in the second year of NanoNextNL there was still little to no awareness about the topics being covered in RATA, the requirement to comply with the EU-CoC or potential societal issues related to their research projects. When asked for, interviewees framed the idea of RI in terms of safety or considering consequences, however without a concrete idea how that could be organized in their own project (Bos et al., 2014).

2.3 Multiple faces of RATA at the beginning of NanoNextNL

The discussion of the frame conditions shows that ‘the’ integration of ‘RATA’ could not be expected to be a straightforward task. Already at the beginning of NanoNextNL, RATA had developed different faces, evolving from a separate *research theme* to an *integrated activity*, partially pushed by public and political debate, and resulting in an additional *obligation* to pay attention to potential risks in every (PhD) project. However, how these different, but connected ambitions had to be realized, did not become part of the consortium agreements. During the design of the consortium contract almost all of the negotiations had been concerned with intellectual property rights, while the RATA obligation and EU-CoC compliance requirement were not translated into binding and mutually agreed procedures.

3. *de facto* integration of RATA in NanoNextNL

In 2011, when NanoNextNL kicked off, the program office stated that NanoNextNL would live up to the EU-CoC compliance requirement by having:

- a. the RATA theme
- b. educational and supporting activities for the researchers in the other themes, and
- c. the required paragraph in each PhD thesis (Gielgens, 2011).

According to the program office, this would be a reasonable and legitimate approach, since all three elements would be implemented following a strategy that would fit the situation and needs of the individual researchers. The secretary leading the program office team framed the requirement to comply with the EU-CoC as:

‘You don’t want to prescribe things people already do (...) 95% of the researchers already comply with the code of conduct. (...) It is the same as with the law. One obeys the law, although one doesn’t know what is in the law books’.

In this view, inspiration from and interaction with RATA would be more effective than telling people what they already do (Bos et al., 2014). Consequently, the program office has been stimulating both lines of ‘inspiration and interaction’ through developing a two-day RATA course for the PhD researchers and by supporting networking activities of the RATA management at program meetings and other events of the other research themes in NanoNextNL. In this section we will discuss both lines of action as these developed until the midterm review of NanoNextNL by the end of 2013.

3.1 RATA course for PhD researchers

The RATA course is a two-day program with introductions to Risk Analysis and ways to anticipate the societal impact/embedding of new technologies (the TA part), as well as group discussions focusing on the identification of potential issues with regard to the research projects of the participants. The course was developed by the two instructors (a RA and a TA expert) during the first year of NanoNextNL (2011–2012). The main goal of the course has been to support PhD researchers with identifying a topic, which they can elaborate in the required part of their thesis or in a separate paper. However, while the course was being developed, this RATA obligation was renegotiated with RVO and lowered to the PhD students located in the programs deemed relevant for RATA, which concerned 56 out of about 180 PhD researchers. According to the RATA program officer, the reasons for this renegotiation were the little knowledge and awareness about RATA in NanoNextNL, which would have made a full coverage of the PhD population difficult to manage, since mandatory participation of the PhD researchers from the exempted research themes was assumed to require a different format.⁷ However, invitations were sent out to all PhD researchers. In the end, about 90 PhD researchers have attended the course, which has been organized in five shifts at a conference venue.

About half of the participants were following the course on invitation by the program office, the other half was ‘pro-actively subscribed’ by the program office. In approaching PhD researchers and their supervisors the program office repeatedly encountered reluctance or even resistance to participation. This attitude towards RATA was also regularly observed in the interviews by Bos et al. (2014), and reflects broader concerns about increasing demands to the scientific practice in general. In most cases it has been sufficient to remind the researchers and their supervisors that there was a formal RATA obligation.

To most of the participants the idea of RA made good sense, although for most of them it was far from easy to think about where to start with incorporating RA elements in the research project (if only the question whom to cooperate with). The significance of TA was less straightforward. The course instructors chose to position TA as starting from analyzing how a particular research project is situated in the innovation domain (who are the actors to which the research might be interesting). Over the subsequent

⁷ Information obtained by feedback of the RATA program officer to earlier versions of this chapter.

editions of the course, the emphasis shifted towards thinking about business creation as a first start to explicate the relevance of thinking about societal embedding. This shift was also aimed at overcoming initial resistance of the participants in later editions, who, in contrast to the first editions, mainly participated because they had been subscribed by the program office.⁸

Participant evaluations, filled in at the end of each shift indicate that the course has been very helpful in providing participants with first ideas how to think about societal aspects of their research, since many of them had no idea before participating in the course. Moreover, initial reluctance and resistance among the participants often turned into enthusiasm during the program. The course, however, could only provide a first introduction, thereby giving little means for the participants to develop follow-up actions once back to their research projects.⁹ The RATA program officer and the course leaders attempted to bridge that gap with offering RATA coaching. About ten PhD students have signed up for this and were linked to a researcher from the RATA theme.

In one research project, a Constructive TA (CTA) workshop was organized after attendance of the RATA course. In this workshop, various stakeholders brainstormed on the possible paths of follow-up research in the context of commercial, regulatory and societal developments. This initiative was supported by a RATA post-doc who had been in contact with the supervisor of the PhD before. The outcomes of the workshop have resulted in a full chapter of the PhD thesis (Stimberg, 2014). This initiative has become an 'icon-project' to the RATA theme and created significant leverage for RATA in a strategy meeting of the NanoNextNL management at 13 March 2014, where follow-up actions in response to the mid-term evaluation were discussed (see below).

3.2 RATA collaboration

Facing the lack of awareness, reluctance and resistance among the 'target group', the RATA management has participated and presented at program meetings of other research themes and initiated a series of RATA FOOD dinners, to which theme coordinators and program directors were invited. These events served to inform and inspire the management of the other research themes on the relevance of RATA for their research, so as to build support for attending the RATA course and other RATA activities. These meetings as well as the participation in program meetings seem to pay off in terms of gaining awareness and first explorations of opportunities to collaborate (NanoNextNL, 2013a). So far, this has resulted in a couple of follow-up meetings between NanoNextNL researchers and RATA experts. Collaborative activities have not been reported so far.

The RATA researchers have been working in relative distance to the program level activities, focusing on the progress in the individual research projects in the RATA theme. From the RATA research theme three of about thirty projects scheduled interactive events with NanoNextNL researchers from other themes. In the Human

⁸ As observed by author in participating in the first (July 2012) and fifth (July 2014) edition of the RATA course and confirmed by course instructor.

⁹ As reported by a course instructor to the RATA program officer in preparing for the mid-term evaluation of NanoNextNL (email 10 March 2014).

Health risks program a decision support tool for predicting the likelihood of hazardous effects of nanomaterials was developed. Little interaction took place in the design phase, but wishes and requirements for the use of the tool were inventoried through a questionnaire that was circulated via the NanoNextNL newsletter. In the TA program a workshop was organized, building on the use of Constructive TA methodologies in NanoNextNL's preceding program NanoNed. In this workshop, researchers, industry and other stakeholders from inside and outside NanoNextNL explored potential use and strategic issues of nano-enabled sensors in the food and water domain. While the issues discussed in this workshop might not immediately affect the (technical) research projects on sensor development in NanoNextNL, participant evaluation forms showed that the workshop had produced strategic insights for sensor development (Te Kulve, 2013; Te Kulve and Konrad, forthcoming).

Next to the mentioned project activities a number of program level activities have been organized. The RIVM facilitated two matchmaking workshops for RA (on measurement and on kinetics of nanomaterials). RATA also has been more explicitly profiled in the new community building concept for an annual Dutch conference on micro and nanotechnology (NanoCity), by a separate RATA parallel session and RATA masterclass. Finally, the RATA management was involved in a closed workshop with external actors on the concept of 'Safe by Design' in the context of the European FP7 project NanoReg. The workshop resulted in a strategy document (NanoNextNL, 2012). While these activities have strengthened the profiling of RATA within NanoNextNL, they were not designed as explicitly contributing to the integration of RATA throughout NanoNextNL.

3.3 Reframing the RATA ambition upon mid-term evaluation

In December 2013 the International Advisory Council held a midterm evaluation based on a self-assessment report (NanoNextNL, 2013a) and a meeting with the Executive Board. The self-assessment report discussed the RATA integration strategy of raising awareness and stimulating interaction and concluded that only first steps had been taken, if one considers that each NanoNextNL project is a potential RATA case. The International Advisory Council concluded that NanoNextNL was well underway and living up to its ambitions in scientific output, but falling behind on business creation. The latter was stated as the main goal for the second half in the NanoNextNL program. RATA was positioned as a unique and essential part of the program, but with little interaction so far and a need to re-orient RATA towards creating business opportunities. The latter was framed as ensuring that potential applications would pass safety regulations (NanoNextNL, 2013b). In its response, the Executive Board took over the focus on business creation as the central theme and underlined the role of RATA therein (NanoNextNL, 2013b).

The strong business focus for RATA, however, met opposition from the RATA project leaders, since the RATA projects had not been designed and budgeted in this way, and objected against a 'service orientation', which was deemed neither feasible nor desirable. In a brainstorm session facilitated by the RATA management following the mid-term evaluation, presentations on the CTA workshop on sensors for food and water and on the CTA workshop organized in the above mentioned PhD project were positively received by a number of theme coordinators and program directors and opened the way towards a more reflexive positioning of what RATA could offer.

However, the language in which RATA was discussed remained focused on risks and public acceptance. In the follow-up, the TA program director developed the idea of a quick scan instrument and setting up a ‘societal incubator’. In parallel, both the RATA management and an executive board member worked on an integrated assessment format in the context of an EU program. At the moment of writing this chapter, the executive board is awaiting the results of this project before taking further steps. In the meantime, part of the RATA budget has been allocated to facilitate follow-up coaching for the participants of the RATA course. The obligation to include a specific chapter, section or paragraph in the PhD theses is, however, no longer actively pursued.¹⁰

4. Learning from RATA, for the governance of RI

What can be learned from the integration of RATA in NanoNextNL? From an outside perspective results may seem mixed. While RATA as a *research program* even overachieved its performance indicators, requirements for fulfilling the RATA *obligation* have been reduced and efforts to *integrate* RATA throughout the programme have resulted in a limited number of interactions. From an inside perspective the very attempts for integrating RATA have been visible though. The strong commitment to both business creation and RATA (no matter if at a somewhat superficial level), and the enforcement of formal obligations (even while negotiated), actually created a considerable awareness among NanoNextNL researchers of RATA as being an inseparable element in the way NanoNextNL is being branded as an innovation program. In addition, the networking ‘diplomacy’ of the RATA management has paid off in the form of changes of attitudes at (research) management level and of PhD researchers in the RATA courses.

For our aim of ‘learning for governance’ we are interested in how these outcomes have been conditioned. Investigating the integration of RATA in NanoNextNL as resulting from a dynamic interplay between actors, governance arrangements, spaces, problem framings and construction of responsibilities, enables us to see that the limited success of integrating RATA is only partially a result of political struggle and diffuse frame conditions. It is one thing to start with substantial budget and high ambitions, but quite another to transform a large research program according to new ideas. In our view, the distributed character of NanoNextNL as an organization is one reason why actual integration has been limited. We will first discuss this aspect and next elaborate on what the actors in NanoNextNL have or have not been learning.

4.1 Integrating RATA as a distributed problem

Although NanoNextNL exhibits a corporate identity and governance structure (through the program office), it mainly functions as a multidisciplinary, collaborative interinstitutional expert network, organized in a familiar mode of research funding through public-private research consortia. Having an integrated RATA theme in such a program is a fairly new structure and requires dedicated integration work. The executive board was supportive of RATA, however without an articulated vision on

¹⁰ Information obtained from discussions with the TA-director and other participants of the brainstorm session.

how the integration of RATA would have to be accomplished. Most of the members of the executive board knew each other for a long time, while being located in different institutions. As key representatives of the Dutch nanotechnology community, the executive board was particularly concerned with living up to the promise of nanotechnology by demonstrating business potential. In line with that, RATA was largely perceived as a key feature in moving forward in this direction, as became apparent in the mid-term evaluation. However, actual integration work has been mainly left to the RATA management.

The RATA management, in turn, relied heavily on opportunities for networking and advocacy to raise awareness of the relevance of RATA among the other projects and for stimulating interaction. However, the members of the RATA management had to get to know each other first, as well as many of the executive board members, program officers, theme coordinators and program directors in NanoNextNL. This had consequences for the mobilization of the RATA research theme itself. The RATA theme consists of multiple disciplines. While annual meetings have contributed to the RATA identity, the RATA project leaders were not closely engaged in the quest for integrating RATA in NanoNextNL and the RATA research activities concentrated on local project dynamics and kept a disciplinary focus, even though interaction with other themes has been part of the Key Performance Indicator scheme and budget for such activities was available.

4.2 Integrating RATA as a learning process

To introduce something new as ‘doing RATA’ in a network type of organization like a research program involves different things to be learned by different actors. For RATA as an *integrated* activity, those in charge of the research projects and programs (including, for example, researchers and theme directors) have to learn which societal aspects and dimensions are at stake, for specific research projects as well as for the thematic research clusters more broadly. However, how such an integrated activity can be conducted in practice requires learning as well, in terms of training researchers and of building support from supervisors, program directors and theme coordinators, the program office and the executive board. Crucially, this kind of learning is also largely improvisational, due to the relative novelty, to changing interpretations and expectations, and because of the distributed (network) character of research consortia like NanoNextNL.

An important factor shaping the learning process is the way in which responsibilities with respect to RATA were understood in relation to how RATA has been framed as an activity. While Risk Analysis (RA) *expertise* actively has been offered in NanoNextNL meetings and in the PhD course, RA itself mainly has been presented as *research*, thereby emphasizing *knowledge* rather than the *interactions* needed to develop targeted knowledge, either for training or for specific assessment. For TA, executive board members as well as participants of the RATA course repeatedly kept framing TA as having to do with public *acceptance*, to be addressed by communication and dialogue, despite efforts to emphasize aspects of *anticipation* and *societal embedding* in a broader perspective.

As reflected in the executive board’s conclusions on the Mid Term Review, but also observed for researchers from other themes, these framings of RA and TA support the expectation that RATA, as a research theme, will *sort out* societal issues and how

these have to be addressed, instead of doing so by *finding out* together. Similarly, enrolling PhD researchers in the RATA course in order to facilitate the RATA obligation of paying attention to potential risks, although lowered in number, has been accepted, but ideas about involving their supervisors as well didn't take off. In effect, both the framing of what RATA is about and how RATA translated into responsibilities, may explain why in-depth exchange between RATA and the other research themes remained an occasional, rather than common process. As a result, there still is more to learn: about what constitutes the most relevant societal dimensions in the research projects, and how these could be addressed, as well as about how RATA as an integrated activity has to be organized as an interactive process.

An opportunity for learning which has been used only to some extent has been the interaction with stakeholders on societal aspects in general, or RATA specifically. Apart from the negotiations with the governmental agency RVO on the interpretation of the RATA obligation and the mid-term evaluation by the International Advisory Council, the ambition of integrating RATA mainly has been a program-internal affair. The CTA workshops showed that this type of learning is important for identifying societal dimensions and appreciated as such by the participants. For learning about how to organize RATA as an integrated activity, interacting with 'outside' actors might have benefitted the process as well. For example, through consultation and evaluation by external expertise on professional formation in research environments, or by opening up the design questions for integrating RATA to (critical) stakeholders.

4.3 Lessons for research governance

So far, our investigation of the integration of RATA in NanoNextNL has shown that transitions in the science system, towards demonstrating societal relevance and responsiveness to societal concerns, are taking foot at the level of large research programs. Still, the practical implementation is not a straightforward process, but rather an ongoing search, experimenting and learning process, which does not guarantee substantial transformation within the time frame of a research program. However, this only confirms the need to learn from cases like NanoNextNL as explorative steps into institutionalizing Responsible Innovation in research governance. From our discussion of the integration of RATA as a learning process and the governance conditions that have shaped the integration of RATA we suggest to draw three lessons:

Firstly, because integration, and even more so the mainstreaming of it at a program level, is a learning process, it should be designed as such. This implies that learning about societal dimensions and societal embedding is not only organized at the level of individual researchers, but also collectively, including the question how such learning should be facilitated. In addition, as shared understandings of goals and appropriate strategies are not a given, but have to be developed, change agents are important and should be carefully supported. In the case of NanoNextNL, the designated change agents were mainly the members of the RATA management. However, their abilities to 'make change' have been limited by a lack of opportunities for in-depth exchange, in particular with regard to the question how RATA as an integrated activity would have to be (collectively) organised.

Secondly, incentive and accountability structures are crucial. Since learning is channeled by obligations and commitments, processes of learning are affected and conditioned by evaluative structures. For example, the first moment of in-depth

evaluation took place in the context of the mid-term review conducted by an international advisory committee. Even though there was resistance to the specific conclusions, it opened up a space for discussions and further interactions. Realizing a beneficial structuring is however far from straightforward: approaching RATA as a learning process requires reflexivity, vision and support, all the way up to executive boards and funding procedures. In this respect it is interesting to note that RATA as an *obligation*, however narrowed down, did positively contribute to the integration of RATA as an *ambition*. Although not sufficient, accountability thus is an important element in facilitating learning.

Thirdly, learning in terms of identifying and addressing societal dimensions in research activities involves trade-offs between developing generic capacities and dedicated collaborative efforts. Identifying for all research projects the societal and risk dimensions to be considered and how these can be addressed, quickly puts a strain on the resources and capacities available. Moreover, a well-known feature of societal dimensions in research and innovation is that these are partly potential or unknown. Therefore, identifying societal dimensions benefits from stimulating reflexive and anticipatory abilities. At the same time, for the very idea of integrating RATA as well as for pedagogical reasons, learning also has to be ‘relevant’ and tailor-made. This tension comes with two implications for learning how to organize ‘integration’ of ‘parallel research’ like RATA. First, it is hard to see how integrating, or mainstreaming, can do without a strong and self-aware core, in our case the RATA research theme. However, the RATA research theme has not been designed to serve interaction and RATA researchers have only to some degree been seeking opportunities for interaction as well, most likely enforced by the same incentive structures as those withholding researchers from the other programs, like being absorbed by their usual research work and disciplinary requirements. Second, even with such a core, learning about societal aspects benefits from interaction with outside actors. This, in turn, requires commitment as well as capacity from executive boards and program and project leaders, to facilitate and evaluate such learning processes.

5. Conclusions

The ambition of integrating RATA in NanoNextNL reflects transitions in the science system, towards demonstrating societal relevance and responsiveness to societal concerns. Together with the substantial budget allocated for RATA as a research theme, this makes the integration of RATA in NanoNextNL an interesting case for learning about explorative steps into the mainstreaming of activities like RATA and the institutionalization of RI in research governance. Our discussion has shown that the actual transition may develop rather slowly, because of the interdependence of learning at different levels, which does not guarantee substantial transformation within the time frame of a research program. However, this only confirms the need to learn: ‘doing’ RATA constitutes a learning process in itself, both with regard to what societal issues and themes have to be anticipated and to organising RATA as an integrated activity in a large research program. This kind of learning can be expected for other attempts to mainstream RI as well.

From our analysis of the integration of RATA in NanoNextNL we can conclude that living up to the ambitions of RI, requires governance strategies and accountability structures that facilitate learning by dedicated integration work. For collaborative

research networks like NanoNextNL, these strategies have to account for the distributed character of learning and integration. For example, the integration of RATA in NanoNextNL could have been helped with more integration *within* RATA as a research theme by developing a shared identity and coordinated approach for liaising with other research themes. However, a more distributed match-making, as happened with coaching trajectory in following up on the RATA course for PhD researchers, seems to be a possible way as well, and may circumvent that first lots of effort is needed for internal adjustments, discussions, and settling of disagreement. Such choices, in turn, require reflexivity about context specific conditions and the tentative, up to experimental, governance of Responsible Innovation as a dynamic goal.

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