Monitoring the Evolution and Benefits of Responsible Research and Innovation (MoRRI)

Analytical report on the dimension of Research and Innovation Governance

Jack Stilgoe & Ralf Lindner

Sub-task 2.5, analytical report, Deliverable D2.4.1

Executive Summary

This report is one out of a series of six reports, each targeting a separate dimension of Responsible Research and Innovation (RRI). The six reports collectively form the main output of Task 2 of the 'Monitoring the Evolution and Benefits of Responsible Research and Innovation' (MoRRI) project.

This report focuses on the 'governance' dimension of RRI. It begins by reviewing selected literature on the relationship between governance, research and innovation, particularly as it relates to moves in governance frameworks that create the possibility for RRI. Governance is defined as steering innovation through the establishment of goals, the establishment of means and the verification of performance. For science and innovation, this therefore means the provision and distribution of funding and the regulation of research and innovation activity through soft (cultural and normative) means as well as hard ones (laws and institutional procedures). The governance of science is concerned with how knowledge is produced and how it is distributed. The governance of innovation is far broader. Particularly important in the case of the governance of science is the realisation that much governance happens within and is done by the scientific community itself.

The last two decades have seen movement towards new models of governance. In line with trends towards greater public engagement, this has meant the 'opening up' of governance considerations, including a focus on the direction of innovation alongside conventional measures of its quantity or 'pace'. For this reason, the measurement and monitoring of governance in quantitative terms is hard, and risks reinforcing the narrow set of considerations that characterised models of governance that are unhelpful for RRI.

Recent EC-funded projects have suggested new approaches to analysing and describing governance for RRI, but these are all qualitative. Governance can be understood as bringing together the other dimensions of RRI.

This report describes how governance across Europe is moving towards RRI. As the focus grows on governance *for* RRI, we need to consider what measures are required in order to assess whether these governance moves are successful and how different regimes are operating. In this sense, policies for RRI are themselves governance, and can therefore be assessed using indicators compiled from our analysis of the other dimensions of RRI. However, there is a set of meta-governance considerations that demands further attention and for which indicators at the moment are patchy if not absent.

Governance for RRI means attempting to shift science and innovation systems from a narrow focus on innovation towards democratically defined societal challenges. However, we currently have inadequate knowledge of the demand side of research and innovation. Indicators for science and innovation are almost entirely on the supply side, measuring productivity in their own terms. This suggests that there is a need for better intelligence on what research and innovation is being supported. It will be hard to ascribe purposes to much of this research, as research and innovation are necessarily unpredictable in many cases, but it would be possible, with improved scientometrics and greater access to funding data from key organisations, to represent portfolios and consider the balance of priorities. Using the MoRRI typology, governance is clearly a 'context' consideration. There may be the possibility of capturing RRI 'inputs' in the form of particular initiatives, but the more important thing to monitor will be 'outcomes', for which there exists a clear gap

Table of Contents

List of tables

1. Introduction - analytical and empirical aspects of Responsible Research and Innovation

This report is one out of a series of six reports, each targeting a separate dimension of Responsible Research and Innovation (RRI). The six dimensions include 'Citizen engagement and participation of societal actors in research and innovation', 'science literacy and scientific education', gender equality', 'open access to scientific knowledge, research results, and data', 'research and innovation governance' and research and innovation ethics'. The six reports collectively form the main output of Task 2 of the 'Monitoring the Evolution and Benefits of Responsible Research and Innovation' (MoRRI) study, and they are informed by the results of the literature review on RRI and its conceptual components which was performed as Task 1 of the project.

The six reports emerging from Task 2 specifically address analytical and empirical issues relating to each of the RRI dimensions. Each report aims to:

- Provide an operational understanding of the RRI dimension it targets
- Present existing empirical information about the RRI dimension
- Assess data availability and specify analytical levels and degrees of aggregation of available material

The reports will provide a platform for subsequent definition of metrics and indicators for the RRI dimensions in Task 3. The report at hand specifically focuses on the dimension of 'research and innovation governance', (for the sake of brevity also referred to as the governance dimension).

The report is structured in accordance with the main aims of Task 2 and also provides an outlet for the results of Task 1.

In chapter 2, results from the literature review are presented. These provide a background for the following chapters.

Chapter 3 is concerned with the development of an operational understanding of governance. The objective is to provide a functional vocabulary of governance by clarifying important analytical components and definitions of governance. This chapter includes specification of the relationship and borderlines between the governance dimension and the other five dimensions of RRI.

Chapter 4 accounts for existing empirical information on governance. It is based on a review of selected studies funded by the European Commission, along with review of evidence from other empirically oriented studies which are considered particularly relevant for the governance dimension.

In chapter 5, availability of existing data on governance is assessed. Following the scheme outlined in the MoRRI proposal, this chapter specifically considers the availability of data on governance relating first to its characteristics in terms of the intervention logic model, i.e. data describing the context, input, output, and outcome of governance. More specifically, **context** relates to the environment and overall situation in a country; **input** to the activities carried out, measures taken, structures created or resources provided to address what is done in order to address issues of RRI and whether it is done in a systematic manner; **outputs** to the immediate or direct results of activities and **outcomes** relate to the achievements (MoRRI Proposal 2014:64).
Second, availability of data are described according to the level of aggregation of these data, distinguishing data that describe the global level, the national level, the regional level, the institutional level, the programme/project level and the individual level.

Reflecting the findings in chapter 5, chapter 6 considers issues relating to data gaps and assesses the overall need for primary data collection to fill gaps. Finally chapter 7 provides early thoughts on the development of indicators and metrics for governance, which will be the objective of Task 3.

2. Results of the literature review on research and innovation governance

This chapter includes a list of the core literature on governance selected for review (approximately 10-15 papers have been reviewed for each RRI dimension), as well as a synthesis of the literature review on this dimension. The literature review was performed in Task 1 of this project. The synthesis should summarize the main conceptual elements of the targeted dimension, and form the background for the succeeding chapter about the 'functional vocabulary' for the dimension.

2.1 Review of core literature relating to research and innovation governance

The objectives of the literature review (Task 1) is to

- review of the state of knowledge regarding RRI
- define the policy context of RRI in Europe and elsewhere
- give a comparative assessment of RRI dimensions, weighing-up advantages, disadvantages and available options
- conduct a preliminary assessment of the availability of empirical evidence on the dimensions
- finalise the definitions and properties of the RRI key dimensions
- finalise the definition and properties of additional factors that may be relevant for the monitoring tasks.

In order to meet these objectives and provide useful input to the thematically and methodologically strongly related aims of Task 2 and other ensuing project tasks, the approach to the literature review was designed in close cooperation with the dimension and task leaders. In a first step, the five dimension leaders were asked – based on their long-standing experience in their respective fields – to select 10 to 15 key publications in each key RRI-dimension for detailed review. Second, a review template was designed in order a) to ensure a systematic analysis of the selected literature and b) to cover all relevant aspects and information required in Tasks 1 and 2. Before it was rolled out to the individual reviewers, the template was subject to a pretest.

For governance, the following key publications were selected and reviewed:

- Barben, D.; Fisher, E.; Selin, C.; Guston, D. (2008): Anticipatory Governance of Nanotechnology: Foresight, Engagement, and Integration. In: Hackett, E.J.; Amsterdamska, O.; Lynch, M.; Wajcman, J. (Eds.): The Handbook of Science and Technology Studies, Cambridge, MIT Press. 979-1000

- Benz, A. (2007): "Governance in connected arenas: political science analysis of coordination and control in complex control systems", in: Jansen, D. (ed.): New Forms of Governance in Research Organizations: From Disciplinary Theories towards Interfaces and Integration, Berlin, pp. 3-22

- Edler, J. et al. (2006): Understanding "Fora of Strategic Intelligence for Research and Innovation", Karlsruhe (Fraunhofer ISI): PRIME Forum Research Project

- Edler, J., Kuhlmann, S. and Smits, R. (2003): New governance for innovation. The need for horizontal and systematic policy co-ordination. Report on a workshop held at the occasion of the 30th anniversary of the Fraunhofer Institute for

Systems and Innovation Research (ISI), Karlsruhe/Germany, 14/15 November 2002, organised in collaboration with the Copernicus Institute, Dept of Innovation Studies, Utrecht University and the "Six Countries Programme - the Innovation Policy Network (6CP)". Karlsruhe (Fraunhofer ISI Discussion Papers Innovation System and Policy Analysis; No. 2/2003): Fraunhofer ISI.

- Edler, J.; Kuhlmann; S., Behrens, M. (eds.) (2003): The Changing Governance Of Research And Technology Policy. The European Research Area, Cheltenham

- Ely, A., van Zwanenberg, P., Stirling, A. (2014): Broadening out and opening up technology assessment: Approaches to enhance international development, co-ordination and democratisation. In: Research Policy 43(3): 505–518

- Felt, U. and Wynne, B. (2007): Taking European Knowledge Society Seriously: Report of the Expert Group on Science and Governance to the Science, Economy, and Society Directorate, Directorate-General for Research, European Commission (EC, Brussels)

- Fisher, E., Mahajan, R & Mitchum, C. (2006): Midstream Modulation of Technology: Governance From Within Bulletin of Science, Technology and Society 26(6): 485-496

- Guston, D. H. (2014): Understanding 'anticipatory governance'. In: Social Studies of Science, 4482:218-242

- Kuhlmann, S. (2007): Governance of Innovation: practice, policy and theory as dancing partners. Inaugural Lecture, University of Twente, http://doc.utwente.nl/59649/1/rede_S_Kuhlman.pdf

- Kuhlmann, S., Boekholt, P., Georghiou, L., Guy, K., Héraud, J.-A., Laredo. Ph., Lemola, T., Loveridge, D., Luukkonen, T., Polt, W., Rip, A., Sanz-Menendez, L., Smits, R. (1999): Improving Distributed Intelligence in Complex Innovation Systems. Final report of the Advanced Science & Technology Policy Planning Network (ASTPP), a Thematic Network of the European Targeted Socio-Economic Research Programme http://mpra.ub.uni-muenchen.de/6426/

- Martin, B. and Johnston, R. (1999): "Technology Foresight for Wiring Up the National Innovation System", in: Technological Forecasting and Social Change 60: 37-54.

- MASIS synthesis report http://ec.europa.eu/research/science-society/document_library/pdf_06/monitoring-policy-research-activities-on-sis_en.pdf

- Nuffield Council on Bioethics, (2012) Emerging Biotechnologies: Technology, Choice and the Public Good. Nuffield Council on Biotechnologies, London (downloaded on 1 February 2013 from http://www.nuffieldbioethics.org/sites/default/files/Emerging_biotechnologies_full_report_web_0.pdf).

- Smits, R. and Kuhlmann, S. (2004): "The rise of systemic instruments in innovation policy", in: International Journal of Foresight and Innovation Policy 1 (1/2): 4-32

- Stirling, A. (2008): Opening Up and Closing Down. Power, Participation, and Pluralism in the Social Appraisal of Technology. In: Science, Technology & Human Values 33(2): 262–294.
- The Report of the Expert Group on Global Governance of Science to the Science, Economy and Society Directorate of the EC http://ec.europa.eu/research/science-society/document_library/pdf_06/global-governance-020609_en.pdf
- Indicators for promoting and monitoring Responsible Research and Innovation, report of the expert group on policy indicators for responsible research and innovation http://ec.europa.eu/research/swafs/pdf/pub_rri/rri_indicators_final_version.pdf

The guidelines for the review process and the findings of the individual reviews are documented in the Appendix to this report.

Indicators for promoting and monitoring Responsible Research and Innovation

2.2 Synthesis of literature review on research and innovation governance

The synthesis of the reviewed literature has been conducted in order to provide a concise overview of the key dimension, its policy context, main definitional elements and functional vocabulary, most important claims about impacts, and relationships to other key dimensions of RRI.

Introduction

The relationship between governance, research and innovation is far from simple, and far from linear. Not only are science and innovation governed in various ways, some of which may be considered more responsible than others, but also science and innovation are a vital and increasing part of our governance regimes.

Michael Polanyi argued that "For at least three hundred years the progress of science has increasingly controlled the outlook of man on the universe, and has profoundly modified (for better or worse) the accepted meaning of human existence. Its theoretic and philosophic influence was pervasive" (Polanyi [1962] 2000:14). Our societies and economies have become, according to the dominant rhetoric, knowledge societies and knowledge economies. But while scientists and others have emphasised the importance of science for society, the influence that society and policy exerts upon science and innovation has been underplayed.

'Governance' here refers to control or management. It can be found not just in the state, but also in businesses or any social organization. In this sense, governance goes substantially beyond 'government'. To take a definition from Bevir (2012), governance means 'all processes of governing, whether undertaken by a government, market or network, whether over a family, tribe, formal or informal organization or territory and whether through laws, norms, power or language'. For Voss et al (quoted in Rip 2008), governance entails 'the characteristic processes by which society defines and handles its problems. In this sense, governance is about the self-steering of society'.

Governance involves the establishment of goals, setting up of means, and verification of performance. This includes providing, distributing, and regulating. When applied to science, governance is often interpreted to mean 'regulation', suggesting a restriction of freedoms. Regulation is a subset of governance focused on steering and confirming trajectories, as opposed to providing and distributing. Discussions of governance should therefore address a wide range of meta-questions: What are the opportunities and uncertainties? Who is likely to benefit? Who or what may be at risk? Who should

make decisions? What principles should underlie decisions? Who should be involved? What criteria must be satisfied?
As described by the Expert Group on the Global Governance of Science, the role of the nation state in matters of science and innovation is diminishing over time. 'Global governance' does not however equate to international governance:

> "In contrast to international governance, global governance is characterized by the decreased salience of states and the increased involvement of non-state actors in norm- and rule-setting processes and compliance monitoring. In addition, global governance is equated with multilevel governance, meaning that governance takes place not only at the national and the international level … but also at the subnational, regional, and local levels. Whereas, in international governance, the addressees and the makers of norms and rules are states and other intergovernmental institutions, non-state actors … are both the addresees and the makers of norms and rules in global governance" (Rittberger, 2001, p. 2; quoted in European Commission, 2009).

The governance of science is concerned with how knowledge is produced and how it is distributed. The governance of innovation is far broader. The concern with the latter goes beyond concerns about technology and its regulation. Particularly important in the case of the governance of science is the realisation that much governance happens within and is done by the scientific community itself. Scientists govern how knowledge is produced, certified, made credible and communicated.

At the same time, institutions that fund, support and regulate science, such as research funders and national academies, are themselves often controlled and influenced to a degree by scientists. As science and innovation play an increasingly important role in political and public life, influencing governance in various ways, we should ask whether the ways in which science is governed serve the ends of responsible research and innovation and therefore the wider public interest.

Kuhlman (2007) describes how studies of science, technology and innovation (STI) have contributed to understanding of the governance of science. STI studies tell us that the governance of innovation is complicated and often informal, taking place across various 'fora', but also that new 'regimes' are possible. In particular, Kuhlman uses Felt and Wynne's (2007) distinction between 'technoscientific promises' and 'collective experimentation' as alternative regimes. In the former, governance is led by the promises of particular technologies. In the latter, governance is rearranged to target democratically-framed problems of concern. However, this requires the formation of alternative fora for discussion.

Benz (2007) discusses governance in terms of hierarchy, networks, competition and negotiation – a combination of structure and procedure. The interrelationship of policy areas and regimes means that, if governance for RRI is to have any purchase, it must be thought of in terms of what Benz (2007) calls the 'governance of governance' or 'meta-governance'.

The 'new governance'

The last two decades have seen moves towards what Alan Irwin (2006) calls "new" scientific governance. Many of these changes substantially overlap with those of public engagement, as described in the separate dimension report. But the important thing to note is that a focus on governance clarifies the purpose of public engagement, which is often confused, as being about improved sociotechnical outcomes (Fisher et al 2006). Put bluntly, public deliberation as part of RRI is only worth doing if it

contributes to the mitigating of problems (often through merely shedding light on them) in innovation systems or the opening up of new possibilities (Stirling 2008).

At the same time, a number of governance innovations have sought to place public engagement alongside other imperatives in improving the ways in which scientists and policymakers engage with uncertain futures. The growth of two-way public engagement coincides with a decline in deference to authority, in general, and expert authority in particular (House of Lords 2000; Beck 1992). The European Commission recognised in 2000 the need to make 'scientific expertise more democratic in particular in the sensitive issues of health and safety' (European Commission 2000).

The STAGE project (Science, Technology and Governance in Europe) provides some insights. Running between 2001 and 2005, this European Commission-sponsored project developed 26 case studies of policy making and social engagement across eight member states. STAGE found significant differences across the eight countries. And it is hard even within one country to identify a distinctive national style of policy across multiple issues. In particular, STAGE considered the role of democratic deliberation in governance processes, finding that the rhetoric of engagement was far ahead of its practice. Even in countries that were seen as more advanced in terms of citizen participation, there was a lack of connection between these processes and governance decision-making.

The term 'upstream' engagement, even though it is informed by thinking that demands the opposite, risks giving the impression that public deliberation is something that can be done early and then forgotten about. Fisher et al (2006) make the point that the modulation of innovation trajectories happens in an ongoing, iterative way, and should therefore be constantly open to forms of public scrutiny and discussion. The clear message from STAGE was that innovations in engagement demanded further attention to the context of governance and the possibility of embedding deliberation within it (Hagendijk and Irwin 2006). At the same time, the STAGE project identified a typology of governance approaches that helps to structure discussions about changing governance (see **Error! Reference source not found.**). The important thing to note is that incentives and moves to democratise governance of science and innovation must be understood in the context of other moves and pressures to close down governance in discretionary, corporatist and market ways.

RRI, then, is clearly aligned with particular ideas of governance and a set of innovations towards this end, such as public deliberation, lay membership of expert committees, transparency and multidisciplinary collaboration. In particular, RRI governance should be seen in the light of recent moves and frameworks aiming towards 'anticipatory governance' (Barben et al 2008; Guston 2014). Anticipatory governance necessitates building capacity for foresight, engagement and integration in order to, as Guston puts it, bend 'the long arc of technoscience more toward humane ends'. Foresight (see Martin and Johnson 1999) concerns the ability to make sense of multiple plausible futures and connect them to current practice. Anticipation is not the same as prediction (Barben et al 2008).

Indeed, it critiques the imperative for certainty rather than seeking certainty. Anticipation is about consideration of plausible sociotechnical outcomes, with all of their associated uncertainties, with a view to reflecting in the present. In terms of research and innovation, anticipatory governance foresight demands consideration of both intended and unintended consequences. Engagement is well-discussed elsewhere in these reports. Integration, as described by Guston, concerns the coming-together of social and natural sciences, as experimentally demonstrated for example by the STIR (Social and Technical Integration Research) project, but we might equally look to the broader challenge of responsiveness (Stilgoe et al 2013), which demands attention to

how processes of opening up governance can generate responses from those in power.

On this last point, anticipatory governance joins other moves, such as real-time technology assessment and constructive technology assessment in shifting the governance emphasis away from the downstream impacts and implications of science and innovation towards the upstream consideration of directions, incentives and motivations. This is the sense in which Stirling (2008) talks about 'opening up' discussions about the trajectories and purposes of innovation. Public engagement and technology assessment can enable this, but it can also, if used instrumentally, close down the debate (Ely et al 2014; Stirling 2008). This shift from the 'governance of risk' to the 'governance of innovation' itself (Felt and Wynne 2007) is at the heart of RRI governance. It means that, as well as considering new governance initiatives, we must also improve the scrutiny and responsiveness of what has been called 'de facto governance'.

De facto governance

We should recognise, following Rip's (2008) description of nanotechnology 'how much actual governance is already occurring… without any particular actor being responsible for the emerging governance arrangements'. Once we accept that, especially with emerging technologies, governance goes far beyond regulation and that which is proscribed by hard law, we see the importance of individuals and institutions in governing from the bottom up. The first task is to understand the *de facto* forces that do, in fact, govern science and innovation. It is also important to consider how technologies, which solidify particular governance arrangements themselves shape and constrain what is possible.

Mapping de facto governance involves understanding, at the highest level, the setting of agendas that often in turn serve particular sociotechnical imaginaries (Jasanoff 2015) that may be hard to elucidate. The contribution of Science and Technology Studies and Science Policy Studies has been to reveal the ways in which the trajectories of science and technology are not predetermined, but rather governed, often by unspoken assumptions.
Practically speaking, a focus on de facto governance moves us towards paying attention to the *barriers* to RRI, asking what it is in science and innovation systems that makes responding to questions of responsibility particularly hard.

Governance actors and functions

The challenge of understanding and improving governance is that it is performed by multiple actors, at different levels and across countless organisations. One should therefore pay attention to the following functions of the Research and Innovation System: resource mobilisation; research funding; scientific cultures and careers; public procurement and commissioning; corporate R&D; regulation; standards-setting; technology assessment; public and policy engagement; university-industry links and more.

Original literature review list

- Barben, D.; Fisher, E.; Selin, C.; Guston, D. (2008): Anticipatory Governance of Nano-technology: Foresight, Engagement, and Integration. In: Hackett, E.J.; Amster-damska, O.; Lynch, M.; Wajcman, J. (Hg.): The Handbook of Science and Technol-ogy Studies, Cambridge, S. 979-1000

- Benz, A. (2007): "Governance in connected arenas: political science analysis of coordi-nation and control in complex control systems", in: Jansen, D. (ed.): New Forms of Governance in Research Organizations: From Disciplinary Theories towards Inter-faces and Integration, Berlin, pp. 3-22

- Edler, J. et al. (2006): Understanding "Fora of Strategic Intelligence for Research and Innovation", Karlsruhe (Fraunhofer ISI): PRIME Forum Research Project

- Edler, J., Kuhlmann, S. and Smits, R. (2003): New governance for innovation. The need for horizontal and systematic policy co-ordination. Report on a workshop held at the occasion of the 30th anniversary of the Fraunhofer Institute for Systems and Innova-tion Research (ISI), Karlsruhe/Germany, 14/15 November 2002, organised in col-laboration with the Copernicus Institute , Dept of Innovation Studies, Utrecht Univer-sity and the "Six Countries Programme - the Innovation Policy Network (6CP)". Karlsruhe (Fraunhofer ISI Discussion Papers Innovation System and Policy Analysis; No. 2/2003): Fraunhofer ISI.

- Edler, J.; Kuhlmann; S., Behrens, M. (eds.) (2003): The Changing Governance Of Research And Technology Policy. The European Research Area, Cheltenham

- Ely, A.; van Zwanenberg, Patrick; Stirling, Andrew (2014): Broadening out and opening up technology assessment: Approaches to enhance international development, co-ordination and democratisation. In: Research Policy 43 (3), S. 505–518

- Felt, U. and Wynne, B. (2007): Taking European Knowledge Society Seriously: Report of the Expert Group on Science and Governance to the Science, Economy, and Society Directorate, Directorate-General for Research, European Commission (EC, Brussels)

- Fisher, E., Mahajan, R & Mitchum, C. (2006): Midstream Modulation of Technology: Governance From Within Bulletin of Science, Technology and Society 26(6): 485-496
- Guston, D. H. (2014): Understanding 'anticipatory governance'. In: Social Studies of Sci-ence, vo. 4482), p. 218-242

- Kuhlmann, S. (2007): Governance of Innovation: practice, policy and theory as dancing partners. Inaugural Lecture, University of Twente, http://doc.utwente.nl/59649/1/rede_S_Kuhlman.pdf

- Kuhlmann, S. / Boekholt, P. / Georghiou, L. / Guy, K. / Héraud, J.-A. / Laredo. Ph. / Lemola, T. / Loveridge, D. / Luukkonen, T. / Polt, W. / Rip, A. / Sanz-Menendez, L. / Smits, R. (1999): Improving Distributed Intelligence in Complex Innovation Systems. Final report of the Advanced Science & Technology Policy Planning Network (ASTPP), a Thematic Network of the European Targeted Socio-Economic Research Programme http://mpra.ub.uni-muenchen.de/6426/

- Martin, B. and Johnston, R. (1999): "Technology Foresight for Wiring Up the National Innovation System", in: Technological Forecasting and Social Change 60, 37-54.

- MASIS synthesis report http://ec.europa.eu/research/science-society/document_library/pdf_06/monitoring-policy-research-activities-on-sis_en.pdf

- Nuffield Council on Bioethics, 2012. Emerging Biotechnologies: Technology, Choice and the Public Good. Nuffield Council on Biotechnologies, London (downloaded on 1 February 2013 from http://www.nuffieldbioethics.org/sites/default/files/Emerging_biotechnologies_full_report_web_0.pdf).

- Polanyi, M. (2000). The republic of science: Its political and economic theory. Minerva, 38(1), 1-21.

- Smits, R. and Kuhlmann, S. (2004): "The rise of systemic instruments in innovation policy", in: International Journal of Foresight and Innovation Policy 1 (1/2), 4-32

- Stirling, A. (2008): Opening Up and Closing Down. Power, Participation, and Pluralism in the Social Appraisal of Technology. In: Science, Technology & Human Values 33 (2), S. 262–294. [also in PE dimension literature]

- The Report of the Expert Group on Global Governance of Science to the Science, Economy and Society Directorate of the EC http://ec.europa.eu/research/science-society/document_library/pdf_06/global-governance-020609_en.pdf

Additional References

- Bevir M. 2012 Governance: a very short introduction. Oxford, UK: Oxford University Press.
- European Commission White Paper on European Governance
- Hagendijk, R., & Irwin, A. (2006). Public deliberation and governance: engaging with science and technology in contemporary Europe. Minerva, 44(2), 167-184.
- Irwin, A., 2006. The politics of talk: Coming to terms with the 'new' scientific governance. Social Studies of Science 36, 299–330.
- Jasnoff, S. (2015) Dreamscapes of modernity
- Rip, A. (2008) De facto governance of nanotechnologies, Regulation and Governance
- Rittberger, Volker, ed. (2001) Global Governance and the United Nations System. New York: United Nations University Press.
- Indicators for promoting and monitoring Responsible Research and Innovation, Report of the expert group on RRI indicators http://ec.europa.eu/research/swafs/pdf/pub_rri/rri_indicators_final_version.pdf

3. Functional vocabulary of research and innovation governance – definitions and terminology

Building on the results of the literature review, the purpose of this chapter is to arrive at a functional vocabulary of governance. The intention of the chapter is to present the definitions and terminology related to governance that will allow an empirical and practical approach to the concept of governance. The functional vocabulary will be the basis for the subsequent exploration of empirical studies and data on governance. Importantly, this chapter will consider the borderlines and relationship between the governance dimension and the remaining five dimensions of RRI.

Governance, as defined by the European Commission in the context of responsible research and innovation, "Addresses the responsibility of policymakers to prevent harmful or unethical developments in research and innovation". It is considered a "fundamental basis for the development of the rest of the dimensions."[1]
This definition is a useful starting point, in order to provide focus for high-level policy, but it should not be taken as the end-point of a governance definition. Governance is about more than just avoiding harm.

In the previous chapter, governance was defined more broadly as 'all processes of governing, whether undertaken by a government, market or network, whether over a family, tribe, formal or informal organization or territory and whether through laws, norms, power or language'. For science and innovation, this means the providing and distributing of resources (perhaps most obviously in the form of funding) as well as the regulation of how those resources are used and their outputs. The approaches taken to these issues can be characterised according to a typology already described, and repeated here in

Table 1: A typology of governance

1. Discretionary governance. Policies in this category are made without explicit interaction with 'the public'. Governance is presented primarily as a matter for government, which is seen as serving universal goals of progress.
2. Corporatist governance. This involves a formal recognition of differences of interest as an input to negotiation. As negotiation takes place within a closed or highly regulated space, the decisive feature of this mode is the admission of stakeholders.
3. Educational governance. This assumes that policies for science and technology have foundered on the shoals of public ignorance. Hence, it is necessary to create an informed citizenry.
4. Market governance. Science and technology are best regulated by demand and supply. The value of science comes from the surplus value created through its commercialization and contribution to the generation of wealth. The public participates as customers and consumers.
5. Agonistic governance. This form of governance occurs in a context of confrontation and adversity. The storage of nuclear waste in the UK is a case where policy seems to have stalled in the face of public opposition: opposition to GM foods has also taken agonistic form.
6. Deliberative governance. This rests on the assumption that open debate and engagement can create a satisfactory foundation for decision-making. In this mode, the public are not consumers of science, but rather 'scientific citizens'.

Source: adapted from Hagendijk and Irwin 2006

[1] http://ec.europa.eu/research/science-society/document_library/pdf_06/responsible-research-and-innovation-leaflet_en.pdf

4. Review of existing empirical knowledge of research and innovation governance

In this chapter, which constitutes the bulk of the report, focus is turned to empirical studies in the area of governance. It presents the results of Sub-task 2.2 and Sub-task 2.3, which reviews the state of knowledge regarding the RRI dimensions, including empirical knowledge emerging from EC funded studies on the RRI dimensions. Results specifically for the governance dimension are presented in this report.

The chapter is divided into two parts. First, a selection of EC studies with particularly rich empirical information on governance is reviewed. Second, a selection of other studies that equally hold rich information on governance is presented schematically. The aim of the review of EC studies is to 1) specify the questions concerning governance, to which the studies provide (partial) answers, 2) tentatively identify the indicators that may be harvested from the reviewed studies, 3) assess whether the information contained in the studies relate to the context, input, output, or outcome of governance following the intervention logic model, 4) specify the analytical level of the information, distinguishing between global, national, and sub-national (regional, institutional, programme/project and individual) levels, and 4) specify whether the studies provide quantitative or qualitative data.

For the extensive list of other relevant empirical studies, the aim is to summarize the sources of information, the analytical level at which information is presented, and the key focus of the studies, in order to pave the road to subsequent qualified selection of existing indicators of governance in Task 3 of the MoRRI project.

These specifications of the studies holding empirical information about governance will be used as the background for assessing the overall availability of empirical information on governance in the succeeding chapter.

4.1 European Commission studies and projects in the area of research and innovation governance

A number of EC projects have explored the dimension of research and innovation governance. These projects are listed in Table 2. For the purpose of this report, four projects are reviewed which are considered particularly relevant for the research and innovation governance dimension in terms of identifying empirical data for further analysis.

Table 2: Commission studies for review

Proposal Call	Project Acronym	Project Title	Project Start Date	Project End Date	Sources
FP7-SCIENCE-IN-SOCIETY-2011-1	**CONSI-DER**	Civil society organisations in designing reseach governance	01-02-2012	31-01-2015	http://www.consider-project.eu/ **Report:** Periodic Report – CONSIDER http://cordis.europa.eu/publication/rcn/16797_en.html
FP7-SCIENCE-IN-SOCIETY	**ACUMEN**	Academic Careers Understood through Measurement and Norms	01-03-2011	28-02-2014	http://research-acumen.eu/ http://cordis.europa.eu/project/rcn/97240_en.html

Proposal Call	Project Acronym	Project Title	Project Start Date	Project End Date	Sources
FP7-SCIENCE-IN-SOCIETY 2008-1	**HEALTHGOVMATTERS**	Health Matters: A social science and ethnographic study of patient and professional involvement in the governance of converging technologies in Medicine	01-6-2009	31-07-2012	http://www.healthgovmatters.eu/
FP7-SCIENCE-IN-SOCIETY -2012-1	**GREAT**	Governance of REsponsible innovATion	2013-02-01	2016-01-31	http://www.great-project.eu/ http://cordis.europa.eu/project/rcn/106794_en.html
FP7-SCIENCE-IN-SOCIETY -2009-1	**PRE-SCIENT**	Privacy and emerging fields of science and technology: Towards a common framework for privacy and ethical assessment	01-01-2010	31-03-2013	http://www.prescient-project.eu/prescient/index.php
FP7-SCIENCE-IN-SOCIETY -2011-1	**ROBO-LAW**	Regulating Emerging Robotic Technologies in Europe: Robotics facing Law and Ethics	01-03-2012	28-02-2014	http://www.robolaw.eu/index.htm **Report:** Periodic Report Summary – ROBOLAW **http://cordis.europa.eu/result/rcn/57151_en.html**
FP7-SCIENCE-IN-SOCIETY -2007-1	**SET-DEV**	Science, Ethics and Technological Responsibility in Developing and Emerging Countries	01-03-2008	31-05-2011	http://www.set-dev.eu/ **Reports:** Periodic Report Summary - SET-DEV http://cordis.europa.eu/result/rcn/54255_en.html Final Report - SET-DEV http://cordis.europa.eu/publication/rcn/14525_en.html
FP7-SCIENCE-IN-SOCIETY -2012-1	**RES-AGORA**	Responsible Research and Innovation in a Distributed Anticipatory Governance Frame. A Constructive Socio-normative Approach	01-02-2013	31-01-2016	http://res-agora.eu/ http://cordis.europa.eu/project/rcn/108668_en.html **Report:** Griessler, Mejlgaard & Pöchhacker (2014): First Annual RRI Monitoring Report. http://res-agora.eu/assets/Deliverable-5_12_withAnnexes.pdf
FP7-ENV-2008-1	**PASSO**	Participatory assessment of sustainable development indicators on good governance from the civil society perspective	01-05-2009	31-10-2010	http://www.isis-it.com/passo/ http://cordis.europa.eu/project/rcn/91257_en.html **Report**: Tehnopolis group (2012): Sis Case Studies, May 18, first version, pp. 174ff
FP5	**STAGE**	Science, Technology and Governance in	15-09-2001	14-12-2004	**Report:** Hagendijk, R., Healey, P., Horst, M., &

Proposal Call	Project Acronym	Project Title	Project Start Date	Project End Date	Sources
		Europe			Irwin, A. (2005). Science, Technology and Governance in Europe: Challenges of Public Engagement.
INTERREG	**KARIM**	European Network for Responsible Innovation and Technology Transfer		2014	http://www.karimnetwork.com
FP7-SCIENCE-IN-SOCIETY	**Responsible-industry**	Responsible-industry	01-02-2014	01-06-2017	www.responsible-industry.eu
FP7-SCIENCE-IN-SOCIETY	**EGAIS**	The Ethical GovernAnce of emergIng technologieS New Governance Perspectives for Integrating Ethics into Technical Development Projects and Applications	01-05-2009	29-02-2012	http://cordis.europa.eu/project/rcn/91156_en.html **Reports:** Periodic Report 1 – EGAIS http://cordis.europa.eu/publication/rcn/10741_en.html Periodic Report Summary 2 – EGAIS http://cordis.europa.eu/result/rcn/53898_en.html Periodic Report Summary 1 – EGAIS http://cordis.europa.eu/result/rcn/46390_en.html
FP7-SCIENCE-IN-SOCIETY	**NANO-CODE**	A multistake-holder dialogue providing inputs to implement the European Code of Conduct for Nanosciences & Nanotechno-logies (N&N) research	01-01-2010	30-11-2011	http://cordis.europa.eu/result/rcn/91262_en.html **Report:** Final Report Summary – NANOCODE, http://cordis.europa.eu/result/rcn/55409_en.html
FP7-SCIENCE-IN-SOCIETY-2010-1	**EPOCH**	Ethics in Public Policy Making: The Case of Human Enhancement	01-11-2010	31-10-2012	http://cordis.europa.eu/project/rcn/96892_en.html **Report:** Periodic Report Summary – EPOCH http://cordis.europa.eu/result/rcn/55321_en.html
FP6-2005-SCIENCE-AND-SOCIETY-14	**RISK-BRIDGE**	Risk-Bridge (Building Robust, Integrative Inter Discipli-nary Gover-nance Models for Emerging and Existing risks)	01-07-2006	30-06-2009	http://cordis.europa.eu/project/rcn/80067_en.html
ERC-2012-StG_20111124	**ITEPE**	Institutional Transformation in European Political Economy – A Social – Legal Approach.	01-02-2013	31-01-2017	http://cordis.europa.eu/project/rcn/105530_en.html
FP7-HEALTH-2007-B	**BRIDGE**	Scoping study of approaches to brokering	01-01-2009	31-12-2010	http://cordis.europa.eu/project/rcn/90965_en.html

Proposal Call	Project Acronym	Project Title	Project Start Date	Project End Date	Sources
		knowledge and research information to support the development and gover-nance of health systems in Europe			**Reports:** Final Report - BRIDGE http://cordis.europa.eu/publication/rcn/14254_en.html Periodic Report - BRIDGE http://cordis.europa.eu/publication/rcn/10272_en.html BRIDGE Result In Brief (http://cordis.europa.eu/result/rcn/86324_en.html)
FP6-2004-MOBILITY-5	**ALIVE**	Accoun-tability and Legitimacy of Gover-nance Institu-tions that support Viable Environ-ments.	01-01-2006	31-12-2007	http://cordis.europa.eu/project/rcn/79139_en.html

Res-AGorA - Responsible Research and Innovation in a Distributed Anticipatory Governance Frame. A Constructive Socio-normative Approach

The Res-AGorA project was initiated in 2013 and will continue until 2016. The main goal of Res-AGorA is to 'develop a normative and comprehensive governance framework for Responsible Research and Innovation (RRI)' which will contribute 'to the EU ambition of becoming a genuine Innovation Union by 2020 striving for excellent science, a competitive industry and a better society without compromising on sustainability goals as well as ethically acceptable and socially desirable conditions'.

This framework – addressing both micro and macro levels - will be constructed on the basis of extensive research on existing RRI governance, key stakeholder inclusion and deliberations as well as a continuing monitoring of RRI trends and developments across 16 selected European countries. In this regard, Res-AGorA encompasses three main empirical components:

- A series of case studies examining in depth existing RRI governance across technological domains
- A systematic country monitoring disseminated through a web portal
- A number of co-constructive workshops bringing together key stakeholders (res-agora.eu)

The extensive amount of data produced throughout the time-span of the project, will be valuable sources to explore for further analysis and as input for the subsequent indicator design within the MoRRI framework.

Due to the ongoing status of the Res-AGorA project, the final socio-normative governance framework has not been finally developed. Nonetheless, other deliverables are available, encompassing information on existing de facto responsible governance situations/practices across Europe as well as information on formalized R&I regulations. As a point of departure for the systematic monitoring of RRI trends and developments, a screening database was constructed covering 9 thematic and 20 specific indicators on issues related to research and innovation. These screening indicators and the general RRI monitoring scheme provide relevant knowledge for further analysis.

Table 3: Examples of research and innovation governance indicators retrieved from Res-AGorA

Guiding question	Indicator potential	Analytical level (intervention logic model)	Analytical level (aggregation)	Data classification and methods
Which regulatory arrangements (soft/hard) for research and innovation are in place?	• Typology over policies • Mechanisms/ instruments to promote national goals with regards to RRI	Input	National (across 16 European countries, comparable data)	Statistical data National reports on RRI policies
Which indicators for monitoring issues related to research and innovation in society can be identified?	• (Screening) indicators of research excellence	Input	European	37 countries included in a screening database containing 9 main thematic indicators and 20 specific indicators on issues related to research and innovation in society (based on of number of existing data sources)
Which de de facto responsible governance situations/practices can be identified?	• Typology	Input	National (across 16 European countries, comparable data)	Case studies National reports
How can a socio-normative governance framework for Responsible Research and Innovation be constructed?	• Guidelines/ Strategies • Cognitive and normative guidelines	Output	European	Desk research Case studies (3 stages) 5 stakeholder workshops

GREAT - Governance of REsponsible innovation

The GREAT project (2013-2016) aims to develop a theoretically and empirically founded model or framework of responsible research and innovation governance. Furthermore, the project 'will explore the dynamics of participation in research and innovation, and investigate the characteristics of responsible practices', for instance by exploring new stakeholder partnerships and networks and their influences on 'knowledge production and policy'. The objectives will be sought met by:

- Determining the characteristics of research and innovation
- Involving diverse groupings and
- Determining the social processes involved in responsible research and innovation practices (great-project.eu).

With regard to the latter R&I practices, a theoretical approach will be developed to 'analyse, compare, evaluate and improve these practices' in order to understand the 'characteristics, influencing factors and best practice of responsible research and innovation in a normative way' while allowing for RRI implementation and assessment in unpredictable contexts and circumstances (great-project.eu). GREAT is still in a phase of implementation and the final publication, including the model of responsible research and innovation, still awaits, but in view of the information already available, relevant data could be retrieved regarding the current RRI practices identified through survey and case study data (see table 4.1.3) in terms of identifying effective mechanisms of governance.

Table 4: Examples of research and innovation governance indicators retrieved from GREAT

Guiding question	Indicator potential	Analytical level (intervention logic model)	Analytical level (aggregation)	Data classification and methods
What are the current practices in RRI and how can these practices be improved allowing for planning, implementation and assessment of RRI?	• Influencing factors • Challenges/ Opportunities • Typology of main characteristics	Input	Across levels	Survey on CIP projects of the Information and Communi-cation Technologies Policy Support Programme In-depth case studies
How can a model of RRI be developed?	• Success factors	Output	Across levels	Structured analysis of case studies comparative analysis (external evaluation) The tool INFSO-SKIN for ex-ante evaluation of research and innovation networks will be adopted for implemen-tation

NANOCODE - A multi-stakeholder dialogue providing inputs to implement the European Code of Conduct for Nanosciences & Nanotechnologies (N&N) research

The NANOCODE project (2010-2011) included a multi-stakeholder dialogue with the aim to provide 'inputs to implement the European Code of Conduct for Responsible Nanosciences & Nanotechnologies Research'. More specifically, the project aimed to 'define and develop a framework aimed at supporting the successful integration and implementation, at European level and beyond, of the Code of Conduct'. (Final Report Summary – NANOCODE).

The four pillars stipulated in the project are:

1. Analysis of existing / proposed codes of conduct, voluntary measures and practices for a responsible Research and development (R&D) in N&N and identification of the relevant stakeholders.

2. Consultation of stakeholders to assess attitudes, expectations, needs and objections regarding the EC-CoC through a survey (electronic questionnaire and structured interviews) to more than 400 stakeholders worldwide.

3. Design of a MasterPlan and a performance assessment tool (CodeMeter) enabling the implementation and articulation of the EC-Code of Conduct, based on the WP2 consultation phase, a series of national workshops in partner countries and a final international conference.

4. Communication in a suitable form and to the widest possible audience of project objectives, findings and outcomes (Final Report Summary – NANOCODE)
In terms of the purpose at hand, the main NANOCODE project outputs consisting of the Masterplan (framework) for a successful implementation of the Code of Conduct as well as the CodeMeter Performance assessment tool seem particular relevant for further exploration; both in terms of the actual indicators and criteria produced as well as the particular research process from multi-stakeholder dialogue/ data collection to a concrete set of indicators. The early stakeholder inclusion across Europe (120 experts involved) also presents an interesting and more general study on how different stakeholders can be involved in deliberative processes of policy-making and how 'trust and self-regulation in the scientific community' can be promoted (Taraborrelli 2014:71).

Table 5 Examples of research and innovation governance indicators retrieved from NANOCODE

Guiding question	Indicator potential	Analytical level (intervention logic model)	Analytical level (aggregation)	Data classification and methods
Which attitudes, expectations, needs and objections regarding the EC-CoC can be identified among key stakeholders worldwide?	• Typology • Main characteristics	Input	Global	Stakeholder consultations in eight European countries + at an international level. The consultations, made by an electronic survey, structured interviews and focus groups, involved more than 400 stakeholders worldwide (approx. across 20 countries)
How can a framework (MasterPlan) aimed at supporting the successful integration and wider implementation of the	• Performance assessment tool CodeMeter (the EC-CoC's general	Output	Across levels	Stakeholder consultations in eight European countries + at an international

Guiding question	Indicator potential	Analytical level (intervention logic model)	Analytical level (aggregation)	Data classification and methods
European Commission code of conduct (EC-CoC) for responsible Nanosciences and nanotechnologies (N&N) be defined and developed?	principles and guidelines transformed to concrete, easily comprehensible criteria) • Best practise criteria • Recommendations			level. The consultations, made by an electronic survey, structured interviews and focus groups, involved more than 400 stakeholders worldwide (approx. across 20 countries

BRIDGE - Scoping study of approaches to brokering knowledge and research information to support the development and governance of health systems in Europe.

The BRIDGE project carried out in 2009 and 2010 broadly aimed to support governments and other stakeholders in effective and well-informed decision making by closing 'the gap between information on health systems and the strategies that could reform them' (Result in Brief, Bridge 2010; Final report Summary, BRIDGE 2010). As part of meeting this objective, BRIDGE has:

- developed a framework to understand knowledge-brokering approaches and their interconnections;

- produced criteria that can be used to assess knowledge brokering mechanisms and organisational models for knowledge brokering;

- described and compared EU and EFTA country experiences with knowledge brokering mechanisms that package information and that allow interactive knowledge sharing and organisational models (whether national or European focused) that foster knowledge brokering highlighting good practices;

- undertaken a set of national case studies that explore further the contextual factors that support the brokering of research into policy making (Final report Summary, BRIDGE 2010)

Despite the field specific character of the BRIDGE project, the knowledge brokering mechanisms as well as the organisational models for knowledge brokering identified and assessed as part of the project developments and outcomes, could potentially be generalized and transferred to other fields as well, in terms of identifying and responding to how 'information could be more effectively brought to bear on decision making' (Final Report Summary, BRIDGE 2010:1) while also strengthening researcher – policymaker interactions.

Table 6: Examples of research and innovation governance indicators retrieved from Bridge

Guiding question	Indicator potential	Analytical level (intervention logic model)	Analytical level (aggregation)	Data classification and methods
Which factors influence the use of health systems information in policy making?	• Assessment of brokering mechanisms	Input	National Institutional	**Systematic review** **Data from 319 organisations outlining their role in knowledge brokering.** **national multi-method case studies of knowledge brokering in action (in Belgium, England, Norway and Spain)**
Which successful (and less successful) knowledge brokering mechanisms and models can be identified?	**Features describing:** • **information-packaging mechanisms** • **interactive knowledge-sharing mechanisms**	**output**	**National Institutional**	**Systematic review** **Data from 319 organisations outlining their role in knowledge brokering.** **national multi-method case studies of knowledge brokering in action (in Belgium, England, Norway and Spain).**

4.2 Other empirical studies on the dimension of research and innovation governance

There are other EC funded studies not reviewed above which may nevertheless be relevant to understanding the breadth of governance considerations across different regimes and technology areas. The following projects may be relevant: EGAIS[2] (The ethical governance of emerging technologies); EPOCH[3] ("Ethics in Public Policy Making. The Case of Human Enhancement"); CIT-PART[4] ("Impact of Citizen Participation on

2 http://www.egais-project.eu/
3 http://epochproject.com/
4 http://www.cit-part.at/

Decision Making in a Knowledge Intensive Policy Field",); INES[5] ("The Institutionalisation of Ethics in Science Policy; practices and impact"); PAGANINI[6] (Participatory Governance and Institutional Innovation).

In addition to the EC funded studies identified and reviewed above, other studies could be seen to offer relevant empirical information on issues related to governance, although not specifically of research and innovation. For example, transparency international publishes rankings of governance regimes around the world based on criteria such as corruption and open governance (http://www.transparency.org/research/). However, such rankings are of limited value in understanding the relationship between science, innovation and the state.

The Eurobarometer survey will provide a useful comparison on public attitudes to science governance, inasmuch as some of the questions cover aspects that we would consider important. In some member states, as policymakers have sought to measure and nurture the 'impact' of research, bureaucratic procedures have led to the generation of case studies that may be a useful resource for RRI. The UK in particular has, through its Research Excellence Framework, created more than 6,000 impact case studies. These are available in an online database (http://impact.ref.ac.uk/CaseStudies/search1.aspx) and researchers have begun to analyse patterns across them (see, for example, this report http://www.hefce.ac.uk/media/HEFCE,2014/Content/Pubs/Independentresearch/2015/Analysis,of,REF,impact/Analysis_of_REF_impact.pdf).

5 http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_RCN=7494499
6 http://www.paganini-project.net/

5. Assessment of data availability on research and innovation governance

Based on the review and presentation of empirical studies on governance above, this chapter provides an overall assessment of data availability on governance for purposes of indicator development. The chapter discusses the issue of data availability in terms of 1) the extent to which the empirical studies provide relevant information across the categories of governance which were identified in the functional vocabulary, i.e. the extent to which the guiding questions that the studies address satisfactorily capture the contents of governance as defined in operational terms, 2) the balance and availability of quantitative and qualitative data respectively, 3) the extent to which available information address the four analytical levels specified in the intervention logic model, and 4) the availability of data at different levels of aggregation.

5.1 Data availability across research and innovation governance categories

There is certainly a range of data available that could speak to questions of the governance of research and innovation. But much of this data has been sought on the basis of governance regimes that are assumed to be desirable but which may be ineffective or counterproductive for RRI. So, for example, the growth of innovation policies in the 80s or 90s has led to increased capture of metrics for patents, spin out companies, licensing and university technology transfer, but much of this could be seen to exacerbate a linear model of innovation that would run counter to the network governance demanded by considerations of RRI.

5.2 Availability of quantitative and qualitative data

The Expert group on RRI indicators makes the point that, given the early stage of the RRI debate, qualitative indicators are certainly necessary, and may even be preferable. There is a danger of prematurely presuming that what can be counted counts, and ignoring the enormous interpretive flexibility of RRI. This is particularly true for nebulous ideas of governance, which often only make sense and provide analytical power at a high level.

That said, there may be adequate proxies for some aspects of governance that could be monitored, measured or mapped. Some of these are likely to overlap with the public engagement dimension. To the extent that RRI favours governance regimes that are more deliberative, more open and more reflexive about the limits of markets and discretionary decision-making, one could presume that governance regimes in which two-way public engagement was more developed would have a greater propensity for RRI.

Completed and ongoing EC-funded projects suggest the potential for useful data and indicators, but they also reveal the need for careful thought about how governance is assessed, given that different member states will have very different governance cultures.

The RES-AGORA project proposes a typology of governance approaches, which would extend the work of STAGE and offer a multidimensional way of assessing different regimes (see table 4.11). The NANOCODE project offers the potential for being able to assess particular governance initiatives aimed at responsible innovation, although only in a qualitative sense. The 'CodeMeter' tool could prove useful in other areas as a basis for an ongoing monitoring of RRI initiative.

Qualitative evidence for governance

There is a relative paucity of easily comparable data on governance that would be immediately applicable to policies for RRI. The crucial conclusion is that indicators for governance are unlikely to be tidily quantitative. Science and innovation policy systems have developed plenty of indicators for the measurement of their 'performance', but these are normally explored and expressed in terms that presume nothing about the direction of science and innovation, including low-carbon innovation, social innovation or pro-poor innovation.

So scientific productivity is relatively comparable using scientometrics. And innovation performance can be compared across a number of proxy measures such as patenting activity, spin-out companies and university-industry collaboration. But these figures tell us little about the nature of governance.

There are possibilities, which we are exploring within the project team, for broadening such metrics in order to analyse, at the level of research and innovation programmes, the nature of the research and innovation that gets supported by governments. But this means challenging conventional notions of scientific 'excellence'. The move to new forms of open, deliberative governance as part of RRI means that diversity (an attribute of any system whose elements can be categorised, as with research and innovation systems) could become an important new indicator, which would itself be amenable to measurement at different levels.

That said, most of the useful evidence with which to describe governance will be in a qualitative form.

6. Data selection for RRI monitoring – reflections of current data gaps and required data collection

The purpose of this chapter is to assess data gaps and provide reflections on the need for primary data collection in order to mitigate data gaps, based on the contents and results of the previous chapter as well as on the promising indicators described in chapter 7.

This report has described how governance across Europe is moving towards RRI. As the focus grows on governance *for* RRI, we need to consider what measures are required in order to assess whether these governance moves are successful and how different regimes are operating. In this sense, policies for RRI are themselves governance, and can therefore be assessed using indicators compiled from our analysis of the other dimensions of RRI. However, there are a set of meta-governance considerations that demand further attention and for which indicators at the moment are patchy if not absent.

Governance for RRI means attempting to shift science and innovation systems from a narrow focus on innovation towards democratically-defined societal challenges. However, we currently have inadequate knowledge of the demand side of research and innovation. Indicators for science and innovation are almost entirely on the supply side, measuring productivity in their own terms.

This suggests that there is a need for better intelligence on what research and innovation is getting supported in the member states. It will be hard to say precisely what the purposes of much of this research are, as research and innovation are necessarily unpredictable in many cases, but it would be possible, with improved scientometrics and greater access to funding data from key organisations, to represent portfolios and consider the balance of priorities.

7. Early thoughts on research and innovation governance indicators

This chapter provides a space for compiling promising indicators based on existing empirical information identified throughout the report. The intention is to prepare for the ground for Task 3, in which the selection of existing indicators and the development of new ones will take place.

Following the lead of the Expert group on RRI indicators, we might look for governance indicators that demonstrate or hint at the potential for 'opening up' the governance status quo. Here, we would be placing value on disruption and reflexivity (Felt and Wynne 2007) as levers for RRI. According to the expert group, indicators should therefore be developed in consultation with a wide range of stakeholders in order that a range of perspectives beyond those that conventionally frame governance are included. The challenge here is to monitor and measure networks of actors that might enable a more Responsible governance of R and I. The expert group also cautions against selecting indicators that reinforce a linear model of innovation in which autonomous science is expected to have downstream 'impact' which can be measured and, through policy initiatives, enhanced. Instead, we should begin with concepts of 'network governance' and search for indicators that adequately capture this complexity.

One clear option could be to map and measure the growing explicit consideration of RRI terminology and ideas in existing regimes for the governance of research and innovation. So we would look for evidence of RRI considerations in governance initiatives such as public-private partnerships, programme funding, regulatory frameworks and technology assessment.
However, this approach, endorsed by the expert group on RRI indicators, suffers from a problem of definition. Not all of the initiatives, actions and levers that we would wish to consider would label themselves 'RRI'.

Table 7: Indicators for Governance

Criterion	Performance indicators		Perception indicators	Key actors
	Process indicators	Outcome indicators		
Governance	Identification of formal and informal networks of research and innovation that promote RRI, both at the national and European level	For each of these networks, the N of RRI debates N of RRI protocols N of RRI policies N of RRI agreements	Involvement of the wider public in RRI debates measured e.g. through social media Involvement of the wider public in RRI policy, the development of policy, protocols	National and supranational governments, major stakeholders in science and society
Governance	Activities of funders to promote RRI	N of funding mechanisms to support RRI activities N of euros invested in RRI projects	N of references in applications to RRI N of collaborative RRI projects	Funding organisations, stakeholders

Source: Expert group on RRI indicators

Mapping de facto governance

At a higher level from that considered by the expert group, we should emphasise the importance of good data for evaluating the current *de facto* governance of science and innovation. The expert group pay more attention to new initiatives rather than the products of existing governance measures. But, for example, we might consider it impossible to develop a sense of whether current R and I regimes are governed responsibly without a clear sense of what is going on at the moment. This means, therefore, that it is vital to know what is getting funded across different regimes. Scientometric tools are being developed by Ingenio and others that allow for the mapping of research portfolios. We should consider how these can be developed in order to provide maps that can be compared with what an RRI framework might consider to be desirable (recognising that this will be contested). Criteria that have conventionally been underplayed in governance, such as diversity, could be reintroduced as an explicit proxy for some aspects of RRI (Stirling 2007).

Broadening out and opening up

Ely et al (2014) argue that a more open approach to technology assessment (which we can understand as substantially overlapping with the emerging agenda of RRI) demands a broadening of the inputs to technology assessment. This means challenging the criteria that are deemed to be relevant to the assessment of innovation, perhaps through deliberative means. And it means maintaining critical scrutiny of dominant metrics and indicators. For technology assessment, we might look in particular at the dominance of measures of economic potential on the upside and health and environmental risk on the downside.

Smits and Kuhlman (2004) describe the limits of a linear model in explaining innovation and its governance, chief among which is the presumption that innovation is simply understood and controlled. They advocate the adoption of a broader range of instruments of governance, at levels ranging from individual projects up to national and international programmes, and the need for experimentation, such as with participatory mechanisms. As a corollary of this, the indicators and measures of success therefore need to be radically broadened to account for the complexity of governance.

Conclusion

Given the inapplicability of indicators for governance that are quantifiable, a sensible approach might be to treat 'governance' as an overarching consideration across the other dimensions of responsible research and innovation. Indicators of the other dimensions could be interpreted together and complemented by qualitative expert analysis of different levels and jurisdictions in order to present a well-rounded description of progress.

Further to the section above on 'data gaps', one urgent task might be to improve knowledge on what research and innovation are getting funded and how they relate to particular grand challenges.

References

Stirling, A. (2007). A general framework for analysing diversity in science, technology and society. Journal of the Royal Society Interface, 4(15), 707-719.

Potential indicators

Existing indicators

1. Morri (RES-AGORA)
2. Eco-innovation
3. R and I policy
4. Responsibility of policy-makers
5. Science for policy

Indicators from other dimensions

6. PE 1 – models of public involvement in S&T decisionmaking
7. Ethics 1 – typology of public ethics
8. Ethics 23 – Infrastructure of ethical governance
9. OA 8 – Funder mandates for open access publishing

Need for new data

10. Portfolio diversity

8. References

Barben, D.; Fisher, E.; Selin, C.; Guston, D. (2008): Anticipatory Governance of Nanotechnology: Foresight, Engagement, and Integration. In: Hackett, E.J.; Amsterdamska, O.; Lynch, M.; Wajcman, J. (Hg.): The Handbook of Science and Technol-ogy Studies, Cambridge, S. 979-1000.

Benz, A. (2007): "Governance in connected arenas: political science analysis of coordination and control in complex control systems", in: Jansen, D. (ed.): New Forms of Governance in Research Organizations: From Disciplinary Theories towards Inter-faces and Integration, Berlin, pp. 3-22

Edler, J. et al. (2006): Understanding "Fora of Strategic Intelligence for Research and Innovation", Karlsruhe (Fraunhofer ISI): PRIME Forum Research Project

Edler, J., Kuhlmann, S. and Smits, R. (2003): New governance for innovation. The need for horizontal and systematic policy co-ordination. Report on a workshop held at the occasion of the 30th anniversary of the Fraunhofer Institute for Systems and Innova-tion Research (ISI), Karlsruhe/Germany, 14/15 November 2002, organised in col-laboration with the Copernicus Institute , Dept of Innovation Studies, Utrecht Univer-sity and the "Six Countries Programme - the Innovation Policy Network (6CP)". Karlsruhe (Fraunhofer ISI Discussion Papers Innovation System and Policy Analy-sis; No. 2/2003): Fraunhofer ISI.

Edler, J.; Kuhlmann; S., Behrens, M. (eds.) (2003): The Changing Governance Of Research And Technology Policy. The European Research Area, Cheltenham

Ely, Adrian; van Zwanenberg, Patrick; Stirling, Andrew (2014): Broadening out and open-ing up technology assessment: Approaches to enhance international development, co-ordination and democratisation. In: Research Policy 43 (3), S. 505–518

Felt, U. and Wynne, B. (2007): Taking European Knowledge Society Seriously: Report of the Expert Group on Science and Governance to the Science, Economy, and Society Directorate, Directorate-General for Research, European Commission (EC, Brussels)

Fisher, E., Mahajan, R & Mitchum, C. (2006): Midstream Modulation of Technology: Governance From Within Bulletin of Science, Technology and Society 26(6): 485-496

Guston, D. H. (2014): Understanding 'anticipatory governance'. In: Social Studies of Sci-ence, vo. 4482), p. 218-242

Kuhlmann, S. (2007): Governance of Innovation: practice, policy and theory as dancing partners. Inaugural Lecture, University of Twente, http://doc.utwente.nl/59649/1/rede_S_Kuhlman.pdf

Kuhlmann, S. / Boekholt, P. / Georghiou, L. / Guy, K. / Héraud, J.-A. / Laredo. Ph. / Lemola, T. / Loveridge, D. / Luukkonen, T. / Polt, W. / Rip, A. / Sanz-Menendez, L. / Smits, R. (1999): Improving Distributed Intelligence in Complex Innovation Systems. Final report of the Advanced Science & Technology Policy Planning Network (ASTPP), a Thematic Network of the European Targeted Socio-Economic Research Programme http://mpra.ub.uni-muenchen.de/6426/

Martin, B. and Johnston, R. (1999): "Technology Foresight for Wiring Up the National Innovation System", in: Technological Forecasting and Social Change 60, 37-54.

MASIS synthesis report http://ec.europa.eu/research/science-society/document_library/pdf_06/monitoring-policy-research-activities-on-sis_en.pdf

Nuffield Council on Bioethics, 2012. Emerging Biotechnologies: Technology, Choice and the Public Good. Nuffield Council on Biotechnologies, London (downloaded on 1

February 2013 from http://www.nuffieldbioethics.org/sites/default/files/Emerging_biotechnologies_full_report_web_0.pdf).

Smits, R. and Kuhlmann, S. (2004): "The rise of systemic instruments in innovation poli-cy", in: International Journal of Foresight and Innovation Policy 1 (1/2), 4-32

Stirling, Andy (2008): Opening Up and Closing Down. Power, Participation, and Pluralism in the Social Appraisal of Technology. In: Science, Technology & Human Values 33 (2), S. 262–294. [also in PE dimension literature]

The Report of the Expert Group on Global Governance of Science to the Science, Economy and Society Directorate of the EC http://ec.europa.eu/research/science-society/document_library/pdf_06/global-governance-020609_en.pdf

Appendix – literature review

Review guidelines

MoRRI
Final version / 17.11.2014 (rl)

Task 1: Literature review | Review template

Background and objectives
The purpose of this template is to provide each member of the review team with a common framework and reference point to conduct the literature review and, one the reviews are conducted, to facilitate a systematic and structured analysis of the literature.

According to the TOR, the main objective of this first task in the MoRRI project is to
- review of the state of knowledge regarding RRI
- define the policy context of RRI in Europe and elsewhere
- give a comparative assessment of RRI dimensions, weighing-up advantages, disadvantages and available options
- conduct a preliminary assessment of the availability of empirical evidence on the dimensions
- finalise the definitions and properties of the RRI key dimensions
- finalise the definition and properties of additional factors that may be relevant for the monitoring tasks.

How to use this document
- Due to the standardized nature of this template, you may feel that the content of the literature cannot be adequately represented. In these cases, please use the comment spaces provided for most questions.
- The literature review takes into account a selection of relevant publications in the 5 key dimensions of RRI (as defined by the EC: citizen engagement, science literacy, gender equality, open access, governance and ethics) and a selection of key publications dealing explicitly with RRI. Some of the questions in this template only relate to the 5 key dimensions, others only to the explicit RRI literature. Please make sure to fill in the template accordingly.
- Try to briefly summarise the relevant statements of the review document in your own words, perhaps using bullet points; please always refer to the page number of the document.
- If a question in the template does not apply to the publication at hand, please leave the entry blank.
- Important definitions or other central statements may be copied into the template; please always make reference to the page number of the review document
- Given the diversity of literature covered in this review, it is difficult to provide guidance on how extensive each review should be. For a "normal" journal article we expect the filled-in template to count roughly about 8-10 pages.

If you have any questions, please get in touch:
Ralf Lindner, ph.: +49 (0) 721 / 6809-292
ralf.lindner@isi.fraunhofer.de

Review reports

Basic information									**Document no.:** (citavi #)	**000**
Reviewer's name	Ralf Lindner									
1. Bibliographical information (author/s, year, title, editor/s, journal/book, volume, publisher, place of publication, pages, DOI)	Barben, D.; Fisher, E.; Selin, C.; Guston, D. (2008): Anticipatory Governance of Nanotechnology: Foresight, Engagement, and Integration. In: Hackett, E.J.; Amsterdamska, O.; Lynch, M.; Wajcman, J. (eds.): The Handbook of Science and Technology Studies, Cambridge, S. 979-1000									
2. Abstract (copy and paste)										
3. Main focus (key dimensions according to MoRRI)	RRI / RI	☐	Citizen participation	☐	Science literacy	☐	Gender equality	☐		
	Open access	☐	R&I governance and ethics	X	Other	☐				
Comment on 3:										
4. Main perspective (multiple entries possible)	Theoretical, conceptual	X	Methodological	X	Policy oriented	☐	Evaluative	☐		
	Other	☐	Comment on 4:							
5. Type of document	Scientific article	☐	Book chapter	X	Book	☐	Report	☐		
	Project deliverable	☐	Policy/ strategy document	☐	Other	☐				
Comment on 5:										
6. System level (if applicable)	Global	X	European	☐	National	☐	Sub-national	☐		
Comment on 6:										
7.1 Country focus (if applicable, please specify)										
7.2 Country/ies of origin indicated by institutional affiliation of editor(s)/ author(s) (if applicable, please specify)	US-American, German				Comments on 7:					
Data and indicator availability										
8.1 Data, indicators, measurements	Document contains data	☐	If yes, please specify (including page numbers in document)							
Comment on 8.1										
8.2 Reference made to data, indicators	Document refers to relevant	☐	If yes, please list source(s): (URLs, data banks, reports, statistics, etc.)							

measurements in other sources	sources			
Comment on 8.2:				

Guiding questions for review
- please add page numbers where appropriate -

9. How is RRI characterized? (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
9.1 Which definition of RRI is being used? (author's definition or reference to other source)	
9.2 Which aspects of RRI receive special emphasis? (e.g., certain normative goals, procedural approaches, reference to one or more of the 5 key dimensions, …)	
9.2 Which arguments are presented in support or rejection/criticism of RRI?	
9.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	
Comments on 9.	
10. Policy context of RRI (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
10.1 Which RRI-related developments (international, EU, national, sub-national) are mentioned, how are they characterized and what are they aiming at (strategies, funding initiatives, regulation etc.)?	
10.2 Which approaches, instruments are discussed to facilitate the uptake of RRI?	
10.3 Which problems, barriers,	

potential drawbacks for RRI are brining discussed, how could they be addressed?	
Comments on 10.	
11. Claims regarding the effects of RRI and / or the key dimension (benefits, costs, disadvantages, trade-offs)	
11.1 What claims are being made?	Starting from the statement that nanotechnologies are fundamentally uncertain, the authors argue that nanotech provides opportunities for STS researchers to participate in the construction of safe, civil and equitable nanotech developments. However, the uncertainty of the technology calls for novel approaches in the conduct of research evaluation and assessment, and new organizations that span the boundary between scientific knowledge generation and public action (Guston 2000) [p. 979] More generally, the authors also state that nanotech's fundamental uncertainties might be a broader case for science and technology decision-making. The authors' main point is the suggestion that in view of policy developments and the STS research activities in the nanotech field, an "emerging yet coherent program that represents a potentially significant development for STS" can be identified. [p.989] The "program" is emerging at the interface of and in interaction with a number of important processes (research, policy making, anticipation of nanotech).
11.2 Which arguments are used to support the claim(s)?	The book chapter describes the characteristics and features of the emerging "program" of STS in nanotech, see 11.1 above. These key characteristics are [p.990ff]: "Ensemble-ization" [p.990f] Here the authors refer to the concept of a "research ensemble" (Hackett et al. 2004: 748) which represents an arrangement of "materials, methods, established practices […] ideas, and enabling theories" (ibid). The concept is used because of its strong focus on the interactions between the work of researchers and wider aspects of society and policy influencing the research processes. Empirically, the authors observe a number of STS engagements with nanotech that resemble the "ensemble-ization" as multiple research methods such as foresight, engagements and integration have been combined around the societal aspects of nanotech since the early 2000s. The observed STS ensembles facilitate interactions among various actor groups and are geared towards constructing and shaping decision making processes, research practices, levels of public trust and transparency. Anticipatory Governance [p. 991ff] Authors argue that discourse about nanotech and the fundamental uncertainties associated with these technologies call for "cultivation of a societal capacity for foresight" [p. 991] → not only formal foresight methodologies, but in general more abilities to take the future into consideration in present decision-

	making. Anticipatory governance in this sense implies that action is not only based on analytical capacities and empirical knowledge. It also requires social and epistemological capacities (such as collective self-criticism, imagination, and learning). The notion of "anticipation" is not to be mixed up with "predictive certainty". The concept rather implies an "[…] awareness of the co-production of sociotechnical knowledge and the importance of richly imagining sociotechnical alternatives that might inspire its use." [p. 992] The concept of "governance" usually denotes a move away from top-down government approaches. Activities related to the concept of governance are diverse and numerous (reaching e.g. from licensing, soft and hard regulation to various participatory practices…) "Anticipatory governance comprises the ability of a variety of lay and expert stakeholders, both individually and through an array of feedback mechanisms, to collectively imagine, critique, and thereby shape the issues presented by merging technologies before they become reified in particular ways. Anticipatory governance evokes a distributed capacity for learning and interaction stimulated into present action by reflection on imagined present and future sociotechnical outcomes." [p. 992f]
11.3 What evidence is presented to support the claims? (e.g., data, indicators, research results, case studies, anecdotal evidence)	The authors observe a number of background developments both in the policy (debate) related to nanotech as well as in STS practices which, according to the article, can be seen to give rise to an emerging "program": NGO / activist responses to nanotech [p.983]: → numerous "doomsday scenarios" associated with nanotech; some groups calling for a moratorium on some forms of nanotech research due to safety and health concerns Response from policy-makers to uncertainty of nanotech and NGO responses: → infected by what A. Rip called "nanophobia-phobia" (Rip 2006): as a response taking a more proactive approach to societal issues, aiming to integrate ELSI, but also social science research into R&D processes. Another learning compared to biotechnology: nanotech was not approached as it would automatically produce the most desirable outcomes. "Instead, policy makers now endorse the conception of R&D that requires the integration of broader societal considerations in order to serve the public good and support decision-making." [p983] → → using the term "responsible innovation" or related headings, governmental institutions in the US and the EU started to propose integrating social science research into nanotech programs early on; according to the authors, all this seems to be indicating more receptiveness to issues of engagement and societal concerns. In sum, on the policy level, the article observes a growing tendency to re-design policy and institutions with the aim to better contribute to the social shaping of nanotechnologies. This is being initiated along 2 avenues: 1) social science is expected to provide nanotech researchers with more contextualized awareness and social perspectives 2) social science is expected to learn more about the processes of the

	emergence of nanotech, thereby improving the basis for making assessments about impacts. [p.984] The article presents some of the main methodological approaches in the STS field which might contribute to responding to the policy developments and challenges in the nanotech field outlined above: Foresight, engagement, integration [p.984ff] Foresight Numerous approaches are being described which share the common goal of improving reflexivity by applying a divers set of foresight methods in the nanotech field [p. 985f] Engagement [p. 987f] Here, different activities aimed at improving the public understanding of science, public dialogues and participatory practices (e.g. consensus conferences) are portrayed. Integration [p. 988f] The authors describe attempts to integrate social science perspectives into the actual research processes at the laboratory level, also with the aim to increase reflexivity and self-critical knowledge generation.
11.4 According to the author(s), which type of evidence/data is missing to better support the claim? (e.g. data gaps, limitations with regard to analytical levels, lack of indicator specifications etc.)	
Comments on 11.	
12. Key dimensions of RRI (For literature dealing with one or more of the 5 key dimensions.)	
12.1 How is the key dimension defined? (terminology applied, central features/characteristics)	
12.2 Does the document reach beyond one single dimension / are more than one of the key dimensions discussed? If yes, what is the proposed relationship between different dimensions (complementary, contradictory…)?	
12.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	

Comments on 12.	
13. Are other important "dimensions" / aspects of RRI discussed, presented which are so far not covered by MoRRI?	
14. Anything else deemed relevant?	
15. General comments and remarks	
16. Relevant sources cited (Please list references to other sources cited in the literature which seem to be highly relevant for MoRRI and/or represent important contributions in the field)	

Basic information									**Document no.:** (citavi #)	**#1028**
Reviewer's name	Ralf Lindner									
1. Bibliographical information (author/s, year, title, editor/s, journal/book, volume, publisher, place of publication, pages, DOI)	Fisher, E., Mahajan, R & Mitchum, C. (2006): Midstream Modulation of Technology: Governance From Within Bulletin of Science, Technology and Society 26(6): 485-496									
2. Abstract (copy and paste)	Public "upstream engagement" and other approaches to the social control of technology are currently receiving international attention in policy discourses around emerging technologies such as nanotechnology. To the extent that such approaches hold implications for research and development (R&D) activities, the distinct participation of scientists and engineers is required. The capacity of technoscientists to broaden the influences on R&D activities, however, implies that they conduct R&D differently. This article discusses the possibility for more reflexive participation by scientists and engineers in the internal governance of technology development. It reviews various historical attempts to govern technoscience and introduces the concept of midstream modulation, through which scientists and engineers, ideally in concert with others, bring societal considerations to bear on their work.									
3. Main focus (key dimensions according to MoRRI)	RRI / RI	☐	Citizen participation	☐	Science literacy	☐	Gender equality	☐		
	Open access	☐	R&I governance and ethics	X	Other	☐				
Comment on 3:										
4. Main perspective (multiple entries possible)	Theoretical, conceptual	X	Methodological	X	Policy oriented	☐	Evaluative	☐		
	Other	☐	Comment on 4:							
5. Type of document	Scientific article	X	Book chapter	☐	Book	☐	Report	☐		
	Project deliverable	☐	Policy/ strategy document	☐	Other	☐				
Comment on 5:										
6. System level (if applicable)	Global	☐	European	☐	National	☐	Sub-national	☐		

Comment on 6:		
7.1 Country focus (if applicable, please specify)		
7.2 Country/ies of origin indicated by institutional affiliation of editor(s)/ author(s) (if applicable, please specify)		Comments on 7:

Data and indicator availability				
8.1 Data, indicators, measurements	Document contains data	☐	If yes, please specify (including page numbers in document)	
Comment on 8.1				
8.2 Reference made to data, indicators measurements in other sources	Document refers to relevant sources	☐	If yes, please list source(s): (URLs, data banks, reports, statistics, etc.)	
Comment on 8.2:				

Guiding questions for review *- please add page numbers where appropriate -*	
9. How is RRI characterized? (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
9.1 Which definition of RRI is being used? (author's definition or reference to other source)	
9.2 Which aspects of RRI receive special emphasis? (e.g., certain normative goals, procedural approaches, reference to one or more of the 5 key dimensions, …)	
9.2 Which arguments are presented in support or rejection/criticism of RRI?	

9.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	
Comments on 9.	
10. Policy context of RRI (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
10.1 Which RRI-related developments (international, EU, national, sub-national) are mentioned, how are they characterized and what are they aiming at (strategies, funding initiatives, regulation etc.)?	
10.2 Which approaches, instruments are discussed to facilitate the uptake of RRI?	
10.3 Which problems, barriers, potential drawbacks for RRI are brining discussed, how could they be addressed?	
Comments on 10.	
11. Claims regarding the effects of RRI and / or the key dimension (benefits, costs, disadvantages, trade-offs)	
11.1 What claims are being made?	In the policy community dealing with the governance of research and technology, a growing need to ensure that the development of emerging technologies is undertaken with due consideration of societal and ethical concerns is being articulated. So far, these concerns have been mostly addressed both "downstream" – via regulation and market mechanisms – and "upstream" with instruments such as technology assessment and engagement. However, the authors point out that the actual R&D process constitutes a largely neglected point for intervention. [p485] They claim that upstream engagement as an attempt to improve the policy approach to technology needs to be complemented with "midstream" integration of technical and societal aspects. [p486]

11.2 Which arguments are used to support the claim(s)?	It is being increasingly acknowledged that new and emerging technologies – such as nanotechnology, biotechnology, cognitive technology – have the potential to disrupt established social and technological systems. Linked to this are growing public concerns about the social and environmental implications of these developments. [p485] The underlying problem of the governance of technology and the rationale for a midstream integration of societal concerns the authors are promoting is based on the observation that the governance of technology in society is performed by two disconnected institutional agents: While one institutional agent promotes technoscience, another set of institutions has the objective to control the effects (or regulatory agencies are separate from technology-promoting agencies). [see Schot and Rip 1997: 264]. Upstream engagement is increasingly seen to have the potential to shape the paths of technological development by the means of "improved social intelligence and better decision-making" (Wilsdon et al. 2005, p. 19) [p.488]. The ultimate objective of participation is to improve sociotechnical outcomes (Guston 2004) [p.488] Authors refer to 2 main lines of reasoning for the promotion of participation [p. 489]: 1) Perspective of the promotion of technoscience: challenge is a lack of trust and acceptance which might put funding and commercialization at risk. Thus, including the views of the public is a matter of self-interest 2) Perspective of social control: concerned with alleviating undesirable concequences and maximizing public interest by providing choice and distributing power. → both perspectives agree that through a broader set of inputs decisions related to technoscience may become more robust and, perhaps more desirable in terms of their outcomes. Implications for the technoscientific community [p.489f]: - Public engagement can potentially broaden social and ethical reflections of scientists and engineers - R&D processes will need to be undertaken differently, in effect impacting on the established practices of self-governance. Particularly this aspect faces strong resistance on the side of scientists. Challenge: unclear how societal perspectives, which have been articulated in engagement processes, can be integrated in/made effective on the bench. Introducing the midstream [p. 490f]: Authors point to the limits of the "stream metaphor" in characterizing research and innovation processes as it tends to support the flawed idea of a linear model. Despite its limitations, the authors see value in the stream metaphor as it underlines the relationship between research (policy), R&D and innovation. Based on these considerations, the authors characterize the main stages of technoscientific governance as upstream, midstream and

	downstream. The midstream part is where the technoscientific community works on th technological trajectories (mostly blacked-boxed). The authors argue that particularly the midstream stage is often overlooked as an opportunity for effective governance. This is supported by the point that during R&D processes, "choices are constantly being made about the form, the function, and the use of technology." (Shot 1992: 37). → theoretical opportunities for midstream modulation of trajectories. Considerable challenge to actually govern midstream processes: → physical limitations, limited resources, limited expertise, institutional and organizational pressures, interests; moreover, lack of policy mechanisms for the midstream for anticipating end-user outcomes. [p.491] Consequently, R&D remains conceptualized as an instrument of technoscientific promotion and where the control of which is delegated to external mechanisms.[comment RL: RRI can be viewed as an attempt to integrate the control perspective into the actual midstream process, e.g. by the means of making actors more responsive to external perspectives…] Modulating the midstream Modulation of ongoing sociotechnical processes can also be applied to the midstream, according to the authors. → has potential to support the integration of the otherwise separated functions of control and promotion. Instruments and approaches to modulate R&D from within already are available. Challenge: capacities to midstream modulation should take root locally and be distributed; emphasis should be put on capacity building of actors to become attentive to nested processes and interactions with which they operate → leads to "reflexive awareness" [p. 492]. Aspect pointed out by authors: midstream modulation occurs all the time at different levels – either consciously or not. Thus, midstream modulation from a governance perspective should begin with an analysis of the de facto modulation already happening. In a next step, reflexive modulation can then give rise to goal-directed modulation.
11.3 What evidence is presented to support the claims? (e.g., data, indicators, research results, case studies, anecdotal evidence)	Brief review of historical attempts to govern science and technology [p. 486ff]: • attempts to enlarge social control of technology already in 18th & 19th century – through indirect public involvement or through governance • other examples of attempts to broaden external influence over science and technology: labour movement's demands for improved working conditions (early 19th century); the public health movement (mid 19th century) etc. → common aspect of these: a) largely reactive to undesired consequences; ad b) external as they were initiated by outsides of the

	science and technology realm After WWII, growing number and broader participation to influence the technosciences, e.g. various codes and declaration (in the life sciences) to influence science via rules and standards During 1950s onward, nuclear weapons and, a bit later, pollution problems led to another wave of urgency to bridge "internal and external" governance of science. On balance, only a minority of efforts to govern sociotechnical outcomes was initiated from within science (e.g., selfregulation such as promoted by the 'Committee on Scientific Freedom and Responsibility of Science) (see Mitcham 2003). [p. 487] TA and ELSI as new approaches to governance of science [p. 487]: • TA in mid 20th century which emphasized the analysis of social and ethical implications of scientific and technological change; TA had a strong anticipatory perspective with the aim to inform the governance of science and R&D • critique of early forms of TA as an oversimplification of R&D dynamics and outcomes; improvements via more participatory and constructive approaches of TA Upstream engagement [p.488f]: Emphasis on more interactive approaches to science- society relations. Idea of these dialogues: complement traditional communication approaches with the aim to create a learning flow and discourse in both directions (also from public to science). → influence of public is meant to co-shape technological developments before technological paths become locked-in. Well-known example of public participation in national policy decisions about science and technology: Danish Board of technology's consensus conferences. Observation: participation activities are receiving growing attention and support from policy makers mainly because expert-based risk assessment and "deficit communication" failed to adequately address concerns re new technologies. Authors cite examples of statements and publications which indicate that ideas of "upstream engagement" are gaining momentum, in essence calling for a reform of the governance of science and technology.
11.4 According to the author(s), which type of evidence/data is missing to better support the claim? (e.g. data gaps, limitations with regard to analytical levels, lack of indicator specifications etc.)	
Comments on 11.	
12. Key dimensions of RRI (For literature dealing with one or more of the 5 key dimensions.)	

12.1 How is the key dimension defined? (terminology applied, central features/characteristics)	
12.2 Does the document reach beyond one single dimension / are more than one of the key dimensions discussed? If yes, what is the proposed relationship between different dimensions (complementary, contradictory…)?	
12.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	
Comments on 12.	
13. Are other important "dimensions" / aspects of RRI discussed, presented which are so far not covered by MoRRI?	
14. Anything else deemed relevant?	
15. General comments and remarks	
16. Relevant sources cited (Please list references to other sources cited in the literature which seem to be highly relevant for MoRRI and/or represent important contributions in the field)	Schot, J., & Rip, A. (1997). The past and future of constructive technology assessment. *Technological Forecasting and Social Change*, *54*, 251-268.

Basic information		**Document no.:** (citavi #)	**#1073**
Reviewer's name	Ralf Lindner		
1. Bibliographical information (author/s, year, title, editor/s, journal/book, volume, publisher, place of publication, pages, DOI)	Kuhlmann, Stefan (2007): Governance of Innovation: practice, policy and theory as dancing partners. Inaugural Lecture, University of Twente, http://doc.utwente.nl/59649/1/rede_S_Kuhlman.pdf		

2. Abstract (copy and paste)								
3. Main focus (key dimensions according to MoRRI)	RRI / RI	☐	Citizen participation	☐	Science literacy	☐	Gender equality	☐
	Open access	☐	R&I governance and ethics	x	Other	☐		
Comment on 3:								
4. Main perspective (multiple entries possible)	Theoretical, conceptual	x	Methodological	☐	Policy oriented	x	Evaluative	☐
	Other	☐	Comment on 4:					
5. Type of document	Scientific article	☐	Book chapter	☐	Book	☐	Report	☐
	Project deliverable	☐	Policy/ strategy document	☐	Other	x		
Comment on 5:	Address delivered upon the acceptance of the Chair Foundations of Science, Technology and Society Faculty Management and Governance, University of Twente							
6. System level (if applicable)	Global	☐	European	☐	National	☐	Sub-national	☐
Comment on 6:								
7.1 Country focus (if applicable, please specify)								
7.2 Country/ies of origin indicated by institutional affiliation of editor(s)/ author(s) (if applicable, please specify)					Comments on 7:			

Data and indicator availability				
8.1 Data, indicators, measurements	Document contains data	☐	If yes, please specify (including page numbers in document)	
Comment on 8.1				
8.2 Reference made to data, indicators measurements in other sources	Document refers to relevant sources	☐	If yes, please list source(s): (URLs, data banks, reports, statistics, etc.)	
Comment on 8.2:				

Guiding questions for review *- please add page numbers where appropriate -*	
9. How is RRI characterized? (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
9.1 Which definition of RRI is being used? (author's definition or reference to other source)	
9.2 Which aspects of RRI receive special emphasis? (e.g., certain normative goals, procedural approaches, reference to one or more of the 5 key dimensions, …)	
9.2 Which arguments are presented in support or rejection/criticism of RRI?	

9.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	
Comments on 9.	
10. Policy context of RRI (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
10.1 Which RRI-related developments (international, EU, national, sub-national) are mentioned, how are they characterized and what are they aiming at (strategies, funding initiatives, regulation etc.)?	
10.2 Which approaches, instruments are discussed to facilitate the uptake of RRI?	
10.3 Which problems, barriers, potential drawbacks for RRI are brining discussed, how could they be addressed?	
Comments on 10.	
11. Claims regarding the effects of RRI and / or the key dimension (benefits, costs, disadvantages, trade-offs)	
11.1 What claims are being made?	The article argues for the need of STI studies in order to improve our understanding of the governance of science, technology and innovation. Three interrelated aspects of STI governance are dealt with in detail: a) interrelationship between science, technology and innovation in practice b) the role of public policy c) the role of STI studies (understood as "theory in action") → metaphor for the interaction of these three aspects: "partners on a dance floor" moving to different melodies and forming different configurations Based on the assumption that STI are interwoven in practice, then the policies and the governance in this area will reflect this heterogeneity. WRT to the relationship of the 3 interrelated aspects of STI governance: STI studies/theory have the potential to provide the other 2 aspects (policy and practice) with arguments, strategic intelligence and new approaches [p 12]; STI studies have a reflexive potential can may contribute to a more rationale debate

	An important factor facilitating learning and the exchange of knowledge between the different actors involved in STI is the principle of an open discussion culture [p. 14] → this leads the author to emphasize the importance of the existence of "fora" for debates of STI issues (cf. Edler et al. 2006): Def. of fora: "defined as institutionalized spaces specifically designed for the deliberation between heterogeneous actors with the purpose of informing and conditioning the form and direction of strategic social choices in the governance of science and technology." [p16] The concept/idea of "strategic intelligence" (SI) also plays an important role in the workings of the "fora": "SI has been defined as a set of sources of information and explorative as well as analytical (theoretical, heuristic, methodological) tools19 - often distributed across organizations and countries - employed to produce useful insight in the actual or potential costs and effects of public or private policy and management." [p. 16] Important examples of SI are evaluation studies, numerous variants of technology assessment and foresight processes → SI is presented as a crucial element of the debates and exchanges among the actors involved in the "fora".
11.2 Which arguments are used to support the claim(s)?	The governance of STI is an issue of concern because it is a precondition for successful attempt in influencing "regimes" of STI. [p.5] Regimes are different in terms of their governance. Author points out 2 basic types of regimes (based on Felt et al 2007): - economics of techno-scientific promise: governance assumption of this regime → division of labour between tech promoters and civil society, thus putting society in a passive consumer role [p. 6f] - economics and socio-politics of collective experimentation: instead of the promotion of a specific technological promise, the goals of the regime are derived from matters of concern, to a large extent articulated by users and other actors (including approaches such as open innovation) [p.6] Authors sites other findings according to which there is a growing interest in demand-oriented R&I policies and in improved governance of R&I, particularly wrt better inclusion of stakeholders (Leon et al. 2007); the report also shows that successful countries in terms of innovation indicators, "the more they dispose of a broader spectrum of experimental policy approaches and mechanisms for the inclusion of stakeholders in innovation regimes [p.7] The governance of a given STI field has a strong influence whether the "regime" will follow the techno-scientific promises or the socio-political collective experimentation: particularly the way actors are involved in the processes of policy choices seems to be decisive [p10] "Fora" for the debate of STI are needed due to a number of reasons: - the growing complexity of the governance of science and innovation policy - likewise, research and innovation processes are influenced by multiple factors, increasing uncertainty - the actor landscapes have become more divers, leading to growing plurality of values, interests etc. - the boundaries between public and private spheres have become blurred

	→ a response to this complexity is to engage in more interactivity among actors in the STI policy field [p. 16]
11.3 What evidence is presented to support the claims? (e.g., data, indicators, research results, case studies, anecdotal evidence)	Author present examples of "fora" in which STI is debated and where STI-related policy decisions are prepared [p14]: the 6CP network and the project ATBEST.
11.4 According to the author(s), which type of evidence/data is missing to better support the claim? (e.g. data gaps, limitations with regard to analytical levels, lack of indicator specifications etc.)	
Comments on 11.	
12. Key dimensions of RRI (For literature dealing with one or more of the 5 key dimensions.)	
12.1 How is the key dimension defined? (terminology applied, central features/characteristics)	Key dimension here: governance of science, technology and innovation. Governance is defined as "as a heuristic, borrowed from political science, denoting the dynamic interrelation of involved (mostly organized) actors, their resources, interests and power, fora for debate and arenas for negotiation between actors, rules of the game, and policy instruments applied (e.g. Kuhlmann 2001; Benz 2006; Braun 2006). [p. 6] An important quality aspect of STI governance is the character of public debate between relevant actors (stakeholders, policy makers, experts).
12.2 Does the document reach beyond one single dimension / are more than one of the key dimensions discussed? If yes, what is the proposed relationship between different dimensions (complementary, contradictory…)?	
12.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	The author's governance concept is taken from political science. Understanding that S, T and I have an interactive, holistic relationship.
Comments on 12.	
13. Are other important "dimensions" / aspects of RRI discussed, presented which are so far not covered by MoRRI?	
14. Anything else deemed	

relevant?	
15. General comments and remarks	
16. Relevant sources cited (Please list references to other sources cited in the literature which seem to be highly relevant for MoRRI and/or represent important contributions in the field)	Edler, J.; Joly, P.-B.; Kuhlmann, S.; Nedeva, M.; Propp, T.; Rip, A.; Ruhland, S.; Thomas, D. (2006): *Understanding "Fora of Strategic Intelligence for Research and Innovation"*. The PRIME Forum Research Project, Karlsruhe (Fraunhofer ISI; http://www.isi.fraunhofer.de/p/Downloads/PRIME_FORUM_Final_Reportv2.pdf) Felt, U.; Wynne, B; Callon, M.; Gonçalves, M.E.; Jasanoff. S.; Jepsen, M.; Joly, P.-B.; Konopasek, Z.; May, S.; Neubauer, C.; Rip, A.; Siune, K.; Stirling, A.; Tallachini, M. (2007): *Taking European Knowledge Society Seriously*. Report of the Expert Group on Science and Governance, Brussels (European Commission) Leon, G. / Romanainen, J. / Inizan, S. / Kneucker, R. / Kuhlmann, S. / Nauwelaers, C. / Timmerhuis, V. (2007): *Open research and innovation policies for Europe - A leap forward!* A Report of the Lisbon Expert Group, Brussels (European Commission) Voß, J.-P.; Bauknecht, D.; Kemp, R. (eds.) (2006): *Reflexive Governance for Sustainable Development*, Cheltenham (Edward Elgar)

Basic information									**Document no.:** (citavi #)	**000**
Reviewer's name	Ralf Lindner									
1. Bibliographical information (author/s, year, title, editor/s, journal/book, volume, publisher, place of publication, pages, DOI)	Martin, B. and Johnston, R. (1999): "Technology Foresight for Wiring Up the National Innovation System", in: Technological Forecasting and Social Change 60, 37-54.									
2. Abstract (copy and paste)	Since 1990, technology foresight has spread rapidly. We begin by analyzing the reasons for this before examining the specific political background to technology foresight in the United Kingdom, Australia, and New Zealand. The article analyzes and compares the approaches to foresight in these countries, identifying the strengths and weaknesses of each approach. We then propose a new rationale for technology foresight, which centers on its role in "wiring up" and thereby strengthening the national innovation system, before arriving at a number of conclusions.									
3. Main focus (key dimensions according to MoRRI)	RRI / RI	☐	Citizen participation	☐	Science literacy	☐	Gender equality	☐		
	Open access	☐	R&I governance and ethics	X	Other	☐				
Comment on 3:										
4. Main perspective (multiple entries possible)	Theoretical, conceptual	☐	Methodological	X	Policy oriented	☐	Evaluative	☐		
	Other	☐	Comment on 4:							
5. Type of document	Scientific article	X	Book chapter	☐	Book	☐	Report	☐		
	Project deliverable	☐	Policy/ strategy document	☐	Other	☐				
Comment on 5:										
6. System level (if applicable)	Global	X	European	☐	National	☐	Sub-national	☐		
Comment on 6:										
7.1 Country focus (if applicable, please specify)	UK, Australia, New Zealand									
7.2 Country/ies of origin indicated by institutional	UK				Comments on 7:					

affiliation of editor(s)/ author(s) (if applicable, please specify)		

Data and indicator availability				
8.1 Data, indicators, measurements	Document contains data	☐	If yes, please specify (including page numbers in document)	
Comment on 8.1				
8.2 Reference made to data, indicators measurements in other sources	Document refers to relevant sources	☐	If yes, please list source(s): (URLs, data banks, reports, statistics, etc.)	
Comment on 8.2:				

Guiding questions for review *- please add page numbers where appropriate -*	
9. How is RRI characterized? (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
9.1 Which definition of RRI is being used? (author's definition or reference to other source)	
9.2 Which aspects of RRI receive special emphasis? (e.g., certain normative goals, procedural approaches, reference to one or more of the 5 key dimensions, …)	
9.2 Which arguments are presented in support or rejection/criticism of RRI?	

9.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	
Comments on 9.	
10. Policy context of RRI (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
10.1 Which RRI-related developments (international, EU, national, sub-national) are mentioned, how are they characterized and what are they aiming at (strategies, funding initiatives, regulation etc.)?	
10.2 Which approaches, instruments are discussed to facilitate the uptake of RRI?	
10.3 Which problems, barriers, potential drawbacks for RRI are brining discussed, how could they be addressed?	
Comments on 10.	
11. Claims regarding the effects of RRI and / or the key dimension (benefits, costs, disadvantages, trade-offs)	
11.1 What claims are being made?	The authors propose a new rationale for technology foresight, centering on its function to "wire up" innovation systems. Foresight is viewed as a method which has the potential to effectively link science and technology to wealth creation and quality of life improvement due to its function in "wiring up" innovation systems and thereby improving learning processes [p. 37f] The growing importance of foresight since the 1990s is related to these functions [p. 39]: - Represents an approach for making choices about research and innovation, helps identifying priorities - Is a mechanism for linking research and innovation with wealth creation - Supports communication and forge partnerships between

	researchers, funders and users
11.2 Which arguments are used to support the claim(s)?	The need for a new rationale for technology foresight is based on - the observation of far-reaching global changes in politics and the economy, resulting in increasing global competition [p. 38] and interrelated with - technological developments in computing and communications, - broad trend towards deregulation. New technologies and innovations are becoming more important as a consequence of these trends: increasingly they are perceived as "strategic resources", particularly as a means of to respond to increasing wage differences and the mobility of firms. These competitive pressures seem particularly high for Australia and New Zealand as they are part of a region with rapidly growing economies with very low labour and production costs. Another factor putting pressure on science and technology and increasing the need for foresight are demands for greater public accountability for public spending. Nations have to make choices for which research and innovation public money should be spent, particularly in smaller economies such as Australia and New Zealand; and mechanisms are needed that link science and technology better to economic and social needs. The authors present foresight as such a mechanism. The article refers to a set of process benefits ("5Cs") which can be brought about by conducting foresight processes (developed by Martin/Irvine 1989): 1. "Foresight has enhanced Communication (among companies and among researchers and between researchers, users, and funders); 2. it has resulted in greater Concentration on the longer-term future; 3. it has provided a means of Coordination (again among researchers and between researchers, users, and funders); 4. it has helped create a level of Consensus on desirable futures over the next 10–20 years; 5. it has generated Commitment to turning the ideas emerging from the foresight programme into action." [p. 48] Using the insights provided from the systems of innovation perspective, the authors argue that foresight processes have the potential to support policies aiming at the correction of systemic failures and improving the interaction and the exchange between the innovation system components as the process benefits of foresight (above) foster network relations between the actors of an innovation system. [p. 50] → foresight as a means of "wiring up" the connections within a system. The function of "wiring up" is also viewed to facilitate system wide learning processes, and this is understood to be particularly important in so-called knowledge-based economies.

11.3 What evidence is presented to support the claims? (e.g., data, indicators, research results, case studies, anecdotal evidence)	The article presents insights in technology foresight in 3 countries: UK, Australia and New Zealand; the foresight exercises in these countries are analyzed, compared and assessed. The comparison of the 3 selected countries shows [p. 46ff]: - all three cases pursued a holistic approach in the foresight exercise - the balance of technology push and demand pull was different in the three countries, with the UK showing an even balance
11.4 According to the author(s), which type of evidence/data is missing to better support the claim? (e.g. data gaps, limitations with regard to analytical levels, lack of indicator specifications etc.)	
Comments on 11.	
12. Key dimensions of RRI (For literature dealing with one or more of the 5 key dimensions.)	
12.1 How is the key dimension defined? (terminology applied, central features/characteristics)	
12.2 Does the document reach beyond one single dimension / are more than one of the key dimensions discussed? If yes, what is the proposed relationship between different dimensions (complementary, contradictory…)?	
12.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	
Comments on 12.	
13. Are other important "dimensions" / aspects of RRI discussed, presented which are so far not covered by MoRRI?	
14. Anything else deemed relevant?	
15. General comments and remarks	
16. Relevant sources cited (Please list references to other sources cited in the literature which seem to be highly relevant for MoRRI and/or represent important contributions in the field)	Martin, B. R., and Irvine, J.: Research Foresight: Priority-Setting in Science. Pinter Publishers, London and New York, 1989.

Basic information									**Document no.:** (citavi #)	**000**
Reviewer's name	Ralf Lindner									
1. Bibliographical information (author/s, year, title, editor/s, journal/book, volume, publisher, place of publication, pages, DOI)	Smits, R. and Kuhlmann, S. (2004): "The rise of systemic instruments in innovation policy", in: International Journal of Foresight and Innovation Policy 1 (1/2), 4-32									
2. Abstract (copy and paste)	Starting from the co-evolutionary development of innovation practice, theory and policy, five functions are identified that play a crucial role in the management of present-day innovation processes: (1) management of interfaces, (2) (de-) construction and organizing (innovation) systems, (3) providing a platform for learning and experimenting, (4) providing an infrastructure for strategic intelligence and (5) stimulating demand articulation, strategy and vision development. From a first analysis of innovation policy instrument portfolios it is concluded that the already existing instruments only cover a small part of the five `systemic' functions. Furthermore it is concluded that the portfolios are heavily dominated by financial instruments. It is argued that the development of a (relatively) new type of instrument, the systemic instruments, should be furthered in order to tune the instrument portfolio better to the needs of actors involved in innovation processes. In order to obtain a better insight into the characteristics of systemic instruments, their success and fail factors, and into strategies for their further development, effectiveness and use, an analysis of four systemic instruments avant la letter is presented. From this analysis conclusions concerning the need for and best practice of systemic instruments are drawn, suggestions for policy are derived and questions for further research are proposed.									
3. Main focus (key dimensions according to MoRRI)	RRI / RI	☐	Citizen participation	☐	Science literacy	☐	Gender equality	☐		
	Open access	☐	R&I governance and ethics	X	Other	X				
Comment on 3:										
4. Main perspective (multiple entries possible)	Theoretical, conceptual	X	Methodological	☐	Policy oriented	X	Evaluative	☐		
	Other	☐	Comment on 4:							
5. Type of document	Scientific article	X	Book chapter	☐	Book	☐	Report	☐		
	Project deliverable	☐	Policy/ strategy document	☐	Other	☐				
Comment on 5:										
6. System level (if applicable)	Global	☐	European	☐	National	☐	Sub-national	☐		
Comment on 6:										
7.1 Country focus (if applicable, please specify)										
7.2 Country/ies of origin indicated by institutional affiliation of editor(s)/ author(s) (if applicable, please specify)	Authors from the Netherlands and Germany				Comments on 7:					

Data and indicator availability				
8.1 Data, indicators, measurements	Document contains data	☐	If yes, please specify (including page numbers in document)	
Comment on 8.1				
8.2 Reference made to data, indicators measurements in other sources	Document refers to relevant sources	☐	If yes, please list source(s): (URLs, data banks, reports, statistics, etc.)	
Comment on 8.2:				

Guiding questions for review *- please add page numbers where appropriate -*	
9. How is RRI characterized? (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
9.1 Which definition of RRI is being used? (author's definition or reference to other source)	
9.2 Which aspects of RRI receive special emphasis? (e.g., certain normative goals, procedural approaches, reference to one or more of the 5 key dimensions, …)	
9.2 Which arguments are presented in support or rejection/criticism of RRI?	
9.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	
Comments on 9.	
10. Policy context of RRI (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
10.1 Which RRI-related developments (international, EU, national, sub-national) are mentioned, how are they characterized and what are they aiming at (strategies, funding	

initiatives, regulation etc.)?	
10.2 Which approaches, instruments are discussed to facilitate the uptake of RRI?	
10.3 Which problems, barriers, potential drawbacks for RRI are brining discussed, how could they be addressed?	
Comments on 10.	
11. Claims regarding the effects of RRI and / or the key dimension (benefits, costs, disadvantages, trade-offs)	
11.1 What claims are being made?	Authors claim that with regard to innovation policy, "systemic instruments" (SI) are gaining importance. SI have the potential to fulfill 5 functions: [p. 5] 1. Management of interfaces 2. (de-) constructing and organsing (innovation) systems 3. Providing a platform for learning and experimenting 4. Providing an infrastructure for strategic intelligence 5. Stimulating demand articulation, strategy and vision development Rise of systemic instruments [p.11] Increasingly, instruments are needed that not only focus on individual organizations but also on the system level. Examples of such instruments: foresight programmes, information campaigns… This rise reflects structural changes in intervention strategies [p. 17]
11.2 Which arguments are used to support the claim(s)?	Trends in innovation practice: 3 main trends are identified by the authors which have implications for innovation policy: [p. 6ff] 1. End of the linear model → Implications: increasing need to manage interfaces between users and producers of innovation 2. Rise of the systems approach /systems perspective → Implications for policy: need to embed innovation policy in socio-economic context, and the need to shift from top-down to network steering (horizontal policies [RL: or "governance"]); move from "market failure" to "system imperfections" as a rationale for intervention 3. Inherent uncertainty and the need for learning → Implication: under the conditions of uncertainty, innovation policy needs a wide variety of instruments; this also implies that innovation policy should leave leeway "for experimentation and calculated failures" (Boekholt et al. 2001) [p. 8] Authors see basically 2 ways in which learning processes necessary to cope with uncertainty can be supported by policy-making: 1) Reduction of uncertainty by using strategic intelligence (TA, foresight, evaluations etc.) 2) Providing actors with the instruments and environments for experimenting and learning (e.g. participative instruments, scenario workshops)

	Conclusions [p. 25ff] Authors draw conclusion from their analysis that contemporary innovation processes need instruments supporting functions at system level. They also see a tendency to introduce more systemic instruments in the portfolio of existing innovation policy instruments. These should be seen to complement (and not to replace) existing instruments.
11.3 What evidence is presented to support the claims? (e.g., data, indicators, research results, case studies, anecdotal evidence)	Authors provide a review of the development of the Dutch innovation policy during the last 25 years [p.12-15] → conclusion that Dutch example shows a trend towards instruments addressing systemic functions Analysis of 4 systemic instruments [p17ff] Selected examples are: - Innonet - DTO - cluster approach - future programme
11.4 According to the author(s), which type of evidence/data is missing to better support the claim? (e.g. data gaps, limitations with regard to analytical levels, lack of indicator specifications etc.)	Agenda for further research [p. 27f] - More stock taking of systemic instruments and more comparative analysis is needed - …
Comments on 11.	RL: Observation that authors do not address any questions of directionality wrt to innovation policy. One of the central motivations of RRI – namely addressing the question which innovation do we want? – has not yet entered the analytic scope of the research presented in this article.
12. Key dimensions of RRI (For literature dealing with one or more of the 5 key dimensions.)	
12.1 How is the key dimension defined? (terminology applied, central features/characteristics)	
12.2 Does the document reach beyond one single dimension / are more than one of the key dimensions discussed? If yes, what is the proposed relationship between different dimensions (complementary, contradictory…)?	
12.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to?	

(e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	
Comments on 12.	
13. Are other important "dimensions" / aspects of RRI discussed, presented which are so far not covered by MoRRI?	
14. Anything else deemed relevant?	
15. General comments and remarks	
16. Relevant sources cited (Please list references to other sources cited in the literature which seem to be highly relevant for MoRRI and/or represent important contributions in the field)	

Basic information									**Document no.:** (citavi #)	**#982**
Reviewer's name	Kerstin Goos									
1. Bibliographical information (author/s, year, title, editor/s, journal/book, volume, publisher, place of publication, pages, DOI)	Stirling, Andy (2008:) "Opening Up" and "Closing Down". Power, Participation, and Pluralism in the Social Appraisal of Technology. *Science, Technology, & Human Values.* Volume 33 Number 2, 262-294.									
2. Abstract (copy and paste)	Discursive deference in the governance of science and technology is rebalancing from expert analysis toward participatory deliberation. Linear, scientistic conceptions of innovation are giving ground to more plural, socially situated understandings. Yet, growing recognition of social agency in technology choice is countered by persistently deterministic notions of technological progress. This article addresses this increasingly stark disjuncture. Distinguishing between "appraisal" and "commitment" in technology choice, it highlights contrasting implications of normative, instrumental, and substantive imperatives in appraisal. Focusing on the role of power, it identifies key commonalities transcending the analysis/participation dichotomy. Each is equally susceptible to instrumental framing for variously weak and strong forms of justification. To address the disjuncture, it is concluded that greater appreciation is required—in both analytic and participatory appraisal—to facilitating the opening up (rather than the closing down) of governance commitments on science and technology.									
3. Main focus (key dimensions according to MoRRI)	RRI / RI	☐	Citizen participation	x	Science literacy	☐	Gender equality	☐		
	Open access	☐	R&I governance and ethics	☐	Other	☐				
Comment on 3:										
4. Main perspective (multiple entries possible)	Theoretical, conceptual	x	Methodological	☐	Policy oriented	☐	Evaluative	☐		
	Other	☐	Comment on 4:							
5. Type of document	Scientific article	x	Book chapter	☐	Book	☐	Report	☐		
	Project deliverable	☐	Policy/ strategy document	☐	Other	☐				
Comment on 5:										
6. System level (if applicable)	Global	☐	European	☐	National	☐	Sub-national	☐		

Comment on 6:	-			
7.1 Country focus (if applicable, please specify)	No country focus. Several UK examples are mentioned though.			
7.2 Country/ies of origin indicated by institutional affiliation of editor(s)/ author(s) (if applicable, please specify)	UK			Comments on 7:
Data and indicator availability				
8.1 Data, indicators, measurements	Document contains data	x	If yes, please specify (including page numbers in document)	Authors mentions several examples from the UK to support his arguments - p. 265: UK policy on nuclear power - p.266: UK energy policy - further references to UK policy: p.269, p.273, p.277 - p. 271 : environmentalist stakeholders in Germany, European environment agency.
Comment on 8.1				
8.2 Reference made to data, indicators measurements in other sources	Document refers to relevant sources	☐	If yes, please list source(s): (URLs, data banks, reports, statistics, etc.)	
Comment on 8.2:				
Guiding questions for review *- please add page numbers where appropriate -*				
9. How is RRI characterized? (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)				
9.1 Which definition of RRI is being used? (author's definition or reference to other source)	-			
9.2 Which aspects of RRI receive special emphasis? (e.g., certain normative goals, procedural approaches, reference to one or more of the 5 key dimensions, …)	-			
9.2 Which arguments are				

presented in support or rejection/criticism of RRI?	-
9.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	-
Comments on 9.	
10. Policy context of RRI (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
10.1 Which RRI-related developments (international, EU, national, sub-national) are mentioned, how are they characterized and what are they aiming at (strategies, funding initiatives, regulation etc.)?	-
10.2 Which approaches, instruments are discussed to facilitate the uptake of RRI?	-
10.3 Which problems, barriers, potential drawbacks for RRI are brining discussed, how could they be addressed?	-
Comments on 10.	
11. Claims regarding the effects of RRI and / or the key dimension (benefits, costs, disadvantages, trade-offs)	
11.1 What claims are being made?	- Efforts both to understand and to affect progressive change should shift attention away from stylized analysis/participation contrasts and towards "opening up" analytic and participatory appraisal alike. Stirling questions the stark dichotomy between expert analysis and participatory practices. (p.268) It is necessary to place attention to the validity and utility of the dichotomy. Therefore he: o Distinguishes between appraisal and commitment o Identifies crosscutting attributes of appraisal, applying equally to analytic and participatory approaches (instrumental, substantive and normative imperatives) o Considers the role of political, institutional and economic power o And finally comes to the conclusion that both have crosscutting issues and one way to think about these is as a distinction between the role of social appraisal

	in opening up or closing down wider policy discourses on science and technology choice. - Whatever the result, consideration of these questions of framing, justification, and power shows that the distinction between opening up and closing down is of considerable normative, substantive, and instrumental importance. In many ways, the distinction may therefore be more salient than conventional contrasts couched in terms such as new versus old, citizens versus specialists, quantitative versus qualitative, or analytic versus deliberative. The significance is all the more acute for being subject to such relative neglect in the academic and policy literature.
11.2 Which arguments are used to support the claim(s)?	Technological commitments: represent "ontological", discursive, institutional, economic, and infrastructural attachments to particular technological pathways. Such commitments encompass a range of structures and processes for allocating resources (such as policy attention, research funding, venture capital, training investments, regulatory standards, fiscal support, contractual risks, and legal liabilities). Commitments need not necessarily take the form of explicit, discrete or even deliberate decisions. (p.265) - Example: recent U.K. policy on nuclear power, activities broadly constituting social commitment include statements of "necessity" by senior officials (King 2005), announcements of government objectives (Blair 2005), drawing up of international agreements (Blair 2006), enactment of laws (Nuclear Industry Association 2006), establishing organizations (Beckett 2002), issuing licenses and setting standards (Health and Safety Executive 2006), developing new research programs (Engineering and Physical Science Research Council 2006), introducing educational curricula (Office of Nuclear Energy 2006), and establishing training and procurement exercises. The social appraisal of technology, on the other hand, concerns the ways in which knowledges, understandings, and evaluations are constructed and rendered salient to inform these commitments. Here we find epistemic processes of learning and communication (Webler, Kastenholz, and Renn 1995; Wynne 1995), rather than substantive ontologies of intervention and deliberate choice (Leach, Scoones, and Wynne 2005). Appraisal does not just imply formalized assessment routines, but also includes wider sociopolitical discourse in what is elsewhere termed the "agora" (Nowotny, Scott, and Gibbons 2001). (p.265 ff.) - activities that might be seen broadly to constitute social appraisal in U.K. energy policy include parliamentary inquiries (Environmental Audit Committee 2005), government reviews (Strategy Unit of the Prime Minister [SU] 2002), advisory body reports (Sustainable Development Commission 2006), and academic and commercial (de W. Waller et al. 2006) assessments. The wider discursive aspects of appraisal include media interventions (BBC 2006), nongovernmental organization initiatives (Nuclear Spin 2006), and wider cultural ctivities (BBC 1985). A common feature of participation and analysis lies in the importance of intentionality. Rationales and motivations underlying appraisal involves three starkly distinguishable types of imperatives: "normative", "instrumental" and "substantive". - **Normative imperatives** take a variety of forms, all focusing on the *process* of appraisal. In expert analysis, a range of idealized Mertonian or Popperian norms are invoked to characterize ostensibly "value free" (Morris 2000) and "sound science" (Blair 2003). In participatory deliberation, normative imperatives variously highlight Habermas's notions of "ideal speech" (1968), "legitimacy" (1975), and "communicative rationality" (1984); Rawls's "public reason" (1993, 1997); or qualities of "social learning" (Wynne 1992), "authenticity" (Dryzek 2002, 1), and "reflexivity" (Wynne 2002; Stirling 2006b). such widening of social agency beyond immediately proximate political actors can be problematic for incumbent interests. As a consequence, examples abound of participatory

	exercises being ignored by their sponsors (Pimbert and Wakeford 2002). • Example: Tony Blair illustrates the underlying attitude in the assertion that repetition of a consultation process will not affect policy. Accordingly, practitioners and researchers alike frequently find themselves reflecting on the persistent failure of participatory appraisals to "impact" tangibly on policy making (Renn, Webler, and Wiedemann 1995). (p.269) - **Instrumental imperative** in appraisal: focus is on outcomes. appraisal is regarded in terms of efficacy in realizing particular favored ends. • Example: the U.K. government's elaborate "GM Nation" initiative (Department for Environment, Food and Rural Affairs [DEFRA] 2003) actually exercised little impact on policy (Baldwin, Webster, and Elliott 2004). In justifying their caution (DEFRA 2004), the government itself cited a critical officially contracted evaluation in which negative conclusions were partly based on application of this kind of policy impact criterion. (p. 270) - **Substantive imperative**: Like instrumental imperatives, it concerns outcomes rather than explicitly normative preoccupations with process. The distinguishing feature of a substantive perspective, however, is that the outcomes in question are not defined instrumentally, in terms of particular values or interests (whose normative justifications remain implicit or concealed). Instead, the focus is on explicit, socially deliberated, publicly reasoned evaluative criteria for the outcomes themselves. One particular instance of this substantive perspective on appraisal is found in high-profile debates about the "precautionary principle" (O'Riordan and Jordan 2000). (p. 271) • Example: environmentalist stakeholders in Germany led to what even manufacturers eventually acknowledged not only as environmental and health but also technical and economic improvements. Similar substantive arguments are advanced by the European Environment Agency. **Power** (p.273ff): it is not necessarily the case that exercise of power in any particular appraisal exercise will be explicit or deliberate, nor that the particular power structures immediately concerned will automatically be those that are extant in wider governance. Whether the exercise of power is judged to be good or bad depends on the context and the point of view. The most well-established context for discussion of power in appraisal concerns the way in which outputs of ostensibly definitive expert analysis are highly susceptible to various kinds of „framing". What is less well recognized is that the design, implementation, and interpretation of participatory appraisal also display similar latitude for contingency and agency (Scoones and Thompson 2001; Wakeford 2001). Framing thus raises important queries both for analytic and participatory appraisal—under normative, substantive, and instrumental perspectives alike. It reveals the enormous latitude for inadvertent, tacit (or deliberate, covert) influence of power. - Examples: management of BSE in the UK food chain (p.277) (expert analysis); UK national consensus conference on GMO (participatory procedure) **Closing down** the formation of technological commitments: the aim is instrumentally to assist incumbent policy-making actors by providing means to justification. - Example: routine features of scientific advisory processes in many countries. (p. 279) **Opening up**: emphasis lies in revealing to wider policy discourses any inherent indeterminacies, contingencies or capacities for agency. - Example: UK science advisory body, GM SRP (p.280)

11.3 What evidence is presented to support the claims? (e.g., data, indicators, research results, case studies, anecdotal evidence)	See 11.2. /8.1.
11.4 According to the author(s), which type of evidence/data is missing to better support the claim? (e.g. data gaps, limitations with regard to analytical levels, lack of indicator specifications etc.)	-
Comments on 11.	
12. Key dimensions of RRI (For literature dealing with one or more of the 5 key dimensions.)	
12.1 How is the key dimension defined? (terminology applied, central features/characteristics)	Stirling contrasts participatory activities with expert analysis. (p.267). On one hand, there are established, narrow, rigid, quantitative, opaque, exclusive, expert-based, analytic procedures tending to privilege economic considerations and incumbent interests (Collingridge 1980; Schwartz and Thompson 1990; Flyvbjerg 1998). Broadly, these include approaches like risk/cost–benefit analysis, technology/life cycle assessment, Delphi methods, and expert advice. On the other hand are seen new, relatively unconstrained, qualitative, sensitive, inclusive, transparent, deliberative, democratically legitimate, "participatory" processes promising greater emphasis on otherwise marginal issues and interests such as environment, health, and fairness (Fischer 1990; Irwin 1995; Sclove 1995). In this way, in fields such as agriculture, energy, transport, and communications (Renn, Webler, and Wiedemann 1995; Joss and Durant 1995), citizen engagement is defended by contrast with (if not a substitute for) conventional expert analysis.
12.2 Does the document reach beyond one single dimension / are more than one of the key dimensions discussed? If yes, what is the proposed relationship between different dimensions (complementary, contradictory…)?	-
12.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	STS, deliberative democracy
Comments on 12.	
13. Are other important "dimensions" / aspects of RRI discussed, presented which are so far not covered by MoRRI?	-
14. Anything else deemed relevant?	

15. General comments and remarks	
16. Relevant sources cited (Please list references to other sources cited in the literature which seem to be highly relevant for MoRRI and/or represent important contributions in the field)	Work of Luigi Pellizzoni, Brian Wynne, Sheila Jasanoff; literature related to the UK cases

Basic information								**Document no.:** (citavi #)	**12**
Reviewer's name	Kerstin Goos								
1. Bibliographical information (author/s, year, title, editor/s, journal/book, volume, publisher, place of publication, pages, DOI)	Benz, Arthur (2007): Governance in Connected Arenas – Political Science Analysis of Coordination and Control in Complex Rule Systems. In: Jansen, Dorothea (Ed.): New Forms of Governance in Research Organisations. Disciplinary Approaches, Interfaces and Integration, p.3-22.								
2. Abstract (copy and paste)									
3. Main focus (key dimensions according to MoRRI)	RRI / RI	☐	Citizen participation	☐	Science literacy	☐	Gender equality	☐	
	Open access	☐	R&I governance and ethics	x	Other	☐			
Comment on 3:									
4. Main perspective (multiple entries possible)	Theoretical, conceptual	x	Methodological	☐	Policy oriented	☐	Evaluative	☐	
	Other	☐	Comment on 4:						
5. Type of document	Scientific article	☐	Book chapter	x	Book	☐	Report	☐	
	Project deliverable	☐	Policy/ strategy document	☐	Other	☐			
Comment on 5:									
6. System level (if applicable)	Global	☐	European	☐	National	☐	Sub-national	☐	
Comment on 6:									
7.1 Country focus (if applicable, please specify)									
7.2 Country/ies of origin indicated by institutional affiliation of editor(s)/ author(s)(if applicable, please specify)	german				Comments on 7:				

Data and indicator availability				
8.1 Data, indicators, measurements	Document contains data	☐	If yes, please specify (including page numbers in document)	
Comment on 8.1				
8.2 Reference made to data, indicators measurements in other sources	Document refers to relevant sources	☐	If yes, please list source(s): (URLs, data banks, reports, statistics, etc.)	
Comment on 8.2:				

Guiding questions for review *- please add page numbers where appropriate -*	
9. How is RRI characterized? (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
9.1 Which definition of RRI is being used? (author's definition or reference to other source)	-
9.2 Which aspects of RRI receive special emphasis? (e.g., certain normative goals, procedural approaches, reference to one or more of the 5 key dimensions, …)	-
9.2 Which arguments are presented in support or rejection/criticism of RRI?	-

9.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	-
Comments on 9.	
10. Policy context of RRI (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
10.1 Which RRI-related developments (international, EU, national, sub-national) are mentioned, how are they characterized and what are they aiming at (strategies, funding initiatives, regulation etc.)?	-
10.2 Which approaches, instruments are discussed to facilitate the uptake of RRI?	-
10.3 Which problems, barriers, potential drawbacks for RRI are brining discussed, how could they be addressed?	-
Comments on 10.	
11. Claims regarding the effects of RRI and / or the key dimension (benefits, costs, disadvantages, trade-offs)	
11.1 What claims are being made?	three main claims are made: 1) When speaking about governance we have to realize that the stabilizing of regulating effects of institutions is limited. Beyond the stabilizing effect of structures, governance is shaped by the strategic actions of participants. (p.17) 2) If the power of actors and procedures of policy-making are not fixed by rules but subject to manipulation, then the issue of democratic legitimacy arises anew. Strategies of actors can be essential for making governance effective, but can also exclude feasible alternatives. Policy-making in governance can also depend on private actors, who are not accountable to any group of affected citizens. (p.18) 3) If the legitimacy of actors is disputable, governance regimes

	require procedures for debating and deciding on the inclusion or exclusion of actors and about the structures of power. → balancing of power between arenas is essential, the "governance of governance" or "meta-governance" is the issue.(p.19ff)
11.2 Which arguments are used to support the claim(s)?	- 4 types of simple governance regimes can be used to describe arenas of policy-making and to understand specific mechanisms working in them: hierarchy, network, competition, negotiation. Governance is to be understood as a combination of structure and procedure, i.e. the way actors interact and the way structures are formed and changed. Mostly, we find combinations of hierarchies with networks, competition and negotiation. P.6ff - When policies are made in connected arenas, decisions that are both effective and approved turn out to be difficult. More often than not, effectiveness depends on policy-making in one arena, whereas results have to get approval in another. Decisions are the result of strategic interactions, and the outcome of these processes cannot be guaranteed at the outset. Actors are embedded in rule systems, either entrenched in institutions or emerging form ongoing interactions. P.9ff - The typology of governance modes provides a basis for clarifying the problem of connected arenas. Depending on the governance structure, different consequences of rule systems arise. Some rule systems enable reliable assessments of policies to be expected in an arena while others make results uncertain not only for external observers, but also for insiders. P.10 ff - Rules in arenas can restrict actors and prevent them from adjusting their behavior to requirements in other arenas, or they can have the effect that actors make policies without knowing what they can deliver. In these cases, rule systems in connected arenas are incompatible and governance is doomed to fails because coordination and control can be obstructed contradicting activities. Failure can appear in different outcomes. See p. 13ff. - Governance failure does not necessarily result from structural conditions. In governance in multiple arenas, actors are confronted by "traps" of collective decision-making, but they are not caught in these traps. In general, iterated interaction between actors in governance allows for collective learning and for the incremental adjustment of individual strategies. More often than not there are a limited number of actors in decisive positions who are able to influence how issues, processes and structures are dealt with. Strategies could be: framing of policies, strategies related to procedures and changing of structures.
11.3 What evidence is presented to support the claims? (e.g., data, indicators, research results, case studies, anecdotal evidence)	The author presents anecdotal evidence: - P.10: example for when decisions that are both effective and approved turn out to be more difficult - P.12: example for problems of coordination in connected arenas of a complex governance regime - P.17: example for how institutionalized negotiations or networks support the power of veto-players against policy-

	changes and institutional development
11.4 According to the author(s), which type of evidence/data is missing to better support the claim? (e.g. data gaps, limitations with regard to analytical levels, lack of indicator specifications etc.)	
Comments on 11.	
12. Key dimensions of RRI (For literature dealing with one or more of the 5 key dimensions.)	
12.1 How is the key dimension defined? (terminology applied, central features/characteristics)	p.3: Scientific concept of governance is far from clearly defined. In political science, governance means the coordination and control of autonomous but interdependent actors either by an external authority of by internal mechanism of self-regulation or self-control (Mayntz/Scharpf 1995). Different forms of coordination and control are covered by the term: unilateral regulation in hierarchies, mutual adjustment in themarket, agreement in negotiations or trust and consensus in networks and social communities. In addition to this broad conception of governance as the coordination and control of interdependent actions of societal actors, a narrower concept has emerged as scholars have regarded government and governance as two distinct forms of governing. This chapter is focusing on governance in connected arenas and assumes that this is the most important issue political scientists are dealing with in governance research.
12.2 Does the document reach beyond one single dimension / are more than one of the key dimensions discussed? If yes, what is the proposed relationship between different dimensions (complementary, contradictory…)?	
12.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	Political science, political economy
Comments on 12.	
13. Are other important "dimensions" / aspects of RRI discussed, presented which are	

so far not covered by MoRRI?	
14. Anything else deemed relevant?	
15. General comments and remarks	
16. Relevant sources cited (Please list references to other sources cited in the literature which seem to be highly relevant for MoRRI and/or represent important contributions in the field)	Authors he cites: Fritz Scharpf, Renate Mayntz, Bob Jessop

Basic information									**Document no.:** (citavi #)	**549**
Reviewer's name	Kerstin Goos									
1. Bibliographical information (author/s, year, title, editor/s, journal/book, volume, publisher, place of publication, pages, DOI)	Ely, Adrian; van Zwanenberg, Patrick; Stirling, Andrew (2014): Broadening out and opening up technology assessment: Approaches to enhance international development, co-ordination and democratisation. In: Research Policy 43 (3), S. 505–518									
2. Abstract (copy and paste)	Technology assessment (TA) has a strong history of helping to identify priorities and improve environ-mental sustainability, cost-effectiveness and wider benefits in the technology policies and innovationstrategies of nation-states. At international levels, TA has the potential to enhance the roles of sci-ence, technology and innovation towards achieving the Millennium Development Goals, effectivelyimplementing the UN Framework on Climate Change and fostering general global transitions to 'greeneconomies'. However, when effectively recommending single ostensibly 'best' technologies or strategies,TA practices can serve unjustifiably to 'close down' debate, failing adequately to address technical uncer-tainties and social ambiguities, reducing scope for democratic accountability and co-ordination acrossscales and contexts. This paper investigates ways in which contrasting processes 'broadening out' and'opening up' TA can enhance both rigour and democratic accountability in technology policy, as well asfacilitating social relevance and international cooperation. These methods allow TA to illuminate options,uncertainties and ambiguities and so inform wider political debates about how the contending questions,values and knowledges of different social interests often favour contrasting innovation pathways. In thisway TA can foster both technical robustness and social legitimacy in subsequent policy-making. Drawingon three empirical case studies (at local, national and international levels), the paper discusses detailedcases and methods, where recent TA exercises have contributed to this 'broadening out' and 'openingup'. It ends by exploring wider implications and challenges for national and international technologyassessment processes that focus on global sustainable development challenges.									
3. Main focus (key dimensions according to MoRRI)	RRI / RI	☐	Citizen participation	☐	Science literacy	☐	Gender equality	☐		
	Open access	☐	R&I governance and ethics	x	Other	☐				
Comment on 3:										
4. Main perspective (multiple entries possible)	Theoretical, conceptual	☐	Methodological	☐	Policy oriented	x	Evaluative	☐		
	Other	☐	Comment on 4:							
5. Type of document	Scientific article	x	Book chapter	☐	Book	☐	Report	☐		
	Project deliverable	☐	Policy/ strategy document	☐	Other	☐				
Comment on 5:										
6. System level (if applicable)	Global	x	European	☐	National	☐	Sub-national	☐		

Comment on 6:	Article looks at TA at the international level, often refers to comparisons between developing countries and EU. Article also focuses on the role of TA in international development processes.	
7.1 Country focus (if applicable, please specify)		
7.2 Country/ies of origin indicated by institutional affiliation of editor(s)/ author(s) (if applicable, please specify)	GB, Argentina	Comments on 7:

Data and indicator availability				
8.1 Data, indicators, measurements Comment on 8.1	Document contains data	x	If yes, please specify (including page numbers in document)	Case studies, see 11.3.
8.2 Reference made to data, indicators measurements in other sources Comment on 8.2:	Document refers to relevant sources	☐	If yes, please list source(s): (URLs, data banks, reports, statistics, etc.)	

Guiding questions for review *- please add page numbers where appropriate -*	
9. How is RRI characterized? (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
9.1 Which definition of RRI is being used? (author's definition or reference to other source)	-
9.2 Which aspects of RRI receive special emphasis? (e.g., certain normative goals, procedural approaches, reference to one or more of the 5 key dimensions, …)	-
9.2 Which arguments are presented in support or rejection/criticism of RRI?	-

9.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	-
Comments on 9.	
10. Policy context of RRI (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
10.1 Which RRI-related developments (international, EU, national, sub-national) are mentioned, how are they characterized and what are they aiming at (strategies, funding initiatives, regulation etc.)?	-
10.2 Which approaches, instruments are discussed to facilitate the uptake of RRI?	-
10.3 Which problems, barriers, potential drawbacks for RRI are brining discussed, how could they be addressed?	-
Comments on 10.	
11. Claims regarding the effects of RRI and / or the key dimension (benefits, costs, disadvantages, trade-offs)	
11.1 What claims are being made?	p.515: Technology assessment practices of various kinds have crucial roles to play in fostering more democratic appraisal of innovation to serve the goals of more sustainable innovation pathways. There is a need towards more coherently coordinated internationally networked approaches. “Broadening out” and “opening up” TA enhances appreciations of the inherently social and political implications, uncertainties and possibilities of innovation. By broadening out of inputs to TA we might resist the instrumental pressure and be more confident that the results achieve a more substantive reflection of shared public values and priorities – including those of less affluent, privileged and powerful groups. (p.508) Advantages (p.513ff) - problem definitions and potential options that are more

	important to use communities were identified that might otherwise have been overlooked in a more traditional TA exercise. - identification of potentially overlooked innovation pathways - identification of practical problems Challenges - Selecting the stakeholders and representatives to be included in the initial framing of the process - Experience and appropriate capabilities are sometimes also lacking - Ensuring that the broad range of participants recognised the utility and validity of the exercise The opening up of plural and conditional outputs in TA can contribute to more robust decision making in the face of otherwise insoluble policy challenges. (p.509) Advantages (p.514 ff) - Can catalyse a shift in debates – most notably providing a key resource for civil society but increasingly being recognized by government and other organizations - Strengthening of connection between actors and institutions involved in innovation processes Challenges - Presenting the output in an easily accessible and clear format - Absence of a clear policy solution
11.2 Which arguments are used to support the claim(s)?	See 11.1
11.3 What evidence is presented to support the claims? (e.g., data, indicators, research results, case studies, anecdotal evidence)	p.510ff: Three case studies in areas of agriculture strategy, emerging technologies for water provision and innovation in crop production are presented: the intergovernmental International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD); a set of NGO initiatives to explore options for potable water provision in Zimbabwe, Peru and Nepal; and a researcher-led appraisal of agricultural innovation pathways in Kenya. In each case the authors exemplify the kinds of "broadening out" and "opening up", the mechanisms by which this was achieved, and the associated implications.
11.4 According to the author(s), which type of evidence/data is missing to better support the claim? (e.g. data gaps, limitations with regard to analytical levels, lack of indicator specifications etc.)	
Comments on 11.	
12. Key dimensions of RRI (For literature dealing with one or more of the 5 key dimensions.)	
12.1 How is the key dimension defined? (terminology applied, central features/characteristics)	No explicit definition of governance. Article focuses on technology assessment.

12.2 Does the document reach beyond one single dimension / are more than one of the key dimensions discussed? If yes, what is the proposed relationship between different dimensions (complementary, contradictory…)?	Deliberation and participation
12.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	
Comments on 12.	
13. Are other important "dimensions" / aspects of RRI discussed, presented which are so far not covered by MoRRI?	
14. Anything else deemed relevant?	
15. General comments and remarks	
16. Relevant sources cited (Please list references to other sources cited in the literature which seem to be highly relevant for MoRRI and/or represent important contributions in the field)	

Basic information		**Document no.:** (citavi #)	**406**
Reviewer's name	Kerstin Goos		
1. Bibliographical information (author/s, year, title, editor/s, journal/book, volume, publisher, place of publication, pages, DOI)	Felt, Ulrike; Wynne, Brian (2007): Taking European Knowledge Society Seriously. Report of the Expert Group on Science and Governance to the Science, Economy and Society Directorate, Directorate-General for Research, European Commission.		
2. Abstract (copy and paste)	This report is the product of an expert working group acting under mandate from the European Commission Directorate General for Research (DG RTD), on the topic of European science and governance. We interpreted our mandate to have three main concerns: i. How to respond to the widely-recognised problem of European public unease with science, especially in relation to new		

	science-based technologies; ii. How to further the stated EU commitment to improve the involvement of diverse elements of democratic civil society in European science and governance; iii. How at the same time to address urgent European policy challenges that are often taken as strongly scientific in nature – including climate change, sustainability, environment and development. Inevitably we have dealt with these policy concerns unevenly, and each deserves more extensive treatment, perhaps especially where we have suggested usually unremarked intersections between them. The overall logic of the report is outlined below. The working group was composed of scholars from the academic field of science and technology studies (STS) and related areas of philosophy, sociology, policy analysis and law, as well as participants from public interest and labour organisations. We were asked to provide insights which might improve the treatment of these governance challenges, both in Europe and more broadly, as well as to make specific practical recommendations where appropriate.							
3. Main focus (key dimensions according to MoRRI)	RRI / RI	☐	Citizen participation	☐	Science literacy	☐	Gender equality	☐
	Open access	☐	R&I governance and ethics	x	Other	☐		
Comment on 3:								
4. Main perspective (multiple entries possible)	Theoretical, conceptual	☐	Methodological	☐	Policy oriented	x	Evaluative	☐
	Other	☐	Comment on 4:					
5. Type of document	Scientific article	☐	Book chapter	☐	Book	☐	Report	x
	Project deliverable	☐	Policy/ strategy document	☐	Other	☐		
Comment on 5:								
6. System level (if applicable)	Global	☐	European	x	National	☐	Sub-national	☐
Comment on 6:								
7.1 Country focus (if applicable, please specify)								
7.2 Country/ies of origin indicated by institutional affiliation of editor(s)/ author(s) (if applicable, please specify)	Expert group: various nationalities and affiliated institutions				Comments on 7:			

Data and indicator availability				
8.1 Data, indicators, measurements	Document contains data	☐	If yes, please specify (including page numbers in document)	
Comment on 8.1				
8.2 Reference made to data, indicators measurements in other sources	Document refers to relevant sources	☐	If yes, please list source(s): (URLs, data banks, reports, statistics, etc.)	
Comment on 8.2:				

Guiding questions for review *- please add page numbers where appropriate -*	
9. How is RRI characterized? (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
9.1 Which definition of RRI is being used? (author's definition or reference to other source)	-
9.2 Which aspects of RRI receive special emphasis? (e.g., certain normative goals, procedural approaches, reference to one or more of the 5 key dimensions, …)	-
9.2 Which arguments are presented in support or rejection/criticism of RRI?	-

9.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	-
Comments on 9.	
10. Policy context of RRI (For literature dealing explicitly with responsible (research) and innovation. If the publication deals with one of the 5 key dimensions, please proceed to 11.)	
10.1 Which RRI-related developments (international, EU, national, sub-national) are mentioned, how are they characterized and what are they aiming at (strategies, funding initiatives, regulation etc.)?	-
10.2 Which approaches, instruments are discussed to facilitate the uptake of RRI?	-
10.3 Which problems, barriers, potential drawbacks for RRI are brining discussed, how could they be addressed?	-
Comments on 10.	
11. Claims regarding the effects of RRI and / or the key dimension (benefits, costs, disadvantages, trade-offs)	
11.1 What claims are being made?	Dominant assumptions about science, policy, and citizens which implicitly define existing institutional approaches to these issues need to be rethought at a fundamental level. - The particular shapes issues of social and policy concern take are open to a variety of equally legitimate and authoritative interpretations. New ways should be found to promote "reflexive thinking" about the multiple meanings and normatively salient dimensions of these objects of attention. Therefore new institutions and procedures for more inclusive and pluralistic discussion, learning and challenge have to be adopted. - Outcomes and effects of science are better regarded as contigent than as determinate predictions represented by

	sound scientific knowledge. Contingent dimensions of science are likely to grow. There is a need for explicit official and scientific acknowledgement of the existence and importance of contingency and the value of socially- and culturally-distributed knowledge in Europe. - EC should undertake as a medium-term strategic commitment the institutional development of more robust, informed and accountable ways of articulating a collective normative capacity in the settling of trajectories for research and innovation. - Some dominant master-narratives of science and society in EU science and governance, need to be reconsidered a replaced (that innovation is a linear process, that evidence-based approaches to policy involve not prior normative social framing commitments, that innovation-oriented research is not imbued with normative understandings about the possible social benefits of the research) - More kinds of comprehensive learning deserves to be promoted. The tendency to redefine cultural differences and dislocation of the kind of underlying 'the European public uneasiness with science' problem as if they were solely pedagogical problems is part of the production of further public unease. A corrective would be procedures for achieving more deliberate forms of 'reflexive learning', occurring before public opposition and failure to exercise authority.
11.2 Which arguments are used to support the claim(s)?	Claims and arguments are developed throughout the report by discussing the public unease with science, shifts from risk governance to innovation governance, learning normative deliberation, public engagement, and narratives and imaginaries of science and society.
11.3 What evidence is presented to support the claims? (e.g., data, indicators, research results, case studies, anecdotal evidence)	Anecdotal evidence in "boxes" throughout the report.
11.4 According to the author(s), which type of evidence/data is missing to better support the claim? (e.g. data gaps, limitations with regard to analytical levels, lack of indicator specifications etc.)	
Comments on 11.	
12. Key dimensions of RRI (For literature dealing with one or more of the 5 key dimensions.)	
12.1 How is the key dimension defined? (terminology applied, central features/characteristics)	
12.2 Does the document reach beyond one single dimension / are more than one of the key	Public engagement, ethics

dimensions discussed? If yes, what is the proposed relationship between different dimensions (complementary, contradictory…)?	
12.3 To which concepts, theories, approaches, schools of thought, communities (scientific or practice) in the area of research and innovation does the literature relate or make reference to? (e.g., STS, constructive TA, anticipatory governance, foresight, deliberative democracy, …)	
Comments on 12.	
13. Are other important "dimensions" / aspects of RRI discussed, presented which are so far not covered by MoRRI?	
14. Anything else deemed relevant?	
15. General comments and remarks	
16. Relevant sources cited (Please list references to other sources cited in the literature which seem to be highly relevant for MoRRI and/or represent important contributions in the field)	