# A Transatlantic Conversation on Responsible Innovation and Responsible Governance

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**Abstract.** How can innovation in nanotechnology be balanced with responsible governance? Responsible innovation and responsible governance are broad concepts that mean different things to different groups. This paper presents the results of a roundtable with academics and policymakers from Europe and the U.S. held at the 2011 Society for the Study of Nanoscience and Emerging Technologies conference. The results of this roundtable discussion raise heterogeneous perspectives on the definition of responsible innovation and responsible governance and the role of philosophy versus practical intervention. At the same time, commonalities are also evidenced in the emphasis on the need for further progress toward commercialization benefits coupled with concrete practices and public involvement.

**Keywords.** Responsible innovation, responsible governance, emergence, policy.

## Introduction

How do actors envisage—and importantly, operationalise—a notion of 'responsible innovation' alongside the twinned and inseparable notion of 'responsible governance' (RI-RG)? Questions of responsibility in the face of inherent uncertainty, risk, and unanticipated consequences—the fundamental characteristics and governance challenges of emergent science and technology—are not new. There is a history of practice and policy in this area, mature on both sides of the Atlantic. However, recently we have witnessed a renewed flurry of policy and academic interest, an investment in related

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research calls, and, in the U.S., a sense of pausing to review ten-year progress and assess the state of the art in the area of responsible governance of emergent technologies (Roco et al. 2011). Furthermore, as nanotechnologies move from lab-settings to commercialisation, we see social scientists and policymakers moving away from polarised polemics of pros and cons toward more plural, middle-ground, and empirically informed analyses of governance implications. Increasingly, researchers and policymakers are focusing on real-time responses to real-time diffusion of technologies into societies, in addition to studies concerned with real-time capture and monitoring of ~~commercialialisation~~ and governance responses.

This chapter presents the results of a roundtable held at the 2011 Society for the Study of Nanoscience and Emerging Technologies (S.NET) conference. Featuring academics and policymakers from Europe and the U.S., the roundtable was designed to stimulate statements about the dimensions of responsible innovation and responsible governance of nanotechnology. Roundtable participants were asked to give consideration to outcomes of recent regulatory decisions. The roundtable pointed out that the multiple trans-boundary, trans-disciplinary characteristics of nanotechnology (as a case example of an emergent and enabling technology) inevitably fall between the gaps of existing (bounded) regulatory frameworks and instruments, producing logical if perverse decisions. An example is the 2007 decision by the U.S. Environmental Protection Agency to classify the Samsung Silvercare washing machine as a pesticide, whilst noting that this decision does not represent a general principle when dealing with products incorporating silver nano-particles. On this basis, it could be asked how far and in what ways policy could go in response to the regulatory challenges of emergent technologies, including how such challenges should be addressed through changes to the scope, content, or philosophy of policy and regulation.

The roundtable also was set up to discuss the broader notion of RI-RG, involving a wider range of existing and new instruments, actors, and governance processes, including education, training, and professional codes of conduct. This conception of RI-RG encompasses the role of the International Organization for Standardization (ISO) and other standards, procedures, and evaluation methods for which responsible governance might be seen as the institutionalisation of performance guarantees inscribed into the creation of measurable qualities of product and service. It also includes consideration of public deliberation mechanisms that frame responsible governance as the democratisation of science and innovation; voluntary pre-market technology assessment, societal foresight exercises, and labelling; corporate activity aimed at developing and maintaining relations with communities, labour, and ecological stakeholders; corporate social responsibility; and actions to promote 'sustainability'.

Drawing upon this plethora of new and existing forms of instituting and changing policy and practice aimed at instilling 'new', 'different', 'greater' (or arguably 'less', or differently 'distributed') responsibilities, it could be asked: through what kinds of rationales/discourses and sources of legitimacy, and through appeals to what instrumental levers and case examples, do actors seek to change existing policy and practice to something quantitatively and qualitatively different, and what questions are raised by these processes? The session thereby emphasised and encouraged reflection on real-time governance responses, taking nanotechnology/emergent technologies as the platform through which to discuss the notion of RI-RG.

Several panellists took their entry point to be that no one is, or could be, 'against' responsible innovation, suggesting that we are not starting from a dichotomy that situates or contrasts a positive state of responsible innovation/governance against some

wild state of irresponsibility. Rather, in common, the panellists described (or implied) interpretations conceptualising a current state of affairs where there is an implicit or explicit wish for institutional, behavioural, moral, interpretative, academic or thought-process improvement (the notion of 'improvement' is implied if not explicit). The panellists then went on to offer reflections on their preferences for new or adjusted research agendas, governance frameworks and interventions (of various kinds, operating at different levels, aimed at influencing a variety of actors, through the implementation or adjustment of a range of initiatives and actions) to be realised through various proposed policy initiatives, methods and approaches. The observations raised in the roundtable can be ~~as~~sorted into three aspects. The first involves a normative 'vision' or framing. Explicit or implicit in each position was a set of proposed values underpinning how a world of responsible innovation should look. The second involves institutional anchors or reference points. A number of panellists referred to an existing source of authority to support their case: an act, treaty, or instrument such as an award scheme. Interestingly, the institutional anchor points cited were, in each case, 'local' to the institutional setting of the speaker (Europe, U.S., Norway), thus providing not only one dimension of variety, but also one explanation of 'localised' diversity of views. The third involves proposed strategies, principles or practical actions for 'feeling-forwards'. Here, panellists differed on the principles and/or practical actions they proposed for advancing their particular 'model' of RI-RG.

Panellists' views are presented in the following sections. European panellists are presented first, followed by American ones. A key theme of each panellist's remarks (albeit not necessarily the only theme addressed) is highlighted in the title of the section.

## 1. Doing Good (Fern Wickson)

Under this view, 'responsible' innovation/governance means more than simply avoiding harm or minimizing risk. It is about actively seeking to do good and cultivating the virtue of care (Wickson 2011). This type of approach is arguably present in the Norwegian Gene Technology Act, which uniquely requires a demonstration of social benefit and contribution to sustainable development for biotechnologies to be approved for release. It can also be found in the recent EU Code of Conduct for responsible nanoscience and technology, which requires that research is in accordance with the precautionary principle and contributes to the millennium development goals (among other things). While it is significant and praiseworthy that the discourse of responsible innovation/governance is growing around fields such as nanotechnology, this view is concerned that a perpetual focus on future technologies may distract us from the irresponsible realities of today, with the innovation and environmental governance of biotechnology being a prime example. This view gave the example that in the EU, a new legislative amendment allowing member states to make their own decisions about the cultivation of genetically modified (GM) crops is currently under debate (Wickson and Wynne 2012). The European Commission (EC) has proposed that these decisions be permitted only on grounds unrelated to health or environmental risks, since the European Food Safety Authority (EFSA) apparently already adequately assesses these. EFSA risk assessments are, however, performed under a host of unethical conditions; e.g. there is a lack of independent research, a lack of transparency regarding key information, an inability for researchers to access test materials, and an application of

double standards in evaluating the quality of evidence (Wickson and Wynne 2012, *in press*). The position expressed is that, at a minimum, these conditions call for enhanced plurality in scientific advice for policy (Stirling 2010, Sarewitz 2011), and that the current EC attempt to close down scientific risk assessment to singular centralized forms works against responsible governance of biotechnology.

The example of Environmental Risk Assessment (ERA) can be taken to argue that a positivist view of ERA, as an example of objective, independent and autonomous 'out-there' scientific practice, masks the point that it actually necessitates and engenders a range of social visions and value-based decisions. There is no static environment external to ourselves that can be objectively harmed or benefited by our actions. Rather, there is a co-evolving dialectical relationship between ourselves and our ecological communities that can be better or worse affected depending on what we (within our diverse cultures) value. Ecological responsibility is therefore not responsibility for the earth, but responsibility for our relationship with it. And just as with all relationships, our aim should not only be to avoid bad ones, but to actively create good ones. How best to do this and the extent to which we have agency to cultivate the virtue of ecological responsibility, are questions that remain open for discussion.

## 2. Shifting Discourse (Arie Rip)

An earlier discourse related to responsible science has now shifted to responsible governance (Rip 2011). Responsibility came into the frame in the 1800s, related to ordering society. It is observed that while the word 'responsible' is used in the English language since the 16th/17th centuries (in various meanings), 'responsibility' comes up, tentatively, in the late 18th century, and comes into its own in the emerging professional-industrial society of the 19th century.

A striking thing about the recent discourse on responsible development and innovation (for nanotechnology and more broadly) is how it shifts away from the earlier discourse on social responsibility of scientists. An observation is the shift away from 'virtue' (of certain agents) to 'consequences'. One example is the definition of responsible development in the U.S. National Nanotechnology Initiative (NNI). The NNI's definition is a very consequentialist way to look at nanotechnology. It is a discourse premised on the objective 'We have to try to find the best balance'. There might be a next step, which is "What sort of responsibilities are addressed here?" This discourse on responsible development of nanotechnology can be characterized as the balancing of efforts to maximize the technology's positive contributions and minimize its negative consequences. Thus, responsible development involves an examination both of applications and of potential implications. It implies a commitment to develop and use technology to help meet the most pressing human and societal needs, while making every reasonable effort to anticipate and mitigate adverse implications or unintended consequences (National Research Council 2006). The overall shift is important, because it puts responsibility again where it belongs: a language and practice of ordering our societies.

But, this is not just discourse at the policy level. A lot of things are happening at different levels: macro, meso, micro levels. There are lots of case studies. There is something out there that is happening and may lead to certain outcomes. It could be asked: under which circumstances should we locate responsible innovation and responsible governance? There is mostly vertical governance. The alternative is not deliberat-

ive democracy but rather reflexive neo-corporatism. Nano reflexivity is a clear example—corporations and civil society organizations together try to figure out what should be done. As an entrance point, taking the division of moral labor—implicit neo-corporatism becomes explicit. A lot of the discussion about responsible governance is based on the tradition of the linear model. Governments think they are doing something because they are addressing the science side. By way of contrast, Rip presents a schematic to depict responsible innovation and responsible governance as a discourse and as practices that work out differently at different levels, with their own dynamics.

If responsible development/innovation becomes part of how we organize ourselves in our societies, it will reinforce neo-corporatism because effective and legitimate decisions will be taken in (horizontal) interaction between institutionalized actors with a "shadow of hierarchy" (Scharpf 1994), a point that has been made in Constructive Technology Assessment (CTA).

Would this constitute good governance? Phrasing the question this way implies that 'responsible governance' need not necessarily be 'good' governance. The reflexive-sociological position is that reflexive neo-corporatism is as good a governance practice as we can get. This position on analysis of the limitations of various top-down governance practices and ideologies equally contains a reluctance to go for bottom-up approaches, even if they are called deliberative democracy. The importance of 'grey zones' (between official rules and legislations, and ongoing practices) is one of the arguments for this position. Other arguments derive from analysis of societal (quasi-) order in terms of intersecting sociotechnical worlds. All this is happening, and it constitutes *de facto* governance. It can qualify as good governance if it becomes 'reflexive'. If fashionable terms like responsible innovation/governance help to create such reflexivity, then Rip is willing to go along with it.

### 3. Responsible Research and Innovation (René Von Schomberg)

What is 'Responsible Research and Innovation' (RRI), why is it needed, and how can it be done? A perspective on definition holds that:

> Responsible Research and Innovation is ultimately defined by the actors engaged with it. The challenge is to organise collective co-responsibility in research and innovation processes thereby ensuring an inclusive process. Responsible Research and Innovation has, therefore, a strong process dimension. Yet, Responsible Research and Innovation can also be understood in terms of outcomes of a responsible process: research and innovation outcomes which contribute to societal challenges, to sustainable development and which are aimed at societal desirable outcomes while being ethically acceptable…Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products. (von Schomberg 2011).

The reference point is policy-making of the European Commission (EC). RRI is building upon the range of deliberative exercises implemented in the course of EC funded Science and Technology Studies (STS) activities and outlines the EU scope and recent initiatives under the domain of Responsible Research and Innovation.

A product dimension and a process dimension have been offered under a conceptualisation of RRI as being defined by and through the actors themselves, providing broad normative guidelines for translating the philosophy and principles of RRI into recommended portfolios of practical action, with rationales. Actors are

encouraged to engage in three axes of action associated with the product dimension and four axes associated with the process dimension (von Schomberg 2012, 2013). The product dimension posits that products marketed throughout a transparent process (will) have been defined in terms of safety, sustainability (environmental and economical) and societal desirability, and brought about through:

1. Use of Technology Assessment and Technology Foresight
2. Application of Precautionary Principle
3. Use of demonstration projects: moving from risk to innovation governance.

The process dimension posits that the challenge is to arrive at a more responsive, adaptive and integrated management of the innovation process. This requires a multidisciplinary approach with the involvement of stakeholders and other interested parties and should lead to an inclusive innovation process whereby technical innovators become responsive to societal needs and societal actors become co-responsible for the innovation process by a constructive input in terms of defining societal desirability of products. These outcomes are more likely to be realised through:

1. Deployment of Codes of Conduct for Research and Innovation.
2. Ethics as a "Design" factor of Technology
3. Deliberative mechanisms for allowing feedback with policymakers: devising models for responsible governance.
4. Public debate.

**4. Geography and Responsible Innovation (Philip Shapira)**

Responsible innovation can also be thought of as innovation that is not harmful, is useful and relevant, and contributes to sustainability, noting that this raises issues about equity and distribution of benefits as well as care of natural environments. It is invariably difficult to develop innovation in trajectories consistent with this wide-ranging formulation of responsible innovation.

One recent U.S. effort to reflect upon and anticipate responsible innovation is found in the project 'Nanotechnology Research Directions for Societal Needs in 2020' (also known as Nano2, Roco et al. 2011). This initiative comprised an extensive process of engaging scientists, industrialists, policy people, and community people to think about where the nano effort was in the last ten years and where it will go. There was a scientific side to this, but also consideration of responsibility and governance. Nano2 engaged people not just in the U.S. but also in Europe and Asia.

The geographical dimensions of responsible innovation and explanations of geographical differences warrant attention. It can be posited that, although there may be some divergences between countries, the huge differences are in the (institutional and regulatory) frameworks. The U.S. does have a specific piece of legislation—the 21st Century R&D Act of 2003—which encourages interdisciplinary working, provides for the commercial development of nanotechnologies, and simultaneously provides for ethical, legal, and societal implication (ELSI) considerations. It is a fairly unique piece of legislation that provides a framework.

Looking back over ten years of nanotechnology in the U.S., one thing that occurred is investment and development of a significant infrastructure for nano in society,

education, and experimentation. A community developed to facilitate the engagement of a general 'public' with policy and vice versa. There has also been some engagement with industry—but that has been the weakest side.

To date, public debate in the U.S. on issues around nanotechnology has been modest, although a series of concerns have been raised around specific applications including those of nano-silver and titanium dioxide. So far, the debate has made companies more attentive and careful (but not necessarily more responsible). However, not all is well. The National Science Foundation has led the way in considering societal assessment, but other agencies have not followed. Moreover, the system focuses on science rather than utilization. It can thus be asked: are we ready for mass applications of nanotechnology? The answer is probably not. This deals with what business is doing, rather than academic researchers. Nanotechnology is being embodied in a large number of incremental applications. In this context, how can applications be socially responsible? The regulatory system cannot deal with this very well because it does not distinguish well whether we should regulate by size or function. Life cycle considerations—including what happens after these products are used—also represent an area of weakness.

Returning to the question of geography in reflections of what constitutes responsible innovation and governance, we are reminded that the leading country for nanoscience publication is China. The geography of consideration of the roundtable discussion is between the U.S. and Europe, which runs the risk of assessing from a well-developed country perspective. Elsewhere in the world, including in China, there is not as large a community engaged in critiquing emerging technology development from an RI/RG perspective.

Going forwards, some principles that might contribute to responsible innovation can be proposed. First, having an overall framework is important. The U.S. policy and legislative framework needs to be updated as nanotechnology moves to an era of mass application. Focus needs to shift or re-balance from constituencies of scientist-researchers onto the innovators. The practical measures begin with responding to the perceived demand from businesses about what is responsible innovation. We should work more with companies. We should also seek to get such concerns considered in business schools. Creating fora for deliberation is most important as new technologies are emerging (hindsight is too late). The priority now is to develop better technology assessment mechanisms where there is an element of sharing findings—this translates into a policy implication of how best to bring about a capability and ability for societal involvement in the commercialisation activities of firms: to get information from companies and to feed that into well thought through analytic processes.

## 5. Levers to Encourage Responsible Innovation (David Guston)

It is pretty hard not to favour responsible innovation. For that reason, responsibility does command a greater immediate consensus, and it enables and opens debate. Whether one is arguing for more resources, or to legislate into university curricula, this consensus-building dimension provides a useful lever.

Illustrative is an initiative involving a gathering of a group of a dozen people in Washington, D.C., from non-governmental organizations (NGOs) to other stakeholders, working in policy. The gathering discussed the possibility of creating a prize for responsibility in innovation. The desire was not to come up with a fine-grained analytic

definition, but to pattern it on the Malcolm Baldridge National Quality Award for manufacturing. In that case, the initial approach involved getting applications, then in subsequent years, the criteria were bootstrapped up by evaluating early winners. It did not require a long-range analytic approach. This has been pursued in a dialogue with a European foundation to try to create a prize for responsible innovation.

The second aspect is noting what happens in universities around their response to scientific integrity versus productivity modelled on the Bayh-Dole Act. This could be leveraged into a framing of responsible governance. For scientists, there would need to be a process to find ways to broaden and make more robust what that means. It is more than not killing human resource subjects or contributing to the local economy. What more do we have to do to be responsible? While universities established tech transfer offices and offices of responsible research, universities should also set up offices for responsible innovation. ~~It is~~ a vast array of tasks and debates between social scientists and humanists, engaging in a way that engineers maybe do not. Scientific responsibility is to responsible innovation the way that microethics and engineering is to macroethics. The political environment in the U.S. focuses on the responsibility of scientists and engineers whereas macroethics gets at ethics of the individual and the society in which they work.

## 6. Practicing Responsible Innovation (Barbara Harthorn, Chris Newfield)

It is easy to agree with all of the principles that have been put forward, but although the principles are here, the practice is the problem. When the Oxford principles for geoengineering have been presented (Rayner et al. 2009), and when Mihail Roco articulates a similar set of values as part of the NNI (Roco et al. 2011), at that level, it is the practices that are missing. Centres are trying to do multi-stakeholder work. It is not all in the language of responsibility; it can be in the language of cultural values. The geoengineering document puts forward a carefully articulated, multi-stakeholder perspective. There is readiness to move from the principles, but the government is not ready and industry is not ready to do so. Although many from industry would agree, they are not ready to take such principles on board as practices.

There is a need to concretize the excellent values the panellists are espousing. It is important to be clear about the goal of responsible innovation. One position advocates a grassroots anticipatory approach, while another is reluctant to rely on bottom-up approaches. The end-user and the community of use are important. For example, the Bayh-Dole Act recognised the need to intervene to introduce new licensing rules to widen access rights to Intellectual Property (IP). However, nano is a continuation of bio's understanding of IP rather than a continuation of software's understanding of IP. In emergent solar technologies, small companies are being as secretive as they can, with a lockdown Apple-economy approach of absolute secrecy. There is an argument that this is retarding innovation progress. The public is used as a source of money, then asked to go away and let the companies work with this money. The IP is given to companies and they will get 100% of the profits. The public is not thrilled about being excluded in the IP system. If the agency is listed as a funder, though many are not, we need to do more to bring the public in and enable financial sharing, such that some of the money from corporate IP goes back to the public.

## 7. Conclusions

Views on RI-RG are marked by variety, lack of consensus and divergence of views. This finding begs the question that if this degree of heterogeneity exists within this primarily transatlantic constituency, then what further diversity of positions might we find by extending this exercise to academics and policy influencers, for example, in China, South East Asia, India, Canada, Russia, and Latin America? Nevertheless the positions did contain some generic components that give clues as to how one might devise a generic analytical framework through which to understand landscapes and contours of divergence and commonalities of positions. All positions were underpinned by the roundtable participants' own normative framing, whether explicit or implicit. Through the rubric of RI-RG all the participants articulated a 'problem' or 'deficit' with policy and practice preferences on how to address that 'problem'. But the participants' positions and argumentation differed on interpretations of the 'problem' to be addressed, on the pre-existing institutional anchors and reference points appealed to, on how to understand and mobilise particular constituencies of actors, and what strategies (top-down, bottom-up, multi-actor arenas of engagement) and interventions were recommended to bring about the envisioned 'better world' of responsible innovation and responsible governance.

The heterogeneity of perspectives reflects in part a difference in entry points. The European participants enter the responsible governance domain through an articulation of philosophy and principles. The American participants are more oriented to empirical entry points: suggesting points of practical intervention, a notion of learning from 'what works' or what has worked in the past.

Despite this heterogeneity, commonalities across regions can be evidenced even if the positions may not be identical. Several common themes emerge: (1) the need not just to avoid doing harm, but even more to strive for "doing good" and achieving benefits; (2) the need to move beyond science more strongly toward commercialization with involvement of the public; and (3) the need to work on concrete practices, be they sets of principles or prizes and incentives. An additional shared point is the need to look beyond the western countries, particularly to Asia, with its cluster of countries with substantial nanotechnology research and commercialization activities.

Institutionalised sources of inspiration or authority, whether existing laws, treaties, or intervention schemes, have been used as jumping-off points for articulating a way forward on responsible governance. Interestingly, these reference points were situated at different levels of local/national institutional contexts, consistent with the participants' national 'home base'. An interesting contrast to this was the reference by both U.K. and U.S. participants to the recent U.K. House of Commons Science and Technology Committee report, *The Regulation of Geoengineering* (2010), which represents an innovation in transatlantic collaboration—an initiative in the policy framing of a new technological domain with trans-border risk, uncertainty, and ethical implications. This hints at one dimension on how institutionalisation 'up-scales'.

Still, questions of conceptualization remain. A number of categories are becoming folded together in the responsible innovation debate. As a consequence, there is a tendency to leave separate categories hanging, under-theorised and under-problematised. For example does responsible innovation differ conceptually and analytically from responsible governance? Likewise does the term 'Responsible Research and Innovation' fold together ontologically distinct categories of science, technology, research, innovation and commercialisation, each involving different constituencies of actors, orientat-

ing arenas of engagement, organising orders, norms, forms of legitimacy and histories of practice, with attendant separate challenges, issues and concerns? Alternatively, is the folding together of these discrete categories a useful strategy, justified, in policy terms, in the name of consensus building?

Moreover, the topic of responsible innovation and responsible governance appears benign but is in fact inherently and fundamentally political. Whether referred to in terms of 'balancing' different interests (a euphemism for a politics of reconciling different and potentially contradictory interests and tensions), or through references to different 'models' of political science, such as reflexive neo-corporatism, questions of politics infuse and inform discussions of RI-RG. At the same time and ironically, questions of power were rather 'hidden'. In particular, questions of asymmetrical powers are raised in negotiating the contours, priorities, and compromises in the production of new 'rules of the game' of RI-RG, of new patterns of inclusion/exclusion, and of winners/losers at the various negotiating tables.

What constitutes RI-RG is differently interpreted. This difference flows through debates in the social science research and policy communities. The use of roundtable sessions and prepared statements can be useful in articulating these differences in transatlantic conversations and research collaborations.

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