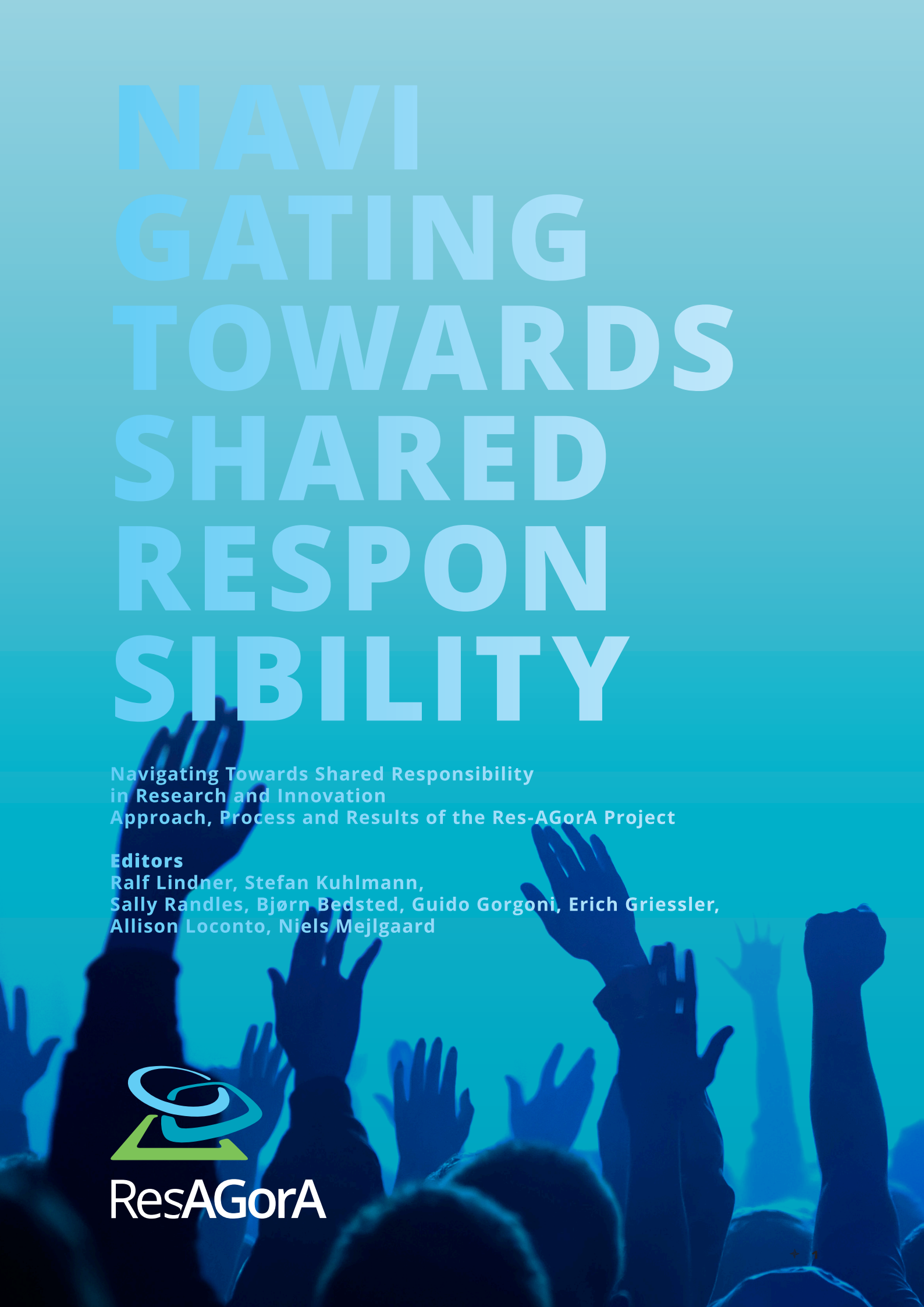
NAVIGATING TOWARDS SHARED RESPONSIBILITY

Navigating Towards Shared Responsibility
in Research and Innovation
Approach, Process and Results of the Res-AGorA Project

Editors
Ralf Lindner, Stefan Kuhlmann,
Sally Randles, Bjørn Bedsted, Guido Gorgoni, Erich Griessler,
Allison Loconto, Niels Mejlgaard



ResAGorA

NAVIGATING TOWARDS SHARED RESPONSIBILITY

Navigating Towards Shared Responsibility
in Research and Innovation
Approach, Process and Results of the Res-AGorA Project

Editors
Ralf Lindner, Stefan Kuhlmann,
Sally Randles, Bjørn Bedsted, Guido Gorgoni, Erich Griessler,
Allison Loconto, Niels Mejlgaard

ResAGorA

Contents

4 **Preface**

7 **Part 1 ✧ Introduction**

9 **1 Introduction**

21 **Part 2 ✧ Approaching RRI Governance**

23 **2 RRI as a governance paradigm: What is new?**

31 **3 Framings and frameworks: six grand narratives of *de facto* rri**

39 **4 Evolution of a concept: a scientometric analysis of RRI**

47 **5 Res-AGorA concepts and approach**

55 **6 The Res-AGorA Co-construction Method**

63 **Part 3 ✧ Empirical programme**

65 **7 Res-AGorA case studies: drawing transversal lessons**

77 Case Study 1 ✧ Fracking

85 Case Study 2 ✧ Danish priority-setting for strategic research

93 Case Study 3 ✧ NanoNextNL

101 Case Study 4 ✧ Critical organisations

109 Case Study 5 ✧ Synthetic biology

115 **8 Monitoring RRI in Europe: approach and key observations**

121 **9 RRI at European universities**

127 **10 RRI in European member states: the case of Germany**

133 **Part 4 ✧ Governing towards responsibilisation**

135 **11 Responsibility Navigator**

161 **12 Conclusion: making responsibility an institutionalised ambition**

169 References

181 Authors

184 The Res-AGorA project consortium

185 Acknowledgement

186 Imprint

Preface

Ralf Lindner

This book is the result of the research project "Res-AGorA" – Responsible Research and Innovation in a Distributed Anticipatory Governance Frame. A Constructive Socio-normative Approach), a three-year (2013–2016), EU-funded project, which had the objective to develop a comprehensive governance framework for responsible research and innovation. As such, Res-AGorA is part of and contributes to the vibrant debate on how to translate the ambitious aims of excellent science, competitive industry and a better society into principles for responsible research and innovation – without compromising on sustainability goals or ethically acceptable and socially desirable conditions.

While a number of explicit proposals for responsible research and innovation have already been developed, these cannot be the definite final manifestation for all the different contexts at different political and organisational levels across Europe, as the very essence of what is responsible in research and innovation is contested and will need constant re-negotiation and deliberation.

This fluid and contested nature of responsible research and innovation is the starting point of Res-AGorA. Rather than constructing yet another framework to specify the normative content of what responsible research and innovation should be, Res-AGorA developed a framework to guide the process of governing towards higher levels of responsibility in research and innovation, where the normative content is negotiated by the actors themselves as part of a continuous process of reflexive, anticipative and responsive adaptation of research and innovation to changing societal challenges. The aim of Res-AGorA was to develop a framework of principles intended to harness the self-governing capacities and capabilities of actors within Europe. This orienting framework will help actors to understand their responsibility challenges and to design, negotiate and implement their own context-specific understanding of responsibility in research and innovation.

Res-AGorA has designed this framework in the form of governance principles, codified in the **Responsibility Navigator**, which was conceived as a means to provide orientation without normatively steering research and innovation in a pre-defined direction. Furthermore, the **Co-construction Method** is a collaborative workshop method designed to systematically facilitate the practical use of the Responsibility Navigator.

This book brings together the main elements of Res-AGorA, ranging from the project's conceptual reasoning and theory-inspired empirical investigations, to our intensive co-construction process, through which the consortium was able to refine and eventually finalise the main output of the project – the Responsibility Navigator.

Throughout the course of the project, Res-AGorA was fortunate to benefit from the support of numerous institutions, colleagues, and stakeholders in the field of research and innovation. We would like to thank the European Commission, DG Research and Innovation, for providing the essential funding for the project. And we are particularly indebted to our project officers Karen Fabbri and Giuseppe Borsalino, who accompanied our work with pragmatism, advice and constructive feedback.

On numerous occasions Res-AGorA took advantage of conceptual input and enlightening discussions with our peers in the research community. Our thanks go to Arie Rip, Bärbel Dorbeck-Jung, Dave Guston, Erik Fisher, and Richard Owen – to name just a few.

We are also indebted to over 100 experts and stakeholders who participated in our expert meetings and co-construction workshops. The systematic involvement of diverse perspectives was an essential element in Res-AGorA's research approach and vital for the project's key outputs. Likewise, the feedback from our International Advisory Board, composed of renowned experts from core stakeholder groups relevant for the debates around responsibility in research and innovation, proved extremely valuable for Res-AGorA. We are very grateful for the time you invested in the Res-AGorA process.

We also take this opportunity to thank our colleagues from the wider project team for their commitment and support: Jørgen Madsen (DBT) for managing external communications; Nikolaus Pöchhacker (IHS), Maria Linden (Fraunhofer ISI) and Hans Jørgensen (DBT) for website design and technical support; Albena Kyuchukova (Fraunhofer ISI) for financial project administration; our research assistants and interns Kim Schönholz, Dominik Hahn (both Fraunhofer ISI), Lea Amby Ottosen and Jakob Ibsen-Jensen (both DBT); Ulrike Aschoff for multi-media support; Sabine Wurst and Jeanette Braun for the design and layout of this publication, and Gillian Bowman-Köhler and Barbara Sinnemann (all Fraunhofer ISI) for proofreading the manuscript.

Karlsruhe, February 2016

PART 1 INTRODUCTION

INTRODUCTION

European Commission 2011b Page 7f.

“Research should take into account the role of various actors, such as legislative, standard setting and certification bodies, regulatory bodies, civil society organisations, research institutions and business operators.”

1

Introduction: The Res-AGorA journey

Ralf Lindner, Stefan Kuhlmann, Bjørn Bedsted, Jakob Edler, Erich Griessler, Pierre-Benoît Joly, Niels Mejlgaard, Elena Pariotti, Sally Randles

The quest for responsible research and innovation has made remarkable progress over the last few years. Starting from a rather confined academic debate calling for responsible innovation (e.g. Hellström 2003), the idea is now part of the European Union’s research and innovation policy as a cross-cutting theme in the current framework programme Horizon 2020. Furthermore, the Rome Declaration on Responsible Research and Innovation in Europe (RRI)[1] received high-level endorsement from the European Council in 2014, and initiatives promoting responsible (research and) innovation have also taken root in a number of European countries (e.g. the United Kingdom, the Netherlands, and Norway).

The Res-AGorA[2] project is part of this dynamic discourse and the notable policy developments related to RRI. Running from 2013 to 2016, the EU-funded project Res-AGorA has co-constructed a good-practice governance framework with practitioners and strategic decision-makers – the “Responsibility Navigator” –, which facilitates reflective processes involving multiple stakeholders and policy-makers with the generic aim of making European research and innovation more responsible, responsive, and sustainable. The project’s key output, the Res-AGorA “Responsibility Navigator”,[3] was conceived as a means to provide orientation for governance without normatively steering research and innovation in a specific direction.

The chapters of this book bring together the main elements of Res-AGorA, ranging from the conceptual reasoning behind the applied research approach, theory-inspired empirical investigations, a selection of the rich case study programme and the lessons learned from their analyses, to our monitoring of RRI trends in 16 European countries, and our intensive co-construction process, through which the consortium was able to refine and eventually finalise the main output of the project – the Responsibility Navigator.

The following provides an overview of the project’s journey. Readers interested in learning about specific aspects or even the whole project are invited to explore the ensuing chapters of this book.

1 http://ec.europa.eu/research/swafs/pdf/rome_declaration_RRI_final_21_November.pdf (accessed 25 November 2015).

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

3 The Responsibility Navigator is presented in Chapter 11 and available online: http://responsibility-navigator.eu/wp-content/uploads/2016/01/Res-AGorA_Responsibility_Navigator.pdf. Please note that the Res-AGorA Responsibility Navigator is licensed under the Creative Commons Attribution-NonCommercial 4.0 International License. To view a copy of this license, visit: http://creativecommons.org/licenses/by-nc/4.0/.

1.1 The project idea and conceptual foundations: Res-AGorA's socio-normative approach

Res-AGorA is a response to a call for research proposals included in the European Commission's Science-in-Society Work Programme for 2012 (European Commission 2011). The call text specifically required the development of a governance framework for RRI, and emphasised that:

"[r]esearch should take into account the role of various actors, such as legislative, standard setting and certification bodies, regulatory bodies, civil society organisations, research institutions and business operators." (European Commission 2011b: 7f.)

Furthermore, the call explained that a:

"[…] comprehensive governance model for Responsible Research and Innovation does not yet exist at the European Level. The availability of such a model and information on the practical role of public engagement can make it possible for policymakers to start working on its implementation, thereby allowing stakeholders and interested citizens to participate and co-design an innovation process for which they can share responsibility." (European Commission 2011b: 8)

In addition to the challenging mission of developing such a comprehensive governance framework for Europe, the call also required applicants to propose a monitoring exercise to observe trends and developments in RRI in Europe, thereby building on the work of the MASIS project.[4]

The representatives of the partner institutions who would later form the Res-AGorA consortium were immediately motivated to respond to this ambitious call. However, a closer look at the challenges associated with such an endeavour prompted a number of consequential considerations.

First, the broader policy context within which a European governance framework for RRI would need to operate is characterised by the European Union's ambitious goal to become a genuine *innovation union*, in which "research and innovation are key drivers of competitiveness, jobs, sustainable growth and social progress" (European Commission 2012b: 4). The Horizon 2020 strategy was developed for this purpose with three simultaneous objectives: excellent science, competitive industry and a better society. However, a number of grand challenges need to be addressed with respect to the latter, such as health and wellbeing or climate change (European Commission 2011a).

These societal challenges already provide research and innovation with a number of normative directions.[5] An influential trend of orientating research and innovation towards societal goals can be observed. This has been given additional momentum by the debate on responsible research and innovation. RRI emphasises specific qualities of research and innovation practices, aims to redefine the roles and responsibilities at science-society interfaces (Nielsen et al. 2015: 58) and has reopened the fundamental debate about how research and innovation can contribute to the desirable futures our societies are striving for. Such normativity is an inherent feature in most definitions of and frameworks for responsible research and innovation (cf. von Schomberg 2011, Stilgoe et al. 2013, Owen et al. 2013, Pandza and Ellwood 2013, and Rip 2014), and is explicitly stated in the call text, to which the Res-AGorA project responded (European Commission 2011b).

Against this background, the Res-AGorA partners did not intend to engage in contributing to the ongoing collective search for and foundation of normative directions. Instead, the real challenge to any RRI framework is the consistent realisation of normative goals. General aspirations such as "excellent science, competitive industry and a better society" are beyond dispute, as is the generic aim to make research and innovation more "responsible". However, the challenge lies in the concurrent and concrete application of these high-level normative goals while not compromising sustainability, ethical acceptability and social desirability. Who defines desirable directions, on what grounds and based on which processes (Walhout and Kuhlmann 2013)? While postulating certain normative positions *a priori* is legitimate, the debates related to RRI have not yet adequately addressed how to deal with the inevitable tensions, conflicts and related power games that arise when a heterogeneous, pluralistic actor landscape with diverging interests is confronted by norms and values intended to change behaviour (Randles et al. 2014: 25, van Oudheusden 2014).

In short, the first central assumption of the Res-AGorA project was that the application of normative positions will more often than not be *contested*. Consequently, acknowledging normative pluralism poses the challenge of identifying conditions and viable mechanisms able to address contestation and facilitate the capacities and capabilities of the relevant actors to engage in constructive negotiations.

Second, the quest for responsible research and innovation did not start from scratch. The institutions, organisations, actors and procedures constituting research and innovation are subject to and influenced by a thick fabric of governance arrangements and practices. These arrangements are highly complex, interwoven, and concurrently incorporate different types of governance (hierarchy, market-based mechanisms, networks), and numerous governance instruments (hard and soft law, information, persuasion, participation, etc.) and levels (from local to global). An important part of these heterogeneous arrangements and practices is concerned with preventing harm, assessing risks, protecting consumers and the environment. In addition to these forms of regulation, Corporate Social Responsibility schemes, ethical reviews, professional standards, various forms of technology assessment, foresight processes, ELSA[6] research, stakeholder engagement and public participation related to research and innovation agenda-setting can be seen as efforts to influence the directions and impacts of research and innovation in a desirable way. These various, often well-established arrangements and mechanisms represent what Res-AGorA has coined "RRI in the making" or the *de facto* governance (cf. Rip 2010) of RRI.

Thus, the second premise of the Res-AGorA project was that any effective governance framework for RRI should take co-existing governance arrangements into account, learn from them, and, where deemed useful, constructively integrate them into such a framework (Chapter 5).

Key assumptions of Res-AGorA

1. RRI is an inherently normative concept. The concrete realization of these normative claims will be contested in the context of pluralistic societies. Instead of downplaying these tensions and potential conflicts, Res-AGorA acknowledged the need to identify conditions and viable mechanisms that facilitate the capacities and capabilities of relevant actors to engage in constructive negotiations.
2. Manifold governance arrangements for research and innovation exist, many of which explicitly address the aims and ambitions of RRI. Res-AGorA had the objective to develop a governance framework for RRI by learning from "RRI in the making".

Based on these two assumptions, the consortium's ambition was to conduct a research project which would result in a governance framework that supports strategic decision-makers and practitioners in research and innovation to transform current practices and institutional conditions in order to make the outcomes of research and innovation more "responsible". To this end, the main analytical focus of Res-AGorA was to be on governance, conceptualised as:

"the dynamic interrelation of involved (mostly organised) actors within and between organisations, their resources, interests and power, fora for debate and arenas for negotiation between actors, the rules of the game, and policy instruments applied helping to achieve legitimate agreements." (Kuhlmann 2001, Benz 2006, Braun 2006)

Consequently, Res-AGorA's working definition of RRI refrains from pre-defining a set of normative directions, while acknowledging their importance for any conception of RRI:

4 Monitoring Research and Policy Activities of Science in Society (MASIS) was an EC-funded project, which ran from 2010–2011. As the original project website was deactivated, Res-AGorA volunteered to make the MASIS results available on its project website: https://rritrends.res-agora.eu/masis.

5 See, for example, the Lund Declaration of 2009, calling for research to focus on the grand challenges of our time: https://www.vr.se/download/18.7dac901212646d84fd38000336/Lund_Declaration.pdf (accessed 10 November 2015).

6 Acronym for Ethical, Legal, and Social Aspects.

"RRI is supported by governance that is facilitating research and innovation processes and achievements following particular normative principles, objectives and outcomes." (Walhout et al. 2013: 7)

While the concrete composition, scope and application level of the governance framework were undecided at the start of the project, Res-AGorA deliberately followed an approach that analysed tensions, barriers and opportunities in the *de facto* governance of RRI. This means that the normativity in our investigation primarily originated from empirical analyses of existing governance arrangements, often involving contestation, and the related normative claims. Learning from these dynamics in different settings and situations enabled us to design a governance framework for RRI capable of modulating these dynamics and their inherent tensions in a transformative way. We called this a "constructive and socio-normative" approach.

Accordingly, the Res-AGorA project proposed to develop a framework supporting actors in governing towards more responsible research and innovation, where the normative substance is negotiated by the actors themselves as part of an ongoing process of reflexive, anticipative, and responsive adaptation of research and innovation to changing societal challenges.

1.2 The project design

Our understanding of the Science-in-Society call and our initial considerations concerning the contested nature of the normative directions associated with any RRI concept and the need to build on *de facto* RRI governance (Section 1.1) were translated into a number of conceptual elements for the project design. These can be roughly grouped into two major steps:

First, in order to learn from and build on existing governance practices related to RRI ambitions, Res-AGorA designed an extensive empirical programme with the aim to systematically analyse "RRI in the making". Given the heterogeneity and complexity of present research and innovation governance landscapes, a case study approach was chosen to generate deep insights into established arrangements, mechanisms and practices of governance across a range of different research and innovation situations and contexts. An explorative rather than a representative approach was applied to select and conduct the case studies. Chapter 5 provides a detailed description of the model guiding the empirical research. The case study programme was to be complemented by a continuous monitoring process of RRI trends and developments in 16 European countries (Chapter 8).

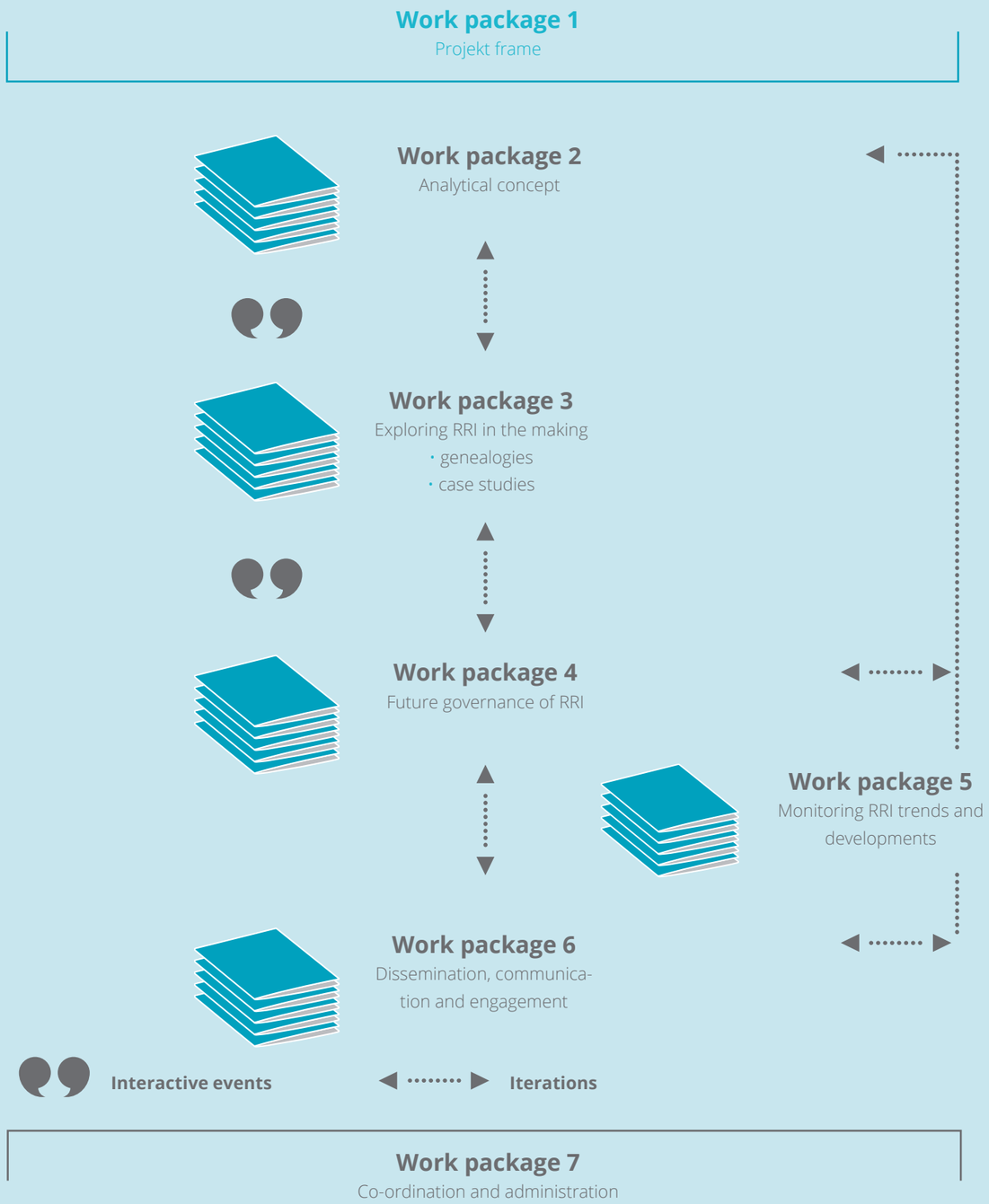
Second, an intensive co-construction process with high-level stakeholders from science, industry, civil society and policy-making was to be conducted with the aim of testing, further developing and refining the building components for a governance framework for RRI.

Figure 1–1 shows an overview of the project's work packages and their interrelations.

A special feature of the project design was the requirement of close interaction between the key strands of research. Most notably, the work packages dealing with the analytical concept (WP 2) and the empirical research (WP 3) were designed in such a way that the deductive conceptual elements generated from primarily literature-based analytical work and the inductive insights derived from the empirical programme could cross-fertilize each other in a number of iterative steps.[7] The purpose of this interplay of deductive and inductive research was to draw lessons from processes of RRI governance in the making in different settings and situations, thereby providing essential input for the construction of the Res-AGorA governance framework. Similarly, the co-construction process with stakeholders (WP 4), a series of five two-day workshops scheduled in the second half of the project, was designed to enable productive iterations between conceptual developments and stakeholder feedback (Chapter 6).

In addition to the empirical programme (WPs 3 and 5) and the co-construction process (WP 4), theoretical and conceptual considerations as well as complementary empirical inputs were other essential elements in the project design. Important theoretical inspirations were to be provided by an analysis of different responsibility

7 Due to the contractual requirement of producing three annual reports in the course of the monitoring exercise, the degree of integration of WP 5 in the iterations was less pronounced.



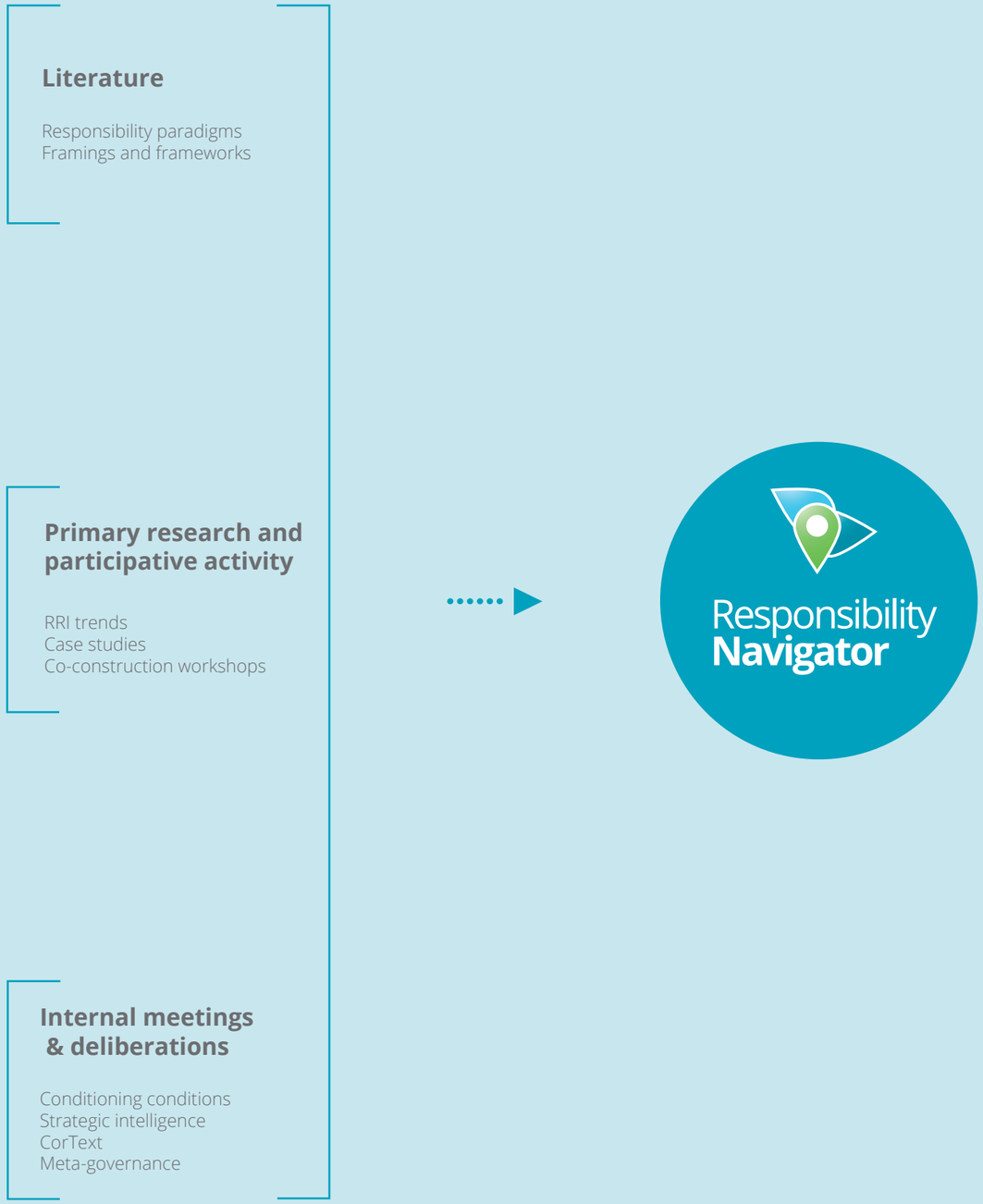


Figure 1–2: Res-AGorA inputs

paradigms and their relationship to the governance of research (Chapter 2). This, together with an analysis of the different frames and framings of RRI (Chapter 3), and a scientometric analysis to construct a genealogy of responsibility discourses in research and innovation (Chapter 4) were included to systematise and improve our understanding of the dynamically evolving, historically and geographically situated, contested phenomenon RRI. Given the broad range of theoretical, conceptual and empirical inputs, the project design also provided sufficient scope for internal deliberations of the team members, enabling us to draw on the rich experience of the partners.

Figure 1–2 provides an overview of the conceptual and empirical elements that contributed to the development of the Res-AGorA governance framework for RRI.

1.3 The Res-AGorA project: deliberation and co-construction

The consortium

Research projects are always unique due to their specific research questions, approaches, framework conditions and the research teams involved. A special characteristic of Res-AGorA is the partners' efforts to apply chief components of the project's conceptual foundation and approach to the actual research process and the internal interactions.

Early on, during the proposal writing phase, great care was taken to include a broad range of profiles, institutional settings and perspectives in the consortium. The eight Res-AGorA partners from seven European countries represent very different institutional settings (see p. 184) – ranging from universities with strong international research profiles to non-university institutes of applied research and a private foundation, all with longstanding experience in providing scientific policy advice. Different scientific disciplines are represented (political science, sociology, communication and media studies, law, economics and business administration, history, engineering, biotechnology, etc.), along with a broad range of focus areas and methodological expertise (science and technology studies, research and innovation policy analysis, regulation, governance of science, technology and innovation, organisational behaviour, ethics, technology assessment, foresight, evaluation, stakeholder engagement and participatory processes, impact assessment, sustainability etc.). While this diversity of epistemic communities and disciplinary cultures frequently resulted in time-consuming internal deliberations about the direction to be taken, the project clearly benefited from the multiple perspectives and the productive tensions generated by such a diversity of partners.

Critical sounding boards

An important element in Res-AGorA's own "governance arrangement" was the structured involvement of external voices and perspectives. Given the objective of developing a governance framework for responsible research and innovation that is deemed both useful and applicable, the consortium decided to invite five renowned individuals to join our International Advisory Board (see page 17). These represent the core stakeholder groups relevant for the debates around the concept of RRI – particularly academia, business, civil society, and government. The Board contributed to the discussions of the consortium, provided critical and constructive feedback, made suggestions about the research approaches and methods applied, and commented on key outputs of the project. In order to balance the need for a continuous flow of information between the Board and the consortium with the limited time resources of the voluntary Board members, one of the members was asked to act as Chairperson. Luckily for Res-AGorA, Hilary Sutcliffe, director of MATTER and well-connected within the European responsible innovation and sustainability communities, agreed to take this position. Her enthusiasm combined with candid outspokenness helped to propel the project forward, particularly by continuously reminding the partners to make the project outputs and reports accessible to potential users beyond academia. The chief concern of the members of the Advisory Board was to make sure that Res-AGorA generated a governance framework with high practical relevance for stakeholders interested in steering their activities towards responsible research and innovation. The Board's critical reflection on our approach, the numerous suggestions for improvements, and the advice inspired by first-hand experience from different contexts was challenging at times, but eventually proved extremely valuable for the project's output.

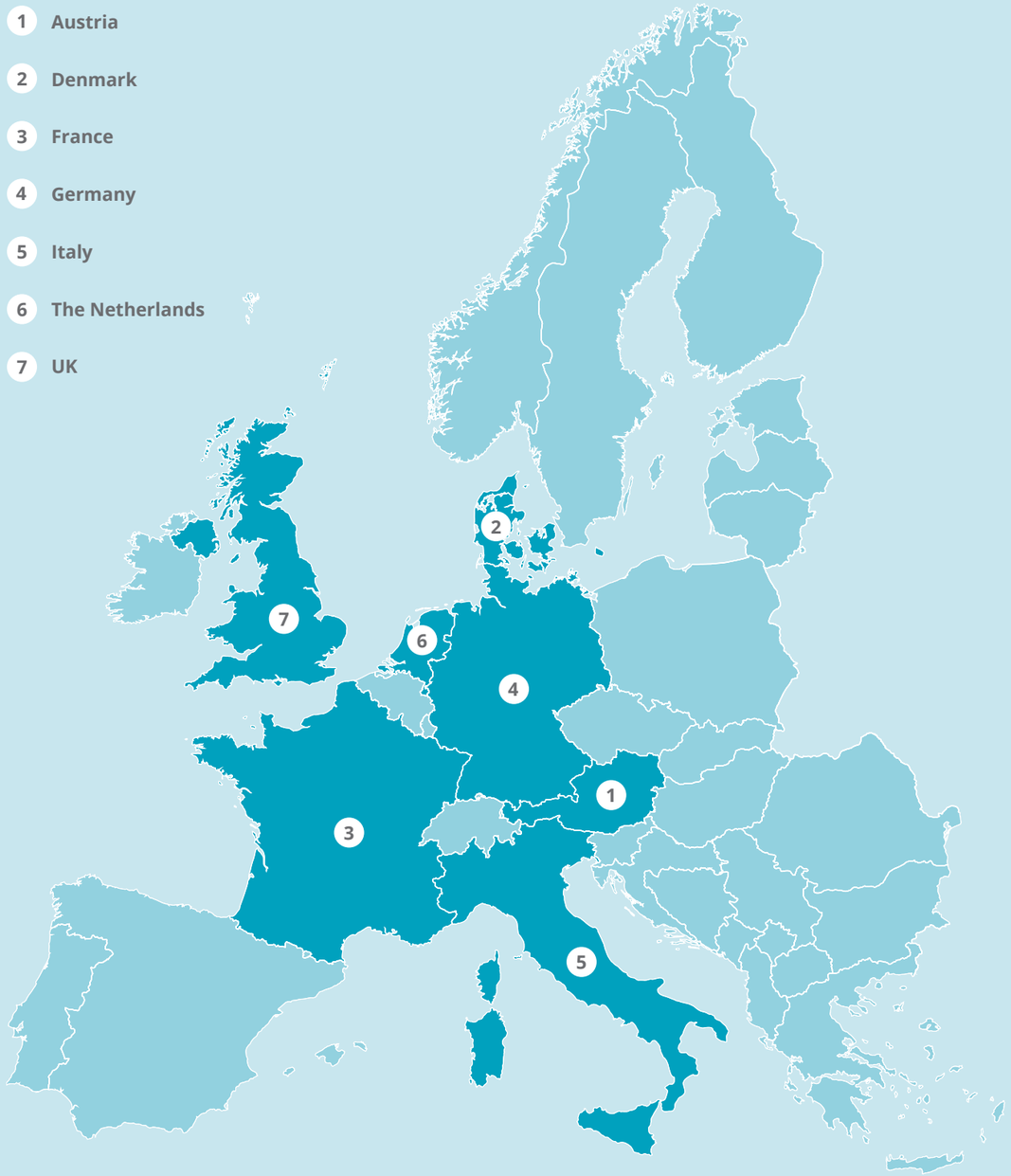


Figure 1–3: Seven partner countries

Members of the Res-AGorA International Advisory Board

Hilary Sutcliffe
Hilary is the Chair of the Res-AGorA International Advisory Board. She is the Director of MATTER, a UK-based think tank, which promotes the understanding of Responsible Innovation, particularly the appropriate use of new and emerging technologies, such as nanotech, biotech, genomics, synthetic biology and advanced materials.
http://www.matterforall.org

Susan Cozzens
Susan is a professor at Georgia Tech, Director of the Technology Policy and Assessment Center, and Vice Provost for Graduate Education and Faculty Development. Her research interests are innovation for inclusive development and science, technology, and innovation policies in developing countries.
http://www.provost.gatech.edu/reporting-units/vice-provost-graduate-education-faculty-development/about-dr-cozzens

Charles-François Gaudefroy
Charles- François is Research and Development Vice-President at Unilever. He is responsible for compliance of Unilever products and developing strategies for a regulatory framework that helps building trust of Consumers, customers and stakeholders in Unilever brands, products and technologies.

David Santillo
David is a Senior Scientist with the Greenpeace Research Laboratories, based at the University of Exeter in the UK. David is a biologist and analytical chemist with almost 20 years experience in providing scientific advice and analytical services to Greenpeace offices worldwide, for a wide range of issues. He has also worked at the interface between science and policy on a diversity of subjects.
http://biosciences.exeter.ac.uk/staff/index.php?web_id=david_santillo

Doris Wolfslehner
Doris is the Head of the Secretariat of the Austrian Bioethics Commission at the Austrian Federal Chancellery. She is a member of the Bioethics Committee at the Council of Europe (DH-BIO) and the Forum of National Bioethics Committees of the European Union. She regularly works as an ethics evaluator at national and international level and lectures at the University of Vienna.

In addition to the feedback from the Advisory Board, Res-AGorA also benefited from manifold interactions with external actors not directly related to the empirical studies of the project. In the course of preparing the conceptual foundations for the governance framework during the first half of the project, more than 25 experts and stakeholders were consulted in a meeting at the Royal Society in London (November 2013)[8] and at a stakeholder workshop in Copenhagen (May 2014). Moreover, on numerous occasions, often facilitated by the European Commission's Directorate-General for Research and Innovation, exchanges with other EU-funded projects focusing on RRI – first and foremost our three "sister" projects: GREAT, Progress and Responsibility[9] – provided support and reassurance for the course the project had taken. And finally, we are grateful for the enlightening discussions with and challenging questions from our peers at a wide range of conferences in fields related to research, technology and innovation.[10] We have no reason to doubt that

8 A report from this meeting is available at: http://res-agora.eu/news/res-agora-advisory-board-and-expert-group-met-at-the-royal-society/.

9 These three projects and Res-AGorA constitute the so-called "G04" (group of four) as they represent the first wave of FP7 projects explicitly focusing on RRI and share the same time frame. For more information about these projects please visit: GREAT (http://www.great-project.eu/), Progress (http://www.progressproject.eu/), and Responsibility (http://responsibility-rri.eu/).

10 In the course of the project, Res-AGorA team members presented numerous academic papers and organised several special sessions at national and international conferences: S.Net 2013 (Boston), STS Italia Conference 2014 (Milan), Eu-SPRI 2014 (Manchester),



the constructive feedback from "critical friends" contributed to the conceptual robustness and practical relevance of the project's results.

1.4 A guide to outputs and results

The following chapters provide concise summaries of the key procedural elements and results of the Res-AGorA project. However, given the limited space available in such a publication, many of the project's activities and outputs cannot be represented here. The Res-AGorA website – www.res-agora.eu – serves as the project's main repository. Here, interested users can find the project's public deliverables,[11] the case study reports,[12] the documentation of the monitoring exercise "RRI-Trends",[13] and references to publications generated by the project.[14] Insights into different stakeholder perspectives on responsibility in research and innovation can be gained by watching the video interviews we conducted with participants of our workshops.[15] And, finally, press releases, short features about and reports from events related to the project or RRI in general are also available here.[16]

Structure of the book

This book is organised in four main parts:

Part 1 – Introduction – presents the main theoretical foundations and the key conceptual components of the Res-AGorA project. Chapters 2, 3 and 4 set the stage by reflecting on central theoretical elements and the dynamic evolution of the RRI discourse. In Chapter 2, Arnaldi et al. discuss RRI as an emerging governance approach, and carve out the concept's distinctive approach to the issue of responsibility. In Chapter 3, Sally Randles et al. present the six most influential discursive traditions and frames that have contributed to present-day understandings of responsible research and innovation. Based on a scientometric analysis of the relevant literature, Tancoigne et al. trace the roots and changing thematic emphases in the discourse of responsibility in research and innovation (Chapter 4). Against this background, the next two chapters present the project's conceptual approach to its main strands of research: Walhout et al. introduce the Res-AGorA research model, which guided the empirical programme (Chapter 5), and Bryndum et al. present the project's workshop method, which was instrumental in conducting our co-construction process with stakeholders (Chapter 6).

Part 2 – Approaching RRI Governance – focuses on the project's extensive case study programme. In Chapter 7, Randles et al. present the 13 lessons for the governance of RRI that were derived from the transversal case study analysis and eventually provided chief components for the Res-AGorA Responsibility Navigator. In order to give insights into the rich empirical research of the project and how we investigated "RRI in the making", five exemplary case studies were selected, from fracking in the UK and Austria (Lang), research priority setting in Denmark (Nielsen), through integrating risk analysis and technology assessment into a Dutch nanotechnology research consortium (Walhout), the approach of multi-national corporations to responsibility (Loconto), up to the integration of RRI in a roadmap for synthetic biology (van Doren).

In Part 3 – Empirical programme – the empirical focus is continued by presenting observations and results from the project's monitoring exercise. Mejlgaard and Griessler explain the methodological approach to RRI-Trends in Chapter 8 and summarise key observations from monitoring RRI in 16 European countries. This overview is followed by two selected analyses based on the data generated in the course of RRI-Trends: Nielsen et al. show to which extent and how RRI has been established at European universities (Chapter 9), and Daimer et al. provide a detailed introduction to one European Member State, Germany, and discuss the specific national policy context for RRI (Chapter 10).

Finally, Part 4 – Governing Towards Responsibilisation – presents the main output of Res-AGorA, the Responsibility Navigator, an orientating framework with the objective to support "navigation" towards learning and institutional transformation (Chapter 11). The concluding Chapter 12 reflects on the experiences made with the specific Res-AGorA approach and, based on the project's analyses, offers policy-oriented recommendations for the future of responsibility in research and innovation.

Basic project information

- Res-AGorA: Responsible Research and Innovation in a Distributed Anticipatory Governance Frame. A Constructive Socio-normative Approach
- Duration: February 2013 to January 2016
- Call: FP7-SCIENCE-IN-SOCIETY-2012-1, Topic SiS.2012.1.1.1-1 (Governance frameworks for Responsible Research and Innovation [RRI])
- Funding: This project was co-funded under the European Union's Seventh Framework Programme for research, technological development and demonstration; grant agreement no. 321427.
- Requested EU-contribution: 3.0 million euros
- Coordination: Ralf Lindner, Fraunhofer Institute for Systems and Innovation Research ISI
- Partners: Fraunhofer ISI, University of Twente, University of Padua, Danish Board of Technology, Institute for Advanced Studies, University of Manchester, University Paris-Est Marne la Vallee, University of Aarhus
- Website: http://www.res-agora.eu

ESOF 2014 (Copenhagen) or EASST 2014 (Torun), Pacita Conference 2015 (Berlin), to name just a few.

11 http://res-agora.eu/eu-deliverables/.
12 http://res-agora.eu/case-studies/.
13 https://rritrends.res-agora.eu/.
14 http://res-agora.eu/publications/.
15 http://res-agora.eu/video-interviews-about-rri/.
16 http://res-agora.eu/news/.

PART 2

APPROACHING RRI GOVERNANCE

APPROACHING RRI GOVERNANCE

The authors of this chapter

“RRI can perhaps be considered as a new paradigm of responsibility that goes beyond the traditional emphasis on fault and punishment, risk and compensation, uncertainty and precaution.”

2

RRI as a governance paradigm: What is new?

Simone Arnaldi, Guido Gorgoni, Elena Pariotti

This chapter frames Responsible Research and Innovation (RRI) as an emerging governance approach in the EU regulatory context. We argue that the reference to fundamental rights makes RRI a distinctive approach to responsibility compared to other existing paradigms and that human rights, in particular those laid down in the Charter of Fundamental Rights of the European Union, are not necessarily a constraint but can instead be a catalyst for innovation. We maintain that a governance framework based on the complementarity between legal norms and voluntary commitments might successfully combine the respect for fundamental rights with the openness and flexibility of the innovation process.

2.1 RRI and the governance of technology[1]

RRI deal with situations in which knowledge is uncertain and consent is contested, so that traditional approaches addressing responsibility *ex post facto* by the means of liability or compensation are unsatisfactory. Instead, RRI promotes a more comprehensive approach to responsibility.

Academic literature and public debates alike have increasingly acknowledged the pervasiveness of uncertainty in science, technology and their governance. Uncertainty is no longer viewed as a residual area of ignorance and risk to be gradually reduced by way of increasing expert knowledge and enhanced technological control. It is rather a consequence of the ecological nature of technology, which cannot be eliminated, and that its interaction with the environment generates (Luhmann 1993).

As a consequence of the difficulty to predict future developments and possible risks, we are often only able to learn about these developments after technologies have been introduced and have shown their consequences for society. This way we enter into the domain of “manufactured risk” (Giddens 1999) and the unavoidable “secondary consequences” of action (Beck 1999). Indeed, this increasingly manipulative knowledge of nature and society produces uncertainty rather than reduces it, and this radical uncertainty reshapes the boundaries between science and policy. Knowledge and technology, therefore, implicitly incorporate models, world views and societal patterns (Wynne 1995), so that “the ways in which we know and

1 All the authors outlined the structure of the chapter. S. Arnaldi wrote Section 2.1; G. Gorgoni wrote Section 2.2; E. Pariotti wrote Section 2.3; all authors wrote Section 2.4. The authors have read and approved the manuscript.

represent the world (both nature and society) are inseparable from the way in which we choose to live in it." (Jasanoff 2004: 2)

Today, the governance of new technologies is therefore designed and implemented in situations that are characterised by uncertain knowledge and embattled consent (Douglas and Wildavsky 1983). We argue that RRI can be an effective answer to this twofold uncertainty, so that responsiveness and the normative steering of research and innovation acquire more importance over risk individuation and management.

The nature of RRI as a conceptual and policy approach aimed at actors' reciprocal responsibilisation, defines a space for innovative forms of governance centred on the adoption and the practical implementation of (self-)regulatory instruments such as codes of conduct, guidelines, technical standards, reporting, and audits.

Broadly speaking, soft regulation is a set of explicit rules, which have either a non-binding character or are utterly voluntary (Fredriksson et al. 2011, Skjærseth et al. 2006). Soft norms have an acknowledged legal relevance, though they lack a formally binding effect, precision, and clearly top-down delineated enforcement mechanisms (Shaffer and Pollack 2009). Because of this characteristic nature, soft norms have often been defined as "non-legislative modes of policy-making" (Hérriet in Fredriksson et al. 2011: 53) or even as "quasi-legal instruments" (Koutalakis et al. 2010: 330). Soft regulation describes a shift "from direct intervention ("rowing") to indirect intervention ("steering") in terms of enabling, motivating and pressing the regulated parties to regulate and to comply with self-regulation" (Dorbeck-Jung and Shelley-Egan 2013: 56).

Soft regulation is useful to regulators as it constitutes a tool for leveraging the information advantages of those actors who need to be regulated. This is considered an important asset in emerging technological fields that are characterised by a high degree of uncertainty and for which regulators lack the resources or information needed to develop sound "discretion-limiting rules" of a mandatory nature as it is:

"particularly the case in highly technical areas where the state depends on individual producers for crucial regulatory information related to product characteristics and production processes." (Koutalakis et al. 2010: 334)

In this context, soft regulation is used in processes where "there is the need to build a participated consensus on legal and political decisions" (Pariotti 2011: 516) and the institutional and organizational configurations of regulatory actions:

"provide little space for different and conflicting interests to be articulated. This does not mean that conflicts disappear, but that they may take other routes, or are put 'on hold', as it were." (Garsten and Jacobsson 2013: 422)

The expansion of soft regulation does not replace hard law as such, but creates "hybrid" regulatory frameworks; this happens when, for instance, a voluntary good practice code is used as a benchmark for compliance with a "hard law" prescription" (Heyvaert 2009: 650) or, on the contrary, when hard law is referred to in broader soft regulatory instruments. We maintain that this complementarity is just the kind of result that is pursued by the idea of RRI.

Table 2–1: Soft regulatory initiatives: some examples (source: Arnaldi 2014)

		Level of initiative	
		National / subnational	**International / supranational**
Initiator	Public	Voluntary Reporting Scheme for Engineered Nanoscale Materials (UK) (DEFRA 2008a, 2008b) EPA Nanoscale Materials Stewardship Program (EPA n.d.)	OECD Working Party on Nanotechnology (n.d.) European Commission Code of Conduct (2008)
	Private	Responsible Nanocode (n.d.)	ISO TC 229 (ISO n.d.) ResponsibleCare (ICCA 2006)

2.2 RRI and the evolutions of responsibility

RRI has to be examined in the context of the diversity and historical evolution of the notion of responsibility. Indeed responsibility is "a syndrome of concepts" (Vincent 2011) variously interconnected (e.g. Davis 2012, van de Poel 2011, Vincent 2011, Gorgoni 2011, Ricoeur 2000, Hart 1968). The different meanings of responsibility can be referred to as two distinct poles: a passive pole, relating to the imputation of responsibility (being held responsible) and an active pole, which is that of the voluntary preventive assumption of responsibility.

Indeed, responsibility can be equally understood in terms of the obligation to bear the consequences of an action (*liability*), as the capacity to act taking into account one's duties and giving an account of them (*accountability*), or as the capacity to act without relying on general pre-established rules or waiting for ex-post accounts, but rather by taking into account the specific context (*responsiveness*).

The idea of responsiveness is different from that of *reaction* typically associated with responsibility and is closer to the idea of a *response*, therefore characterising the idea of responsibility as both *open* and *active*:

"Response entails previous listening to a question. It entails openness, a willingness to understand and confront the other's commitments and concerns with ours, to look for a possible terrain of sharing. It entails readiness to rethink our own problem definition, goals, strategies, and identity." (Pellizzoni 2004: 557)

The distinction between the active and the passive modalities of responsibility implies the distinction between the temporal directions of responsibility, namely the retrospective and the prospective (Cane 2002).

Retrospective responsibility, or "historic responsibility" (Bovens 1988), is backward-looking, i.e. past-oriented, and is essentially linked to the idea of a *reaction*, which shapes the idea of responsibility in terms of sanction, compensation or justification. Responsibility in this case is called "retrospective" in that its key moment is the *ex post* evaluation of a situation.

Prospective responsibility is forward-looking, i.e. future-oriented, and is essentially linked to the idea of *assuming* and *exercising* responsibility, certainly in the sense of complying with the duties associated with our roles, but also by (pro)actively assuming responsibilities when the contents of our duties and tasks are not (or cannot) be established in advance. Responsibility is called "prospective" in that responsibility is not an ex-post judgement over a certain state of affairs, but a *projection* onto it, i.e. with no judgement in terms of a subsequent fault or compensation, but rather in terms of commitment. This active understanding of responsibility is central in regulatory strategies based on *responsibilisation*, intended as "predisposing actors to assume responsibility for their action" (Dorbeck-Jung and Shelley-Egan 2013: 60).

Considering the two semantic poles we described above and the predominant time dimension the different understandings of responsibility refer to, different *paradigms of responsibility* can be distinguished, according to their changing logic in combination with these elements. In our view, three main paradigms can be identified, all of which coexist despite the fact they were developed under specific historical conditions and therefore they do indeed characterise some typical "eras" of responsibility. By revisiting the work of François Ewald, we distinguish between the following:

1. The paradigm of fault, corresponding to the traditional moral and legal idea of responsibility as linked to a faulty causation by the agent. This paradigm of responsibility is essentially retrospective as it is based on the ex post judgement of a past action, and possibly on its sanction, and characterises both the legal and the ethical field (e.g. Hart 1968).

2. The paradigm of risk, in which the focus of responsibility is put on guaranteeing victims against damages (without reference to anybody's fault), rather than on sanctioning the "responsible" person(s), whose involvement in producing or not the damage becomes irrelevant under the "objective" logic of compensation. This model of responsibility is indeed prospective in that it aims at anticipating the occurrence of damages by the means of risk management techniques (Beck 1999). This way responsibility is turned towards the

future disclosing opportunities for action (otherwise "tied" by the spectrum of fault); but at the same time it remains linked to a retrospective logic in that it anticipates the occurrence of damage but it does not imply a higher responsibilisation of the practices concerned, as responsibility is based on statistical and not on ethical or legal criteria. Thus, paradoxically a sort of de-responsibilisation in terms of commitment is induced.

3. The paradigm of safety, as a reaction to a situation of uncertainty that cannot be domesticated by means of risk calculation. This paradigm was inaugurated by the development of the idea of precaution, both in the ethical and in the legal sense. Indeed the two former paradigms of responsibility are seriously challenged by the evolution of science and innovation, as they both presuppose either an identifiable author (fault) or some reliable data on which calculations (risk) are based, whilst contemporary science is characterised by uncertainty, as the direct or indirect outcomes of innovation practices cannot be fully anticipated (e.g. the effects of the use of chemical products in agriculture and their effects on the ecosystem, the effects of GMO's on the biosphere, etc.). Therefore the preventive approach of risk management cannot provide acceptable answers, nor would the fault paradigm help in making innovation processes more responsible. Within this context of uncertainty the focus of responsibility is put on anticipating the undesirable outcomes of techno-scientific activities, basing responsibility on value-centred decisions in a context of uncertainty rather than on a risk-based approach.

Those paradigms of responsibility coexist, overlap and sometimes compete with each other. When compared to the RRI idea, it presents some distinctive features that we should briefly analyse.

Despite some differences, the literature on RRI shares a largely common understanding of responsibility and its dimensions (see von Schomberg 2013, Owen 2014, van den Hoven et al. 2013, Forsberg et al. 2015):

- Responsibility is oriented to the future: the specific approach of RRI does not aim only at sanctioning, compensating or preventing the negative consequences of innovation; it aims indeed at steering the innovation processes according to societal values and needs, therefore advocating a *prospective* idea of responsibility.

- Responsibility is more proactive than reactive: responsibility is intended to be mainly a driving factor of the innovation process rather than a constraint, therefore it goes beyond the boundaries of what is legally due and relies on proactive anticipatory interventions.

- Responsibility is a collective and participative process: rather than being individual, responsibility is shared across different actors with different roles and powers along the innovation process, engaging with the collective shaping of societally acceptable research and innovation trajectories.

- Responsibility is plural: RRI links different dimensions of responsibility, namely the political, legal, ethical, and economic. Indeed the pursuit of responsible innovation rests on the voluntary adoption of standards which are not legally binding (ethical dimension of responsibility). These standards may become the normative references for RRI activities (political dimension of responsibility), so that our current "grand challenges" can be answered (social dimension of responsibility) respecting and promoting EU Fundamental Rights (legal dimension of responsibility) at the same time.

These features seem to set RRI apart from the other responsibility paradigms we have briefly described above (see Table 2–2 for an unavoidably simplified comparison). It does not mean that it *replaces* the other ones; rather it combines some of their elements in an original, and more comprehensive, fashion. Indeed, RRI can perhaps be considered as a new paradigm of responsibility that goes beyond the traditional emphasis on fault and punishment, risk and compensation, uncertainty and precaution, as it aims at *steering the innovation process from the inside* towards societal goals rather than coping with its (actual or anticipated) unwanted and unintended externalities.

Table 2–2: RRI and the evolution of responsibility paradigms

Paradigm	Fault	Risk	Safety	RRI
Criterion of ascription	Liability	Damage	Uncertainty	Responsiveness
Mean of realisation	Sanction	Compensation	Precaution	Participation
Target	Negative outcomes	Negative outcomes	Negative outcomes	Negative and positive outcomes
Dimension	Individual	Systemic	Collective	Collaborative
Orientation in time	Retrospective	Prospective / Retrospective	Prospective / Anticipative	Prospective / Proactive
Regulating mechanism	Hard law	Hard law	Hard law / Soft law	Self-regulation / Soft law / Hard law

2.3 RRI as a governance paradigm

RRI aims at actors' reciprocal responsibilisation, opening to innovative forms of governance centred on the adoption and the practical implementation of (self-)regulatory instruments such as codes of conduct, guidelines, technical standards, reporting, and audits. These types of regulatory instruments and their incorporation into hybrid regulatory schemes promote participation and power sharing, the integration of different levels of governance, diversity and decentralization, expansion of the space for stakeholders' deliberation.

RRI comprehensively combine and integrate various earlier approaches and methods, as:

"technology assessment and foresight, application of the precautionary principle, normative / ethical principles to design technology, innovation governance and stakeholder involvement and public engagement [in both deliberation and regulation]." (von Schomberg 2013: 65)

The literature that is most close to the EU policy environment from which the notion of RRI originates, includes fundamental rights as the source of orientation of research and innovation (von Schomberg 2013, Ozolina et al. 2009). In its most cited definition, RRI is defined as:

"a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)." (von Schomberg 2011: 9; 2013: 63)

In this view, ethical acceptability "refers to a mandatory compliance with the fundamental values of the EU Charter on fundamental rights" (von Schomberg 2013: 63). Moreover, social desirability "captures the relevant and more specific normative anchor points of the treaty on the European Union" (von Schomberg 2013: 64).

Competitiveness, scientific progress, fundamental rights, environmental protection are among the normative anchor points of EU research and innovation policies and, therefore, it seems reasonable that they play a role as the normative "building-blocks" of a governance framework.

The definition of RRI we have cited grants a role to the legal dimension of RRI, and, above all, emphasizes the integrated presence of multiple dimensions within the notion of RRI, like the ethical, political, social and legal ones. The reference to fundamental rights could be

regarded as a way to rigidly set values and goals, even regardless of the development of public debate and public opinion. From this point of view, fundamental rights could be considered as normative constraints defined in a top-down way, limiting the scope and influence of public involvement. However, this representation of fundamental rights in general and of their specific role in RRI is indeed debatable.

Human rights are usually seen from two opposite perspectives and both of them should be rejected. According to a first view, human rights are abstract ideals, which can easily be reduced to rhetorical appeals. According to a different one, human rights are expressed by norms concerning solely the relationships between citizens and their governments or judicial courts. In this understanding, fundamental rights have no relation to public opinion.

Fundamental rights can, on the contrary, be thought of as claims that are justified by strong moral reasons and supported by legal norms, suitable to regulate both the relations between the government and the citizens ("vertical dimension"), and those between private actors ("horizontal dimension").

However, it is important to note that the legal norms supporting such claims are often structurally vague, because they have to apply to as many cases as possible.

The content of those fundamental rights is not established once for all in the law-making process, but must be shaped, also in a bottom-up manner and by several relevant actors during the application stage, like judges but also private actors promoting tools of self-regulation.

In science, technology and innovation, many private actors actively self-regulate as they possess the relevant information and knowledge, so that the contents of fundamental rights should emerge in a bottom-up fashion. Therefore, it is possible to maintain that fundamental rights are a basic reference for RRI and that, nevertheless, the development and implementation of such a model should and can come to terms with different values and with different interpretations of the rights themselves.

When understood in this way, human rights gain a central space in RRI as they affect the regulation of innovation in several ways:

1. on a judicial level: the judicial stance contributes to the definition of the content of rights.
2. on a policy level: the protection and promotion of rights act as a driver for policy making.
3. the reference to human rights plays a role also on a horizontal level, between private actors, like, for instance, when the most diverse organizations adopt and implement social responsibility instruments (codes of conduct, self-regulations).

Considering fundamental rights as essential elements of RRI does not imply the narrowing of the scope and of the role of public involvement in defining the objectives of research and innovation and their social acceptability. It does not mean that the normative standards to be complied with and the goals to be pursued are already fully set in a top-down manner. Far from it, once listed, fundamental rights have to be filled with contents and have to be detailed with regard to specific domains, contexts, and cases by the means of an open-ended process of interpretation and application, where societal values and norms can find (and usually find) a way of expression. The reference to fundamental rights, therefore, does not involve any closure to public involvement. They can rather be seen as "a public normative practice" (Beitz 2009: 170) in which the reference to fundamental rights do not exclude, but on the contrary implies the contribution of stakeholders and the public for determining their content and the concrete goals to be pursued.

Besides a general reference to safety as a paramount criterion for assessing technology and innovation, fundamental rights play a key role in assessing the ethical acceptability of the innovation process, representing "normative anchor points" characterizing the specific European approach to the ethical and regulatory challenges of innovation (Ozolina et al. 2012: 27), in particular with reference to the EU charter on fundamental rights (Ozolina et al. 2012: 27, van den Hoven et al. 2013: 58). Moreover, innovation is expected to take account of the societal needs "expressed in the Treaty on the European Union", as sustainable development, equality, quality of life (van den Hoven et al. 2013: 58). Yet, fundamental rights and societal needs are seen as explicitly and mutually linked goals of a comprehensive normative framework for the governance of science, technology and innovation.

In this sense fundamental rights are not simply constraints on innovation that aim to reduce or avoid its undesirable or negative consequences by warranting the respect for human health, dignity, privacy, etc. Rather, they also concern the shaping of policies, so that rights are not only respected and protected, but also promoted by way of proactive initiatives.

2.4 Concluding remarks

RRI can be deemed as a governance approach to research and innovation practices integrating fundamental rights and soft regulatory mechanisms and instruments. The efficacy of this approach is based on the combination of principle-based and outcome-oriented regulation. We emphasized fundamental rights as the main "building blocks" of principle-based regulation and, more in general, of this framework.

The combination of fundamental rights with soft and hybrid regulatory instruments seems particularly apt to cope with the situation to which RRI is called to answer. In the context of RRI, the reference to fundamental rights could be seen as an important component in the constellation of elements determining the ethical acceptability of innovation and techno-scientific developments.

The success of referring to fundamental rights as a solution to provide "normative anchor points" for RRI requires careful examination of the legal and regulatory framework in which STI activities are framed in the EU and, at the same time, a deliberate effort to construe a governance framework designed to ensure the complementarity between hard and soft regulation, legal norms and voluntary commitments.

This situation reflects the RRI focus on actors' *responsibilisation* and the appeal to their capacity of committing to some goals that are not mandated by law, under the perspective of a renewed approach to responsibility.

The potential of fundamental rights to successfully combine a stable normative orientation with openness and flexibility is ultimately a matter of how the basic requirements of the constitutional state can be preserved in the multilevel and manifold regulation that characterises RRI governance approach.

The authors in this chapter

“[…W]e have identified a small number of clustered narratives of *de facto* responsibility in research and innovation settings, and find congruence as well as conflict and contestation […].”

3

Framings and frameworks: six grand narratives of *de facto* rri

Sally Randles, Philippe Laredo, Allison Loconto, Bart Walhout, Ralf Lindner

3.1 Background and methodology

Our developmental work on the “six narratives” began some years ago (Randles et al. 2013). Back then, it was the authors’ view that before we could credibly address the task of developing a (new) framework to govern responsibility across the full spectrum of research and innovation situations, it was important to undertake a preliminary review of the existing landscape. This review sought to make sense of how actors have through history participated in processes that construct, negotiate, and institutionalise – *in the sense of embed into governance structures and everyday practices* – very particular ideas of what it means to be responsible (responsible to whom and for what)?

Our scope is broad, spanning the full spectrum of research and innovation (R&I) settings and contexts, i.e. stretching beyond the limiting confines of science and technology development to consider innovation occurring in systems of multiple actors working in alternative innovation spaces. Here they are developing new forms and themes of responsible innovation such as political or ethical consumption; considering business-model innovation and new forms of organisational design beyond the individual organisation to multi-organisation complexes; and beyond the dominant narrow focus on product and process innovation. Crucially, we are also interested in innovations in the governance modes, instruments and methods / techniques themselves.

The central question is what kinds of governance strategies and mechanisms have been designed and operationalized through history, with varying levels of effectiveness, in order to instil a particular vision of responsibility into particular spaces? We examine particular locations and temporal settings from formal research predominantly undertaken in universities and public / private science laboratories and institutes, to innovative activity occurring at the edges of formal settings, such as so-called “garage” innovation, or the emergence of new governance mechanisms to co-ordinate new forms of entrepreneurial multi-actor organisation and action.

Following this opening premise, i.e., that actors have long sought to govern research and innovation processes according to whatever conception of responsibility holds at a given time, our opening method was purely pragmatic. We did a preliminary sweep of the academic literature and secondary and web sources to provide an in-road into how actors themselves construct discourses of responsibility in multi-actor, collective contexts. We identified how these discourses manifest materially as governance

instruments, such as the formation of new, collectively shared "responsibility standards" (think of the European Union's REACH Regulation [REACH 2006] or the ISO 26000 on Social Responsibility [ISO 2010]). We sought to sketch a preliminary landscape of empirical examples demonstrating the range of ways actors guide, negotiate and formalise normative understandings of responsibility and translate these into instruments or "devices" (Callon et al. 2007) to govern practice, effectively already steering research and innovation processes, according to whatever pre-assumptions or "frames" of responsibility they hold.

In constructing the "stylised" Six Grand Narratives that form the core of this chapter, we drew upon the authors' knowledge as well as the wider Res-AGorA research community[1] to capture the breadth of existing governance mechanisms incorporating the institutional work behind the development and creation of new standards and Codes of Conduct, the work of ethics committees, parliamentary offices of technology assessment, and new tools and methods to facilitate the participative engagement of civil society actors. We use the term *responsible research and innovation*, or (rri) to define this quest to understand how actors themselves *de facto* frame, and embed understandings of responsibility into the full scope of research and innovation contexts, situations, organisational settings and professional practice. We differentiated it from the recent emergence of new frameworks for Responsible Research and Innovation (RRI) that are intentionally labelled with the acronym in its capitalised form. In this chapter we examine rri and not RRI.

Further, inspired by Rip's (2010) concept of *de facto governance*, which proposes that governance of research and innovation always combines bottom-up experimental activity with top-down steering – and that this process is an emergent one, shifting and changing over time – we called our empirical, socio-historical and quasi ethno-methodological approach "*de facto governance of responsible innovation*". We understand it to be unfolding continually over time, as "*responsible-innovation-in-the-making*". It is a process that is sometimes stable, at other times contested by different groups, and moving to the rhythms of how the problem of responsibility itself is framed differently through space and time. In earlier decades, responsibility was seen as a problem of the self-regulation of science in elite institutions, away from the prying eyes of wider society. More recently it seems to be accepted as a distributed activity, with other societal actors seeking a place at the table to co-construct the agenda of how research and innovation should respond to societal problems. These are sometimes, but not always, limited to "grand challenges" such as climate change, poverty, food security, the depletion of natural resources, and health and well-being in ways that serve not only the current generation but also those to come.[2]

The construction and depiction of the Six Narratives should be taken as a continually developing project, not one which is permanently fixed in time.[3] This applies in two respects. First, it points to the need to continually monitor empirical cases that support or challenge our six abstract representations. For example, though we have presented six narratives there is no reason why additional empirical cases might not prompt the addition of further "ideal types" lying outside the current six by virtue of new characteristics outside the "family resemblances" of the internal coherences and concomitant features that define and differentiate our proposed six. Indeed, we would expect and actively search for such "outliers" rather than ignore or dismiss them since we understand the continual emergence of new cases that challenge us to modify and refine the existing narratives, or prompt the addition of new one(s) to be a methodological precondition[4] consistent with understanding that our proposed Six Narratives can, indeed need to be, continually "tested" against new empirical cases. Second, consistent with our proposition of responsibility in R&I as itself an emergent and continually evolving phenomenon, we would expect it to generate new manifestations of responsibility – the consequence of new R&I situations and responsibility "problem framings" that we have not, indeed cannot, anticipate. Thus, we would not expect the Six Narratives to remain a permanent capture of this emergent process. On the contrary, we merely hold that the six abstract "types" provide a plausible theoretical schema of *de facto* responsible research and innovation (rri), here and now in the first half of the 21st century.

1 The work developing and refining the six Grand Narratives of *de facto* Responsible Research and Innovation, continued in tandem with, and was verified, modified and stabilised, by the parallel work on the Res-AGorA case studies, as well as on the case studies which will illuminate Randles and Laredo (eds.) (2016).

2 For a detailed account of RRI's distinctive approach to the issue of responsibility in relation to other paradigmatic understandings of responsibility, see Chapter 2.

3 Indeed, latterly, our Six Narratives work has benefitted from the scientometric analysis of the RRI literature undertaken by our IFRIS colleagues of creating a "genealogy" of Responsible Research and Innovation (RRI), see Chapter 4.

4 In this sense the broad methodological approach followed in the Six Narratives is that of abduction – the continual search for new empirical material which confronts and forces change to the theoretical propositions (temporarily) put forward, whilst the theoretical proposition that we propose is the best explanation we can offer (i.e. neither causally deductive nor empirically inductive) at the present time.

3.2 The Six Grand Narratives: a brief overview of each

In summary our Six Grand Narratives are:

- **A** Republic of science
- **B** Technological progress: weighing risks and harms as well as benefits of new and emerging technologies
- **C** Participation society
- **D** The citizen firm
- **E** Moral globalisation
- **F** Research and innovation with / for society

Below we provide a brief overview of the narratives, highlighting their focus on specific values and framings of the "good" way to progress research and innovation with consequential implications for responsibility: responsibility to whom, for what, and how (in terms of which actors are involved), and what governance mechanisms and instruments are designed and deployed to materially manifest that responsibility.

Narrative A: "Republic of science"

As articulated by Michael Polanyi in 1962, this narrative revolves around the self-regulation of scientific activity, by, with and for scientists, to freely and independently identify and pursue their own problems, as members of a closely knit organisation. The implications for responsibility lie in the conditions for maintaining these freedoms, set primarily by the main funding body, the State. In exchange for such freedoms, the scientific enterprise must comply with certain guarantees thus creating a *de facto* Science-State contract. A number of dimensions sit at the heart of this contract. A first is to make research results a public commons through peer-review publication in scientific journals. A second is to guard against fraud and other deviances which would undermine trust in the scientific establishment, such as the misrepresentation of results, linked to a requirement to provide clear and replicable details on research methodology. A third relates to an ethics of care around the treatment of objects of research (whether human or non-human): how experimental objects are obtained and maintained, including how animal welfare is ensured and testing conditions regulated. A fourth relates to the maintenance and reproduction of the scientists' own field of operation: from health and safety in the laboratory to the training and support of young scientists and would-be scientists, most recently stretched to issues of gender and diversity within the scientific community. The identification and achievement of each of these "responsibility aims", is today negotiated between the scientific community and agents of the state such as funding research councils, and drives the evolving governance of practice in this narrative. Most recently, Arnaldi and Bianchi (2015) provide an elaborated account of the opposition between Narrative A: *Republic of Science* and Narrative F: *Research and Innovation with / for Society.*

Narrative B: "Technological progress: weighing risks and harms as well as benefits of new and emerging technologies"

How best to govern the uncertainties of new and emerging technologies is an age-old question, which over the past decades has generated multiple forms of institutionalised responses such as risk mitigation, remediation insurance, and evaluation techniques under conditions of uncertainty (including Foresight methods). The central question is how to balance the opportunities and benefits afforded by new technologies with uncertain technology-induced risks and harms. The narrative extends already firmly institutionalised rights and regulations (protecting the health and safety of workforce and users) to those "in close proximity" of facilities such as local residents. The management of such risks and the balancing of harms and benefits are addressed via both voluntary instruments and law, exemplified / accelerated in the aftermath of disasters, with some ubiquity around chemical catastrophes (Chernobyl, Bhopal). The precautionary principle extends this care to

unforeseen and unforeseeable risks. The constituency of actors now expands, bringing in a central role for business alongside scientists and technologists, and the state as regulator. A long trend addressing these concerns can be traced for example to the establishment of the Club of Rome in 1968[5] and is more recently illustrated by the highly significant development and implementation of the European Union Chemicals Directive, REACH (2006) which regulates the specification, usage, production and distribution of chemicals. An important regulatory extension within this narrative involves the emergence of "soft law", or voluntary measures to govern such risks, such as ELSA[6] assessments and reflections; and the EU Code of Conduct for Nanosciences and Nanotechnologies (EC 2009). This narrative is all about the precautions that are required in the steering and anticipation of technological development; and the mechanisms and methods that can be put into place to reflect upon, and then mobilise the results of such reflections, into the next rounds of development of new and emerging technologies.

Narrative C: "Participation society"

The main argument in this narrative, as articulated by Beck, (1992 [1986]), is that since we exist increasingly as a knowledge society, a heightened appreciation of an uncertain future opens the right for a wider constituency of actors to participate in the analysis of specific technological debates and questions around the shaping of the innovation future that unfolds. *Participation society* acts as an adjunct and additional support to the modes of decision making under contemporary models of representative democracy. Particularly, this narrative demands a place at the table of research and innovation futures and at the origination and design stages of research and innovation processes, for civil society organisations and other organised constituencies of actors such as user groups, before decisions and trajectories become "locked in". The demand therefore is not just about inclusivity of a wider and more diverse range of perspectives, but that inclusion follows a co-construction ambition, quite different from linear processes associated with conventional science communications, outreach, or "make and then consult" approaches since all of these modes negate the possibility of wider interests participating in the framing of research, innovation, and responsibility "problems". This narrative represents a research and political agenda championed by sociologists of science and technology studies (STS), who seek to define and operationalize progress towards the normative objectives and governance mechanisms that define Narrative C (e.g. citizen juries), creating a distinct line in the academic literature (Tancoigne et al. 2016).

Narrative D: "The citizen firm"

The normative questioning of the role of business in society links to a historical reflection on the firm as a social as well as an economic actor. To date, the concept of "Corporate Social Responsibility (CSR)" has been mainstreamed and standardised, mainly by individual (large) companies and latterly stabilised for practitioners (if not academia) through voluntary instruments for corporate responsibility. However, this stable conceptual interpretation, which according to Carroll (1999) originated in the 1950s, but which in fact we can trace to Donham (1927) has evolved and been contested over seven decades (Carroll 1999), only recently finding institutional stability as represented by the ISO 26000 standard on Social Responsibility. In terms of the scope of appropriate activities, investments and the roles, relationships and division of responsibilities between the firm and other organisations (called "stakeholders" in this narrative), this is opened again through new debates on planetary stress, climate change and the depletion of natural resources. Covered also are the implications for management practice of embedding social dimensions into the fabric of the organisation, and quantitative and qualitative evaluations of the stakes at stake, the diversity of forms, and the difference it makes, to be a highly developed socially transformative and innovative *citizen firm*. Work within management sciences has produced a large corpus of literature on CSR, business ethics, and sustainability, responding to the changing implications on / by *the citizen firm* and managerial responses to it.

Narrative E: "Moral globalisation"

Moral globalisation witnesses the engagement of Civil Society Organisations (CSO) in the (re)introduction of moral dimensions and ethical values calling for the remediation of adverse conditions of production through the mechanism of collective governance of global value chains. It introduces us to the ethical consumer, and intervenes on innovation system trajectories via international economic exchange and markets. Coalitions of co-ordinated actors including but going beyond CSOs invest in the formulation of governance instruments (such as environmental and ethical labels and standards: fair-trade, marine stewardship and protection, sustainable forests and palm oil), accompanied by certification processes seeking to embed social and environmental values and transformation into international economic activity (via supply chains and markets). In a certain way, action in this domain compensates for the failures of inter-governmental regulatory bodies. These new modes of intervention connect places of (distant) production to sites of consumption, putting centre stage the role and force of a new actor, the "political consumer".

Narrative F: "Research and innovation with / for society"

Finally, the actuality of *Research and innovation with / for society* beyond an intellectual ideal to its manifestation in practice, incorporates the normative rationales of narratives B–E above, but importantly stands at a 180 degree turn – an inversion of and opposition to Narrative A *Republic of science*. The central argument is that research, technological development, and ultimately entire innovation complexes are too important a domain to be delegated to a narrow group of actors. It is for wider and more diverse collectives to co-construct with scientists and researchers, the societal problems and orientations that science and research should address (including but not exclusively "grand challenges"). The focus is first on societal outcomes, with processes such as deliberation or participatory governance aiding this outcome, not being ends in themselves. At present, Narrative F is far from institutionalised, in the sense of existing in an integrated cohesive form which is systematically routinized, historically stable, and supported by discourse, resources and action. Nevertheless, Narrative F seeks to put in place assurances that those who are tasked with and have received investments from wider society (tax and fiscal returns) to develop the specialist knowledge to carry out the important science / research; work on behalf of society, do so in such a way that benefits society by addressing and solving societal problems and taking co-responsibility for societal impact. Science, research and innovation exist to serve society. To be effective, according to this narrative, processes must include wider publics in the definitions of societal problems and challenges and co-construct with scientists and researchers the technological and innovation pathways that shape those futures.

3.3 Crossing the divides: struggle, consolidation, blurred lines, bridges and boundary work across the six narratives

The six narratives are depicted as variously stable and porous. Experimentation and evolution is seen in all of them, simultaneously. Moreover, *boundary-crossing* between the six is evident. Looking to the future an interesting question is how the existing institutionalised pattern might shift. Clearly an objective of RRI is to (de)institutionalise Narrative A and deepen the institutionalisation of Narrative F. But, if this is so, who would do the institutional work to cross these boundaries by embarking on projects and experiments at the intersections of the narratives?

Some clues can be found in the preliminary findings of our Res-AGorA "Voices" research on institutional entrepreneurs of *de facto* rri (Randles et al. 2015c; Randles and Laredo 2016). One of the interesting findings from this project so far is the extent to which our participants in "Voices" are engaged in boundary work, crossing the divides or connecting two or more of the six narratives. For example, *Erik Fisher*'s Socio-Technical Integration Research (STIR) project located a social scientist next to the bench scientist, in a number of diverse institutional settings and over an extended period of time, in order to see whether the continual probing of the basis for decisions of the natural scientists, taken in the context of the everyday practices of the lab, created however temporarily, natural scientists who were more critically and societally reflexive, in the sense of self-questioning, than they had been at the beginning of the experiment. Fisher concluded that it did (Fisher 2015). This experiment, precisely opens up Narrative A to critical reflection, and can be seen as an experiment located at the interface of

5 Founded in 1968, the Club of Rome is an association of independent leading personalities from politics, business and science, sharing a common concern for the future of humanity and the planet: http://www.clubofrome.org/ (accessed 08 January 2016).

6 Ethical Legal and Societal Aspects of the emergence of new technologies.

Narrative A *The republic of science* and Narrative F *Research and innovation for / with society*.

In terms of taking the level of institutionalisation deeper, *John Goddard*, an early pioneer of an inter-disciplinary research institute oriented to addressing urban and regional economic development, CURDS, at the University of Newcastle, UK has latterly articulated his vision of the Civic University (Goddard 2009) which breaks into the "triple helix" of academic-business-government by inserting civil society as a fourth actor participating in the framing and co-construction of research and innovation processes orienting towards societal grand challenges, via the conduit of changes to the institutional structures and *modus operandi* of the University. Thus Goddard challenges both Narrative A and Narrative B, and seeks to institutionalise Narrative F. Similarly, *Michael Crow*, President of Arizona State University (ASU), has been at the helm of the twelve year, and still evolving, re-design of ASU to the "New American University", premised on the pillars of:

- **A** access to the full demographic of students to mirror the demographic of Arizona State,
- **B** maintenance of academic excellence, and
- **C** societal impact (Crow and Dunbars 2015), again challenging Narrative A by demonstrating an organisational case study of Narrative F.

Elsewhere, the Netherlands "Voices" participants *Annemieke Reebook* and *Merijn Everaarts* describe projects of social and business model innovation which connect Narrative D *The citizen firm*, Narrative E *Moral globalisation* and Narrative F *Research and innovation with / for society*. All these people, through their personal stories, visions and actions, provide some hints as to how the shifting sands and re-institutionalisation of the six narratives might practically occur.

3.4 Conclusion: linking the six narratives to the transformative ambition of the Res-AGorA Responsibility Navigator

In this chapter we have identified a small number of clustered narratives of *de facto* responsibility in research and innovation settings, and find congruence as well as conflict and contestation, across and within the Six Narratives. In so-doing we have confirmed that there already exists an evolving *de facto* governance landscape of responsibility in research and innovation "out there", and that contemporary instantiations of responsibility governance have emerged from this history. This is a necessary start point, in our view, to the construction of any new governance instrument seeking to influence or transform the *de facto* prior institutionalised landscape.

The *Responsibility Navigator* (Chapter 11) is an instrument of this kind. It represents the culmination of Res-AGorA's work and offers a practice-oriented governance tool to assist multiplexes of strategic decision-makers move towards responsibilisation and deep institutionalisation (Chapter 5 and Chapter 7) steered by collectively negotiated normative visions of responsibility through a dialogue-facilitated co-construction workshop methodology (Chapter 6). In this respect the "Navigator" is a contemporary governance innovation of the kind we have been discussing under each of the six narratives. Taken in the round, the *Responsibility Navigator* with its transformative ambition, and other practitioner tools like it, sit within pre-existing and continually evolving systems of hard (law) and soft (voluntary) regulation spaces. New instruments such as the *Responsibility Navigator* play an important role in shaking up, altering and potentially re-instituting the six narratives.



The authors in this chapter

"The discourse of RRI is very distant from earlier discourses on scientific responsibility since it raises the issue of the goals of research upfront."

4

Evolution of a concept: a scientometric analysis of RRI

Elise Tancoigne, Sally Randles, Pierre-Benoît Joly

This chapter is based on the forthcoming article Tancoigne, Randles and Joly (2016): *Power and the Performativity of Language: Words of power in the recasting of science and society relations: Responsible Research and Innovation (RRI) as "hype cycle" or the institutionalization of a new academic and policy concept?*

4.1 Introduction

Political scientists have considered the complex interactions between words and power for a long time. The power of words lies not only in the performativity of language – a typical situation where saying something is doing something – but covers a wide range of means related to sense making, issue framing, and the control of perception and the interpretation of reality. The importance of words of power (meaning powerful actors) may be identified in different mundane operations of political life (i.e. when spin doctors elaborate elements of language) and through well-known operations such as labelling or storytelling. These strong interactions between words and power have been taken into account in various streams of public policy analysis (Fischer 2003). They are also a central theme of policy fiction such as George Orwell's 1984 which points out the role of "Newspeak" in totalitarian states. Hence, the appearance of new expressions in policy discourse ought to be considered as a symptom of crisis and / or of potential key changes. The case of Responsible Research and Innovation (RRI) is interesting for its own sake but also since it illustrates the key role of the European Commission as a political entrepreneur which heavily draws on discourse framing (Schmidt and Radaelli 2004). In this chapter, we question the power of RRI words as well as the use of RRI by powerful institutions. What is the power of RRI, i.e. (to say it roughly) a tool for recasting governance of research and innovation or a tool for washing responsibility (Randles et al. 2014)? Who are the actors who define / discuss / promote RRI?

We performed a scientometric and textual analysis of texts related to RRI. In order to grasp this emerging word of power, we designed a dual approach which takes into account the evolution of the use of the term "responsibility" related to research and innovation (*lato sensu* approach) and the evolution of the expression RRI (*stricto sensu* approach). By using the former approach, we show that the use of responsibility is not unified but that it has formed different streams related to different concerns and to different intellectual traditions, namely: research integrity, risks related to innovation, and more recently research governance (which is the main root of RRI). When

dealing with the latter approach, we define RRI as a concept which is not (yet?) stabilized and we analyze RRI as a discursive space. This allows us to identify tensions and conflicts which are related to RRI and hence to outline its main stakes in terms of research and innovation policies.

4.2 Scope and methodology

Although RRI benefits from a fair amount of institutional support, its definition is not yet stabilized. This variety of definitions is a challenge to textual analysis. We designed a stricto sensu approach that gathers documents whose content includes the words "responsible research and innovation". A lato sensu approach gathers documents whose content is semantically close to the ideas of "responsible research" and "responsible innovation".

RRI *stricto sensu* corpus

A Google Scholar query on "responsible research and innovation" brought in 548 references, of which only 107 references were relevant (20 per cent). Given that 12 documents remained unavailable (mostly ongoing thesis or conference work), we relied on 97 documents for content analysis. Then, to study the discursive space, we classified the documents according to their amount of discussion on RRI, and kept only those whose topic mainly focussed on RRI (n = 27). Most of the remaining texts mentioned the term without further developing or extending the concept. We coded the text of the corpus for three dimensions of analysis:

1. Types of governance of innovation (self-governance of research and innovators v. new regulatory State);
2. Major stakes of research and innovation in society (need for a paradigm change to address grand challenges vs foster acceptance of new technologies);
3. Meaning of responsibility (retrospective account (accountability, liability) vs future-oriented responsibility).

RRI *lato sensu* corpus

First, we retrieved a corpus from the bibliographical database Scopus, with the following query executed on fields AB, TI, AUTHKEY (n = 206 documents): "responsible research" OR "responsible innovation" OR ("RRI" AND responsib*). Second, a list of terms extracted from TI, AB and AUTHKEY was produced and checked (n = 412 terms) and close semantic terms, i.e. terms related to the notion of responsibility of research, were selected to broaden the stricto sensu query. The lato sensu corpus includes 4,585 references, obtained with the final query: "responsible research" OR "responsible innovation" OR ("RRI" AND responsib*) OR "responsible development" OR "ethics in research" OR ("ELSA" OR "ELSI") and "ethic*") OR "responsible conduct of research" OR (RCR AND responsib*) OR "research integrity" OR "scientific integrity" OR "scientific misconduct" OR "research misconduct" OR "broad* impact*" OR "technolog* risk".[1] We relied on the chain of tools available on the CorText Manager Platform[2] to identify clusters of thoughts (socio-epistemic networks) and their historical origin.

4.3 The position of RRI in the wider landscape of scientific responsibility

This analysis of the RRI *lato sensu* corpus shows that the same radical, "responsib*" is used by different actors with different meanings. Several trends are revealed: scientific responsibility is an old and institutionalized discourse (with its actors, organizations, competences, training programmes, etc.). However, responsible innovation (and RRI) is different, both in terms of semantic network and intellectual tradition. The trend devoted to RRI is strongly linked to the words "governance", "science and technology studies", and "responsible innovation". Interestingly, it is related to some old references like Michael Polyani (1962) "The Republic of Science" and David Collingridge (1980) "The social control of technology", two authors who have raised the question of science and technology governance in very different ways. The other references are post-1990 and include (among other) issues related to the role of publics (authors Funtowicz and Schot), to the recasting of relations between science, society and democracy (Jasanoff, Kitcher), to the governance of science and technology (Guston, Gibbons), to responsible development of research (Nordmann) and to responsible innovation.

The uptake of "RRI" in the literature started in 2011 (Figure 4–1, *stricto sensu* corpus). It is highly connected to

1 See Tancoigne et al. (2016) for figures and complete description.
2 http://www.cortext.net/projects/cortext-manager.html (accessed 04 January 2016).

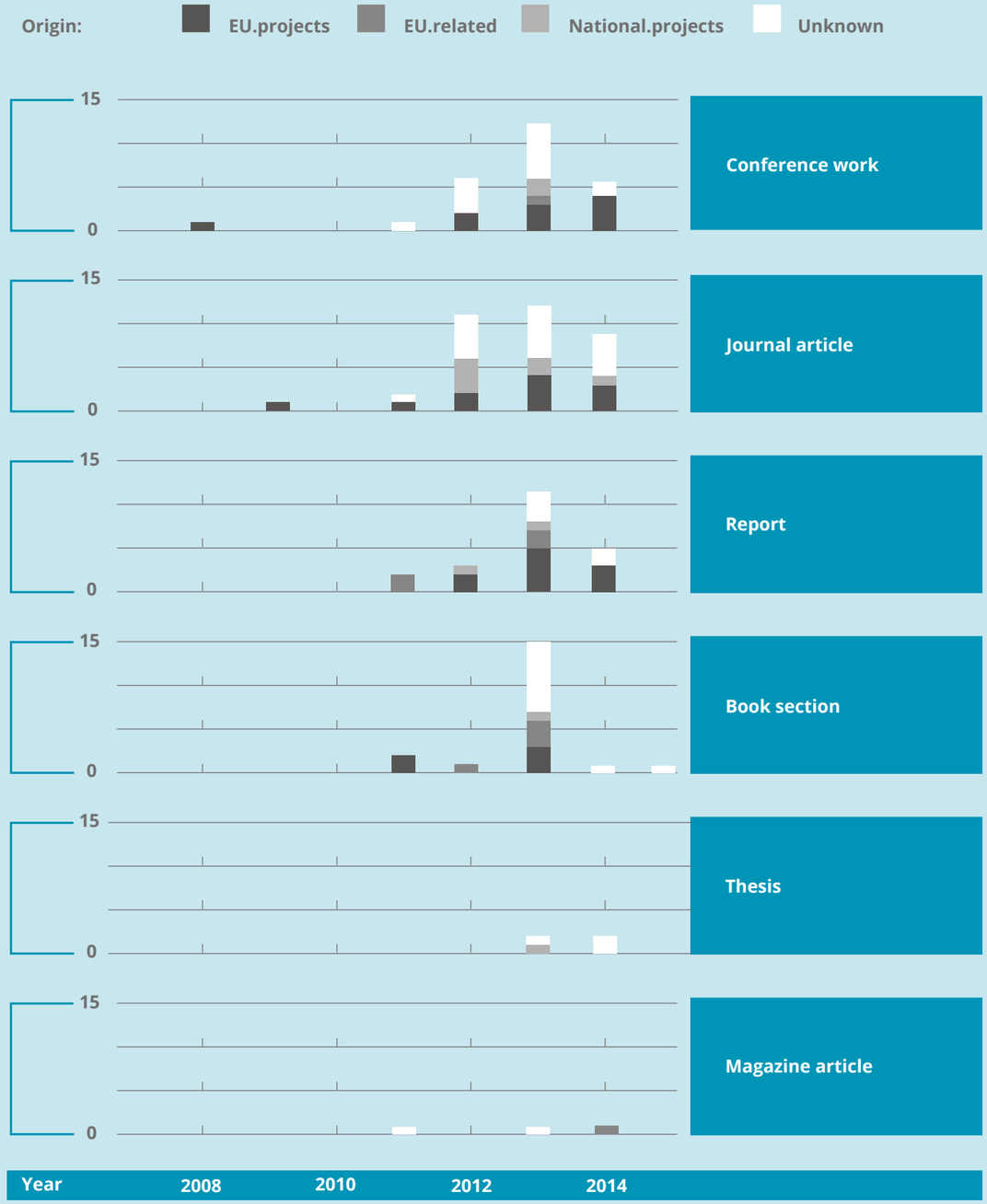


Figure 4–1: The uptake of RRI started in 2011. It is mainly academic and highly connected to European funding ("EU.projects") or to a European Commission context ("EU.related")

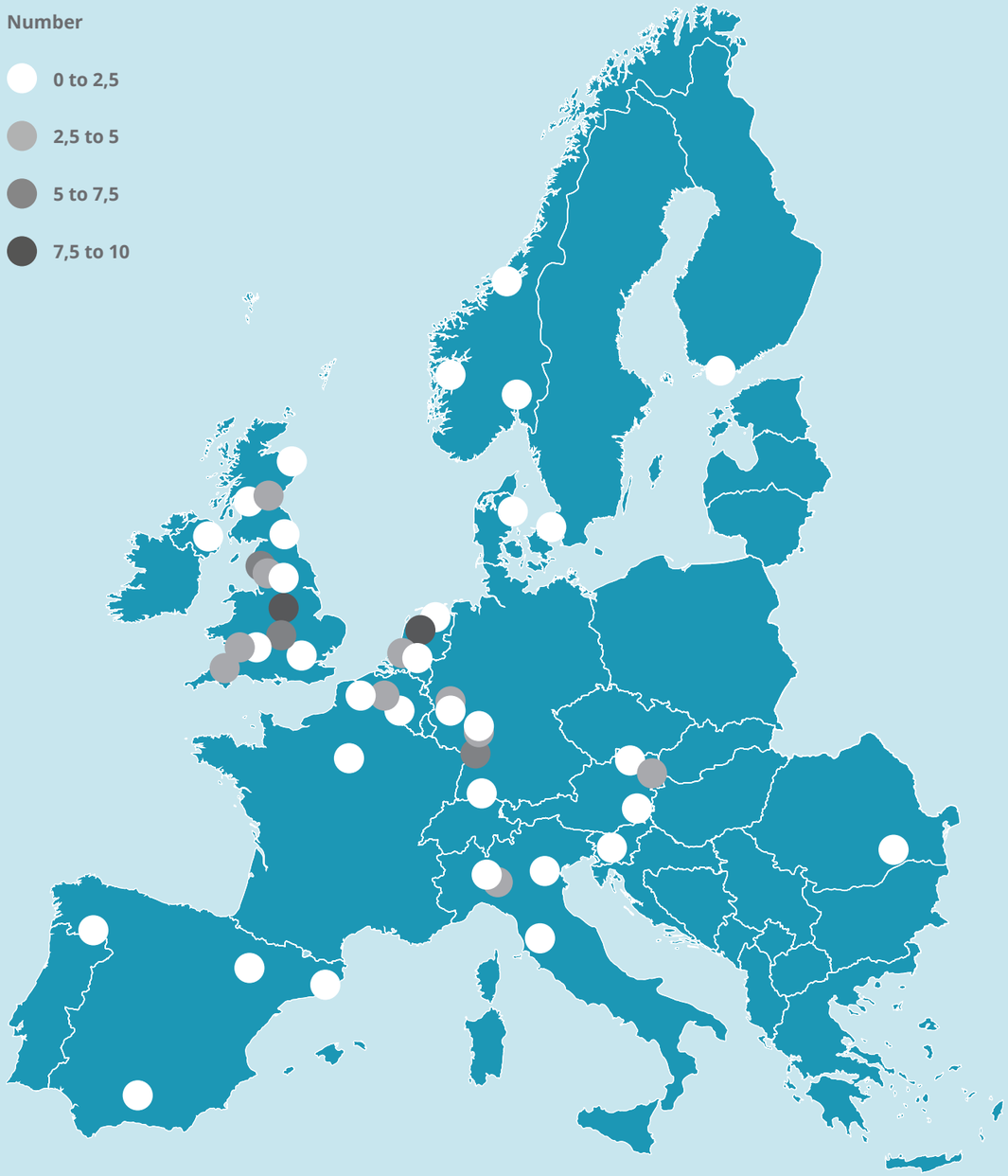


Figure 4–2: Authors discussing, mentioning or using the concept of RRI work in Europe, most of them in academic institutions

research projects funded by the European Commission ("EU.projects"), or to a Commission context (e.g. conferences, writings of scientific officers: "EU.related") and is discussed, used or mentioned by authors working in Europe (Figure 4–2, stricto sensu corpus). Most of the authors discussing it are scholars (90 per cent), of which 34 per cent are also involved in research policy, either at the national or European level. Most of the authors are social sciences and humanities (SSH) scholars based in Europe, many of whom are involved in European projects or interact closely with the European Commission. Hence, the coalition attached to the RRI discourse includes social scientists, a small group of European Commission Officers involved in the science / society field, and some consultancies.

The analysis of the *lato sensu* corpus shows that it is not the practice of scientific research as such that is at stake, but instead its implications (positive and negative) for society. It is not only about controlling adverse effects but also about a broader appraisal of transformative effects of science and technology. Although RRI has its own characteristics, one of the questions for the future is the way some connections between the different clusters of this broad landscape can be established, including the wide trend of Responsible Conduct of Research which is currently prominent in the US.

4.4 An analysis of RRI as a discursive space

In comparison with the other discourses on responsible research identified in the *lato sensu* corpus, the RRI stream focuses on governance of innovation. All the texts have a position that limits the role of governments to the support of the activities and coordination of involved actors. The governance process appears to be opened to a variety of actors, well beyond scientists: stakeholders, the general public, users, consumers, etc.

The discourse of RRI is very distant from earlier discourses on scientific responsibility since it raises the issue of the goals of research upfront. The texts of the *stricto sensu* corpus share a representation of innovation as an interactive and transformative process. The traditional representation of innovation as a linear, top down process is systematically challenged. This leads to a call for more inclusive, deliberative processes of research / innovation. Taking such a position, these texts are far from original. They reflect what is "in the air": a new vulgate on research and innovation originating from research in STS and Studies of Policies for Research and Innovation (SPRI) that gained political influence in the late 90s. Interestingly, these texts also point out the internal contradictions of RRI and the risk of the approach to be used only for legitimizing reasons, without challenging the objectives of research and innovation.

The emphasis on the collective and prospective dimensions of responsibilities is pervasive in the corpus. Responsibility is less a matter of liability and accountability than a matter of care, responsiveness, anticipation. It is less a matter of avoiding hazards and unintended consequences than failing to develop solutions to address crucial societal challenges. As compared to the *lato sensu* corpus, the notion of responsibility is broader, but also weaker. In the streams related to research ethics and deontology, responsibility is related to professional norms of behaviour, hence the references to Merton, Rawls, and references to bioethics. The notion of responsibility is mainly associated to "virtue responsibility" (Vincent 2011) and it is individual. In the stream of risk, the sense of responsibility is related to the hazards, and hence to "causal responsibility" and liability (Vincent 2011). Interestingly, precautionary principle, a concept present in the map leads to an extension of individual responsibility, even though there is no certainty about the causal relations involved. As compared to this, the texts of the corpus generally point out the difficulties of attributing responsibility. One text refers to the ecology of responsibilities, another coins the notion of distributed epistemic responsibility. Added to the general reluctance to set legally binding devices, this weakens the role of responsibility as a governance tool. Hence, responsibility is much broader since it includes the concern to seriously address societal challenges but, as we have just shown, it is weaker.

1.1 Discussion

In different respects, RRI appears as a breakthrough compared to earlier discourses on scientific responsibility.

Contrary to what might be expected, RRI discourses are quite convergent and they have three distinctive features. First, RRI discourses are about governance of innovation. Drawing on difficulties related to new emerging sciences and technologies, RRI seriously takes into account the need to govern innovation in order to address major societal challenges. Second, although RRI discourse acknowledges the limited capabilities of government to steer research and innovation, it refers to inclusive and participative forms of governance, and thus is differentiated from early discourses that praised self-regulation of science by scientists. Third, the meaning of responsibility embedded in RRI is prospective rather than retrospective, moral rather than legal, collective rather than individual, and it is concerned with failing to address major challenges rather than avoiding unintended consequences.

The analysis performed allowed us to identify only one main position in the discursive space. Most of the authors of the corpus consider that RRI is associated to a paradigm shift, moving from a competitive frame to societal grand challenges. The society they imagine is an Habermassian one, where rational deliberation is instrumental in defining common goals and assembling citizens of all countries to fight against global enemies (climate change, global hunger, etc.). In order to do this, we need a new social contract between science and society. Although they do not appear in our analysis, we can identify some other positions in the discursive space, related to other imagined societies. One may be defined as neo-elitist and technophile. Science and technology are still considered as the main source of progress and the solution to the problems we face, either grand challenges or economic growth. But public deliberation is not an option since citizens do not have the required knowledge and their perceptions are biased. Public participation is at best populism and it is up to those who know that they have to take responsibility and make good decisions. The traditional social contract based on a strong boundary between science and society has to be preserved: the strong autonomy of science under the umbrella of the state, and free market competition to promote Schumpeterian innovation. In this sense, substituting prospective responsibility with a retrospective one is crucial since the mood of "risk society" has led to apply risk-adverse policies – i.e., the precautionary principle as a way to block innovation and new technologies – and that it is necessary to rebuild a culture of innovation in Europe. On the other hand, radical critiques are also against public deliberation because they consider participation as a way to manipulate public opinion. The environmental and societal problems we currently face are huge. But it is necessary to address them through political and societal changes, and get rid of the technological fix. This position shares Hamlet's concern about an uncertain trajectory: "rather bear those ills we have than fly to others that we know not of". In this world view, legal framework, liability and accountability are key elements that may protect those who are in a weak position, and prevent irresponsible behaviour. Hence, the discursive space of RRI is more conflicted than it may appear in our textual analysis.

We performed the analysis on a corpus built in early 2014, a period in which RRI is in an embryonic and exponential growth stage. The future of RRI does not only depend on dynamics within the discursive space, but also on the possible relations with earlier discourses of scientific responsibility. Questions related to ethics, deontology, risk management, might be reframed in RRI as a larger paradigm. This would eventually allow RRI to enrol organisations such as ethical committees or those devoted to responsible conduct of research.

In any case, RRI as a new word of power is related to broader changes of governance, related to the weakening of the power of national states, the rise of soft law, and the acknowledgement of the role of civil society. It is definitively embedded in a new way to govern science in society.



Jessop
2002
Page 242

"[C]ontinuing dialogue and resource-sharing to develop mutually beneficial new joint projects and to manage the contradictions and dilemmas inevitably involved in such situations."

5

Res-AGorA concepts and approach

Bart Walhout, Stefan Kuhlmann, Gonzalo Ordóñez-Matamoros, Jakob Edler

5.1 Introduction

The basic thrust of Res-AGorA is to develop a governance framework for Responsible Research and Innovation (RRI) by learning from "RRI in the making". In Chapter 1 we have argued that such an approach is needed because of the manifold, already existing, governance arrangements for research and innovation, many of which are explicitly covering RRI goals and ambitions. If RRI has to make a difference, any governance strategy which intends to stimulate RRI will have to relate to this "*de facto* governance" (cf. Rip 2010) of RRI. Moreover, as discussed in Chapters 2–4, RRI is already finding its way, not only in academic literature, but also in, for example, re-framing practices of Corporate Social Responsibility (CSR) or engaging citizens in discussions about research and innovation. This is not to exaggerate the positive impact of RRI – in fact, the previous chapters have shown a "proliferation" in understandings of RRI as well as the weaknesses of merely adopting the notion – but to underline the need to reflect on the governance of RRI against the backdrop of existing modes and instruments in the governance of research and innovation as well as the ongoing discussions and understandings of RRI.

In this chapter we will discuss how our aim of learning from "RRI in the making" translates into a research model for empirical analysis, what kind of framework we are aiming for and how the lessons taken from our case studies (Chapter 7) as well as our investigations into the meaning of RRI (Chapter 2–4) and our monitoring of RRI Trends in Europe (Chapter 8–10) will inform the construction of our framework.

5.2 Learning from "RRI in the making"

As argued above, the governance of RRI has to be thought of as part of the governance of research and innovation. This immediately poses a big challenge for empirical research. *Research and innovation* are creative social processes in which many actors and governance arrangements are involved across a wide range of scientific and technological fields. Just think of markets, supply chains, regulations, rankings and career paths, research funding and evaluation, intellectual property protection, promises and concerns about new technologies, etc., all of which are affecting research and innovation. It is impossible to draw a "full picture" of all these factors, but it is not necessary either. We can limit ourselves to research based practices of technology development and related innovation, often referred to as "emerging technologies". It is with regard to these practices that the discourse on RRI has emerged, on

the one hand responding to the inevitable "production" of questions about safety, sustainability or even desirability of particular technological developments, and on the other hand reinforcing the strategic orientation of research towards applications which are expected to provide solutions for societal challenges. The latter rests on the firm belief that human progress and economic prosperity are to a large extent enabled by technological innovation. Innovation thus is not just invention, or the adoption of new technologies, but also the societal ordering in which these processes take place. Innovation can be seen as a "journey to users" of new products, new services, new business models and so forth, through networks of actors crossing worlds of science, worlds of research and development, of finance, of marketplaces, media and other intermediaries. That is not to say that these journeys are all well-organised travels. Innovation journeys (van de Ven et al. 1999) often are explorations and experiments, full of contingencies.

Our understanding of *governance* links up with the above-mentioned conceptualization of research and innovation. Governance is a broad term as well, figuring in diverse strands of literature, in descriptive as well as normative ways. In Res-AGorA we are not interested in capturing all perspectives on governance as such, nor will we analyze the governance of research and innovation in general, but we are interested in those practices in which the participating actors work towards legitimate normative objectives and outcomes. These normativities are performed and qualified and become institutionalized through various means and strategies, can stabilize into hard and soft regulatory instruments, but can also become "unhinged" when political contexts shift. Therefore we conceptualize governance as:

"the dynamic interrelation of involved (mostly organized) actors within and between organisations, their resources, interests and power, fora for debate and arenas for negotiation between actors, rules of the game, and policy instruments applied helping to achieve legitimate agreements." (Kuhlmann 2001, Benz 2006, Braun 2006)

Accordingly, we have been investigating the purposive aspect of working towards goals and legitimate agreements, which have to do with RRI (though often not labelled as such), as processes of "RRI in the making" in our case studies. Our aim is to learn from the tensions, barriers and opportunities present in various situations, from large research programmes to sustainable production labels, together reflecting the richness of RRI goals and ambitions. Learning involves both understanding conditions and mechanisms and evaluating the qualities and outcomes of governance processes. To this end we have developed the research questions and model discussed in the next section and an evaluative frame helping to identify building blocks for our framework (Section 4).

5.3 Research questions and model for empirical analysis

Our approach to learn from "RRI in the making" basically involves two questions:

1. How is "RRI in the making" conditioned?
2. What are building components for our governance framework?

The first question is about analyzing the factors (which can be actors) which not only shape governance processes in general, but specifically "condition" the qualities and outcomes of it, as perceived by the actors involved and observed in our case studies. To bring about a logical order in our investigations in terms of governance, we distinguish between three dimensions:

- The *governance arrangements* and objectives around which actors mobilize resources and personnel in an attempt to realize responsibility in research and innovation
- The *actor landscape* involved
- *de facto governance practices*, i.e. the places and spaces in which the RRI governance arrangements are called upon, objectives are negotiated and instruments are implemented.

As emphasized in our conceptualization of governance in the previous section, there is a dynamic interrelation between these dimensions (see Figure 5–1). The purpose of distinguishing them is to enable us to study the "fate" of various approaches and related instruments to RRI, as a function of both actors' ambitions and interests and of the affordances and constraints of the particular places and

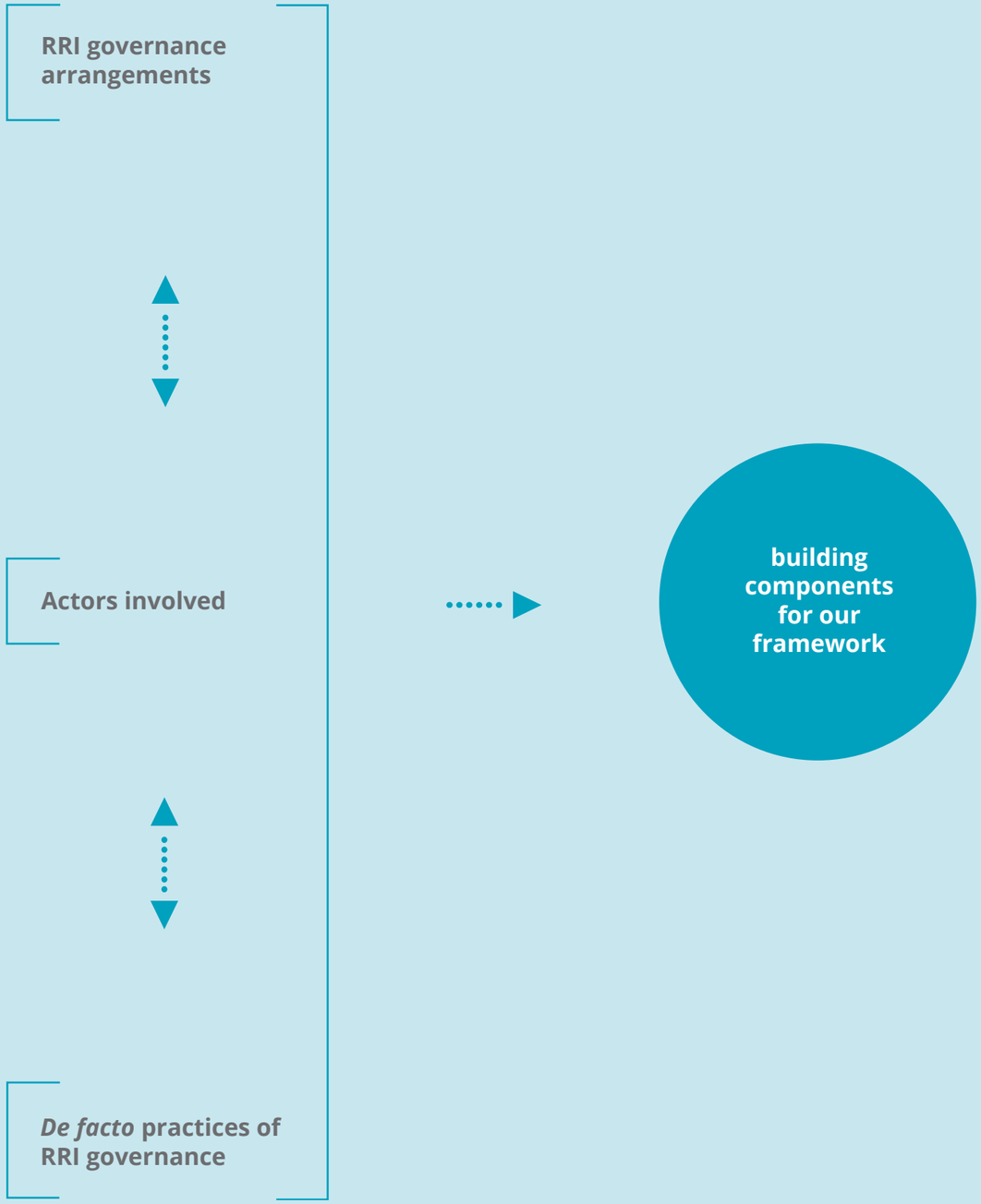


Figure 5–1: Research model in search of components for the RRI governance framework

spaces where the conditioning of "RRI in the making" takes shape. These can be the "fora for debate and arenas for negotiation" in our conceptualisation of governance, but also procedures or particular problem framings. Think of processes of agenda setting, the articulation of ambitions and translations into instruments. It is in these processes that strategic behavior occurs and certain frames gain dominance, while other perspectives can be silenced.

The second question concerns how to draw lessons from our investigations. For this purpose we are in need of an evaluative perspective, which will be discussed in the next section. In the remainder of this section we will discuss what kind of phenomena and characteristics we have been looking at in each dimension.

The empirical search strategy in action

To facilitate cross-case analysis we have used a limited set of "descriptors", specifying the objects and features each case study had to cover for each of the three dimensions in the research model. For example, we have asked the researcher for each case to describe the research and innovation setting, since these can vary from public research settings to regulating value chains. The case studies focused on specific governance arrangements which have been described in terms of the goals and instruments deployed, but also how they were situated in relation to other governance mechanisms. For example, the Danish research priority setting process discussed in Case Study 4 is situated in the set of institutions and (political) procedures regulating the research budget.

The dimension of the "actor landscape" in the processes of "RRI in the making" has been explored by characterizing the actors in terms of differences in types of organisations (e.g. single companies, ministries, but also charity organisations) and highlighting the actions of key individuals where relevant. We have asked the case researchers to be particularly sensitive to the differences in capacity to be engaged in debates and negotiations, the specific problem frames and the roles and relations adopted in practice. For example, the comparative study of discussions about fracking in the UK and in Austria (Case Study 1) shows not only differences in the way actors have been involved, but also in what kind of arguments have been brought in.

Finally, the dimension of *de facto* RRI governance practices has been researched in terms of how actors actually have been mobilized, how interests have played out, value clashes have been modulated or whether competing claims have been aligned. We are particularly interested in how such dynamics are being conditioned by the "rules of the game" in the places and spaces where actors meet. For example, the analysis of the Risk Assessment and Technology Assessment (RATA) theme in the Dutch research and innovation consortium NanoNextNL (Case Study 3) shows how the explorative character of the efforts to integrate RATA actually allowed for the continuation of a traditional distribution of responsibilities.

These and other descriptors have been used as guidance for the case studies, but not in an exhaustive manner. Having a core structure allowed us to contrast situations, or the use of specific arrangements (see Chapter 7). The more important use of the descriptors is in *understanding* strengths, weaknesses, barriers and opportunities in the governance processes studied. To identify these, we have used an evaluative frame, discussed in the next section.

5.4 Qualifying governance processes and outcomes

When studying the governance of RRI it is tempting to look for "good governance". However, if there is one thing our case studies have confirmed, it is that good governance criteria can and will be used quite differently, because they are interpreted and applied in heterogeneous settings. Following our conceptualization of governance we can say that governance processes are "successful" if there is an acceptance of a shared understanding of responsibility, and the development and application of instruments, mechanisms and processes which serve to embed this shared understanding into practice to an extent that it guides and structures reflections, learning, behavior or decision making. Below we will conceptualize these features in terms of "constructive" and "productive".

But first, we emphasize that "success" (or "failure") is not attributed to individual actors, nor to the legitimacy of outcomes or effectiveness of the instruments and arrangements deployed, but to the *working towards* legitimacy and effectiveness. We do not focus on what RRI is (and hence would determine legitimacy or effectiveness), but on the processes and mechanisms by which it is thought to be realized. These can be studied in "multi-actor" settings, such as stakeholders deliberating over fracking or sustainability certification, but also to multinationals with their internal divisions of labor and coordination and responses to external actors and claims.

In such situations not only governance is a dynamic process (including strategic games), but RRI often is a moving target as well. While actors may agree on normative principles, objectives and outcomes in general terms, these have to be (re)articulated and specified in relation to the novelty produced by research and innovation as well as in relation to concurrent objectives, or to be reinterpreted in response to change in the societal context. In close connection, the effectiveness and legitimacy of the governance arrangements by which the normative objectives of RRI have to be realized is often challenged. Contestation can arise from conflicting logics, polyvalent valuation, overlapping if not competing arrangements, incongruent framings or ambiguities in proposed solutions. Although such tensions occur as much within organisations, these can be more visible *between* organized parties, up to (public) controversy, thereby also bringing along its own dynamics.

In this context the emerging discourse on RRI has to be understood as a quest, on the one hand for urging actors to be what they understand as truly responsive with regard to normative principles, objectives and outcomes, while on the other hand (re-)designing procedures and institutions to align competing claims of responsibility, effectiveness and legitimacy. Actors in RRI governance certainly will require that its arrangements are "legitimate" and work "effectively". But as mentioned above, claims about legitimacy and effectiveness are a prolific source of contestation of the governance of RRI. Accordingly, we can evaluate "governance success" in terms of how well this dual dynamic is coped with. We will group the range of factors that are said to be essential for coping with these challenges under the headings of "responsibilisation" and "contestation":

- **Responsibilisation** is about the governance of (self-) stimulating actors to care for their duties of being anticipatory, reflexive, responsive, etc. by drawing on a clear understanding of their responsibilities and un-coerced application of values. This stimulating governance can take the form of facilitating, equipping and rewarding of actors to take their responsibilities seriously.

- **Managing contestation** is about the governance of deliberating and negotiating competing claims of responsibility, effectiveness and legitimacy, which are the result of different understandings, framings and evaluations of the need for and processes and instruments by which normative objectives are to be accomplished (whether or not specifically articulated as RRI).

It is with regard to the dual challenge of responsibilisation and contestation we can qualify the interactions between the "actors and factors", as discerned in the research model in the previous section, in terms of "constructive" and / or "productive".[1]

- **Constructive interactions** can be characterized by an adequate treatment of the issue(s) under discussion (including the framing of the problem) and mobilization of resources (from mental to financial). Here, "adequate" is not simply an objective measure, but set in context of the nature and distance between actor perceptions of what the RRI "problem" is, and how to resolve it in governance terms (e.g. the mobilisation of, or reference to, particular governance instruments, and their effective utilization).

- **Productive interactions** bring about transformation, either in the behavior or attitude of actors[2], in line with new understandings of responsibility, working towards a higher level of shared understanding of responsibility or in responsive / reflexive improvement in the governance arrangement itself (which then defines and supports specific goals).

Similar to the descriptors provided for using the research model in the case studies, we have listed descriptors for

1 This phrasing has been inspired by the notion "productive interactions" introduced by Spaapen and van Drooge (2009).

2 Transformations of behaviour is not necessarily equal to "compliance" (to a certain regulation), but already start with changing attitudes and commitments, which in turn increases the possibilities to hold actors to account.

analyzing how well responsibilisation and contestation have been coped with as determined by the constructive and productive qualities of interaction. "Constructive" in relation to "responsibilisation" will (at least) cover:

- Having the "right" set of actors involved (think of different problem types requiring different modes and scope of participation), in a way that is perceived as meaningful and fair. This aspect will be conditioned by the governance arrangements, for example in providing the capacity to have actors with different stakes, power, etc. involved in a meaningful way. But it will also be conditioned by how key actors – consciously and unconsciously – put such arrangements into practice.

- Developing a shared (or a sufficient level of complementary) understanding of the governance challenges and how these have to be addressed. The question of how to cope with uncertainties, for example, shows that next to actor representation, there has to be an adequate "problem representation" across the actors involved. This "robustness" of the knowledge base underpinning the governance arrangement shapes the deliberation enabled by participation.

- Next to representation and understanding, the constructive quality of interactions critically depends on the capacities for learning and embedding of responsibilities (e.g. addressing various levels within organisations instead of only having "spokespersons" involved). We can expect both to be related to the capabilities of actors, but the characteristics of the governance arrangement(s) are important as well, notably in providing the spaces and capacities to stimulate reflexivity and responsiveness, and in the institutionalization of commitments.

With regard to "managing contestation" we can think of constructive interactions as covering:

- Accepted procedures or "rules of the game", which is important to the extent to which the inclusion of actors is perceived to be meaningful and legitimate.

- Transparency, i.e. with regard to procedures of inclusion as well as to the robustness of the problem framings.

- Trust in the *de facto* governance process, which depends on transparency and procedures, but also on the way actors are involved (their behavior and commitments).

For using these descriptors we have mapped these into the evaluative frame set by our dimensions of responsibilisation and contestation on the one hand and how these are shaped in the interaction between "actors and factors" on the other. This is depicted in the table below. However, as for the descriptors of the research model, we have used these descriptors in a sensitizing rather than exhaustive way.

Table 5–1: Evaluative frame

	Constructive (input requirements)	Productive (transformation)
Responsibilisation	Actor inclusion Robustness of the knowledge base Capacities for learning Embedding of responsibility	Actors change behavior / attitude in line with new understandings of responsibility
Contestation	Procedures and "rules of the game" Transparency Trust in the *de facto* governance process	Governance arrangements align with or are changed towards input requirements (constructive)

5.5 Identifying building components and constructing the framework

In the Res-AGorA project we have used our case studies (five of which are summarized in Part 3) not as representative of the variety of research and innovation settings and governance dynamics, but as a rich source of inspiration, next to our investigations in the (evolving) discourse about RRI (Chapters 2–4), conceptual reflections (more extensively covered in project deliverable D4.8 and D4.11)[3], country monitoring (Chapters 8–10) and feedback from practitioners and academics in a series of co-constructive workshops (Chapter 6).

Two analytical perspectives have been guiding in linking these various inputs in a meaningful way. The first builds on our conceptualization of governance in Section 2: conceiving governance as a dynamic interplay and considering the many and heterogeneous elements in it. An important lesson to be taken from scholarly literature on governance is that in such a complex and dynamic setting, every mode of governance will be sub-optimal or fail. Jessop (2002) argues that a self-reflexive self-organization of substantively interdependent but formally independent actors is a mode of governance that is less prone to failure as it takes into account the complexity of the social world. Self-organisation, Jessop claims, would draw on:

"continuing dialogue and resource-sharing to develop mutually beneficial new joint projects and to manage the contradictions and dilemmas inevitably involved in such situations." (Jessop 2002: 242)[4]

Jessop's take on "meta-governance" as "organising the conditions for governance" (Jessop 2002: 242) by self-organisation which closely resembles the way we have looked at responsibilisation and contestation as a dual dynamic *and* challenge for RRI governance. Likewise we conceive our governance framework as a meta-governance frame.

The second perspective concerns the specific use of our meta-governance frame. Where the meta-governance feature, as discussed above, has guided us in identifying building components for our framework, we also need to construct a frame which can be used in a meaningful way by the governance practitioners we have discussed in Chapter 1. For this purpose we have conceived our framework as a means of "strategic intelligence",[5] supporting actors in reflecting on their own position and abilities, as well as those of others, considering the dynamic interplay between (RRI) governance arrangements, the way actors are (not) involved in sense and decision making and institutional processes and conditions. Chapter 11 discusses how our framework has been constructed according to this aim and the approach discussed here.

3 The Res-AGorA deliverables are available at http://res-agora.eu/eu-deliverables/.

4 Jessop (2002) distinguishes between the governance modes of a) market exchange, where free interaction between independent profit-maximizing actors is expected to act as an invisible hand providing the conditions necessary for progress; b) hierarchical command, where imperative top-down actions is assumed to assure coordination between actors toward a defined goal); and c) reflexive self-organization, which is the one we elaborate upon here.

5 Kuhlmann et al. (1999) defined strategic intelligence as "a set of – often distributed – sources of information and explorative as well as analytical (theoretical, heuristic, methodological) tools employed to produce 'multi-perspective' insight in the actual or potential costs and effects of public or private policy and management."

The authors of this chapter

“The workshop design offers a unique process for organisations which want to steer research-related decision-making processes towards more responsible research and innovation.”

6

The Res-AGorA Co-construction Method

Nina Bryndum, Alexander Lang, Christoph Mandl, Morten Velsing Nielsen, Bjørn Bedsted

6.1 Objective of the Res-AGorA RRI workshop design

A small team within the Res-AGorA consortium[1] developed a workshop design that aims at facilitating and encouraging reflective processes between diverse and often opposing stakeholder groups. It is centered on the conceptualization and implementation of Responsible Research and Innovation (RRI) in organisations and elsewhere. The workshop design offers a unique process for organisations which want to steer research-related decision-making processes towards more responsible research and innovation. It provides an open space for reflection without normatively predefining what “responsibility” is. Rather, it is designed to “walk the talk”, making it possible for stakeholders to gain firsthand experience on how to possibly promote RRI in organisations and elsewhere.

The workshop design itself resulted from extensive deliberative co-construction work within the Res-AGorA team and has been tested in real life settings. Five two-day stakeholder workshops demonstrated a model for a governance framework for RRI while reflecting upon and further developing findings of Res-AGorA. This process evolved to have unique generic workshop qualities for stakeholder co-construction and reflection on responsible research and innovation, thus the Res-AGorA “Co-construction method” came about.[2]

The workshop design merges default conceptual dimensions and principles of RRI with a rigorous bottom-up approach of bringing in stakeholders’ everyday experiences in implementing measures for the responsibilisation of research and innovation (R&I) processes. The dimensions and principles of RRI are based on in-depth theoretical deliberations and field investigations conducted within the Res-AGorA project. The conceptual and empirical insights were consolidated into a preliminary governance framework for RRI and comprised a set of principles and dimensions of RRI, illustrations, and questions to deliberate upon when striving to reach higher levels of responsibility. The series of workshops further developed the preliminary framework into the Responsibility Navigator (Chapter 11). In the subsequent sections, the Responsibility Navigator constitutes the input for further possible

1 The team consisted of Erich Griessler and Alexander Lang, Institute for Advanced Studies, Vienna, Bart Walhout, University of Twente, Christoph Mandl, Mandl, Lüthi and Partner. It was led by Bjørn Bedsted, Nina Bryndum & Morten Velsing Nielsen, The Danish Board of Technology Foundation.

2 For more information please visit: http://res-agora.eu.

workshops aiming at making research and innovation more responsible. It may be useful to supplement this with the manual for the Co-construction Method, as the detailed generic version of the workshop design[3] has been made available on-line.

As a point of departure, Section 6.2 presents the process, assumptions and considerations in developing the workshop design. Section 6.3 offers a short practical introduction on how to make use of the workshop design in your own context and culminates in important conclusions in Section 6.4.

6.2 Producing the workshop design

Prior to constructing the workshop design, the Res-AGorA consortium held a number of arduous yet productive academic conversations concerning the prospective design of the workshops, which included discussions on how to select stakeholders, how to decide which domains to cover and how to approach relevant stakeholders and encourage them to participate, etc. The efforts and difficulties the Res-AGorA consortium underwent are comparable to those that a stakeholder might face when participating in the RRI workshops such as experiencing provocative discussions, demanding working groups and plenary sessions, and the collaborative production of output.

Explaining RRI

Subsequently, numerous feed-back sessions regarding the workshop design were established via face-to-face meetings and through video conferences within the small Res-AGorA team which developed the design. One of the most difficult aspects faced by the team was the indeterminate notion of RRI per se. An important aim of the stakeholder workshops was to refrain from imposing a certain definition of RRI. The question arose how to inspire very busy stakeholders with packed schedules for months ahead to participate in the workshops. How could we explain the topic of the workshop and the importance of RRI for their work? And how could stakeholders, who had hardly any preconceived notions of RRI, be expected to understand the importance of their feedback and the need to be involved in a co-constructive process aimed at building a governance framework for RRI?

Selecting stakeholders

The collaborative processes lay the grounds for the selection of stakeholders which resulted in the following guidelines for broad-based stakeholder nominations:

- The nominees should be involved in the governance of responsible research and innovation.
- They should be derived from both governance bureaucracies and from industry with extensive knowledge of the use of responsibility-related issues in R&I.
- They should be recruited from diverse non-governmental organizations (NGOs) and international organisations concerned with responsibility in R&I.
- They should have some record of or reputation for critical / reflective thinking and action in relation to R&I governance.
- Geographically they should be recruited from the east, west, north and south of Europe.
- Gender representation should be balanced.

Producing openness and depth

Key in this process was an increase in our awareness concerning the elements of unclarity and uncertainty intrinsic to the concept of RRI and the aim of the workshops. In order to deal with these circumstances, the team made the following decisions:

- The uncertainty of the vaguely defined RRI concept was openly stated in both the invitation and the workshop design itself as well as in the information material on the Res-AGorA governance framework for RRI, which was used as a basis for discussion among the participants.
- The diversity of the many and often contesting interpretations of RRI already booming in academia should be embraced and presented.
- The workshops should be kept open-ended regarding the type of output ultimately produced.

The amazing openness amongst the participants and the deep level of discussion contributed to an utterly instructive experience for all involved throughout the five workshops. The strength exhibited by the workshops in so openly defining responsible research and innovation in combination with the carefully designed workshop process was noteworthy.

Producing flow and dynamic interaction

Our preconception of the stakeholders we invited was that they would be professionally socialised to be viewed as "owners" of expert knowledge. Thus, it was presumed they would be inclined to inform others and share their knowledge, rather than opening up to listen and learn from others. However, such a mental model creates an unintended communication pattern among experts regarding who is right and who is wrong and thus disables collective learning. As a result, groups of experts often act less intelligently than each of them would as an individual (Argyris 1991).The underlining dilemma was that we ideally wanted to have participants with a high level of expertise who do not necessarily behave as experts. That was the challenge. The balance of acknowledgement and willingness to honor all participants as experts with their willingness to behave as learners and listeners was required in the workshops. In order to disrupt the prevailing communication patterns, a couple of elements were carried out differently than what is typically done when organising workshops with experts:

- Workshop invitations made clear that the Res-AGorA team wanted primarily to listen to participants' expertise rather than to convince participants of Res-AGorA findings.
- During workshops, participants had the freedom of choice which parallel working groups they wanted to join.
- Moderation of working groups by Res-AGorA team members was performed by listening and asking questions rather than by making judgmental statements about what participants said. The careful facilitation supported the ability of participants to behave similarly and created a role model for everyone.
- The plenary was facilitated in such a way that neither the facilitator nor a "first come first serve rule" decided the order of who would speak. Rather, the participants themselves decided who would speak and who would listen by using what is known as a "talking stick".
- Time slots for presentation by the Res-AGorA consortium were very limited.
- Seating was arranged in a circle-style setting and not as in a classroom setting.
- The alteration between groups and plenary enabled participants to experience both learning from others in plenaries and sharing their own respective thoughts in groups with others.

6.3 The workshop design

Figure 6–1 is an attempt to visualize the iterative process we designed to merge a bottom-up process with a top-down approach in the workshop design. The aim was to generate a process that assures everything said and done during the workshop contributes to the deepening and contextualisation of the participants' perception of responsible research and innovation in relation to their respective organisations / work-situations, while simultaneously bringing about all the invaluable real-life experiences of "doing" responsible research and innovation that the participants carried with them. These entailed mainly initiatives labelled very differently across the diverse institutional settings participants came from.

Thus their experiences and ideas were merged with suggestions made by the Res-AGorA researchers for a comprehensive set of principles to guide informed and deep thinking processes on RRI among contesting stakeholder groups.

The "works" of the design

The workshop design is divided into four phases informing one another iteratively:

1. **Exploration phase:** Exploring stakeholders' experiences with RRI
2. **Presentation phase:** Presenting dimensions and principles of RRI
3. **Investigation phase:** Making effective use of the Responsibility Navigator's dimensions and principles
4. **Concretisation phase:** Effectively practicing RRI

The two first phases of the two-day workshop method form the basis for reflection and inform the in-depth work in phase 3 and 4. These phases are presented roughly but systematically one at a time. The following describes what to do (*Description*), why to do it this way (*The reasoning*

3 The Res-AGorA Co-construction Method is available at http://responsibility-navigator.eu/co-construction-method/.

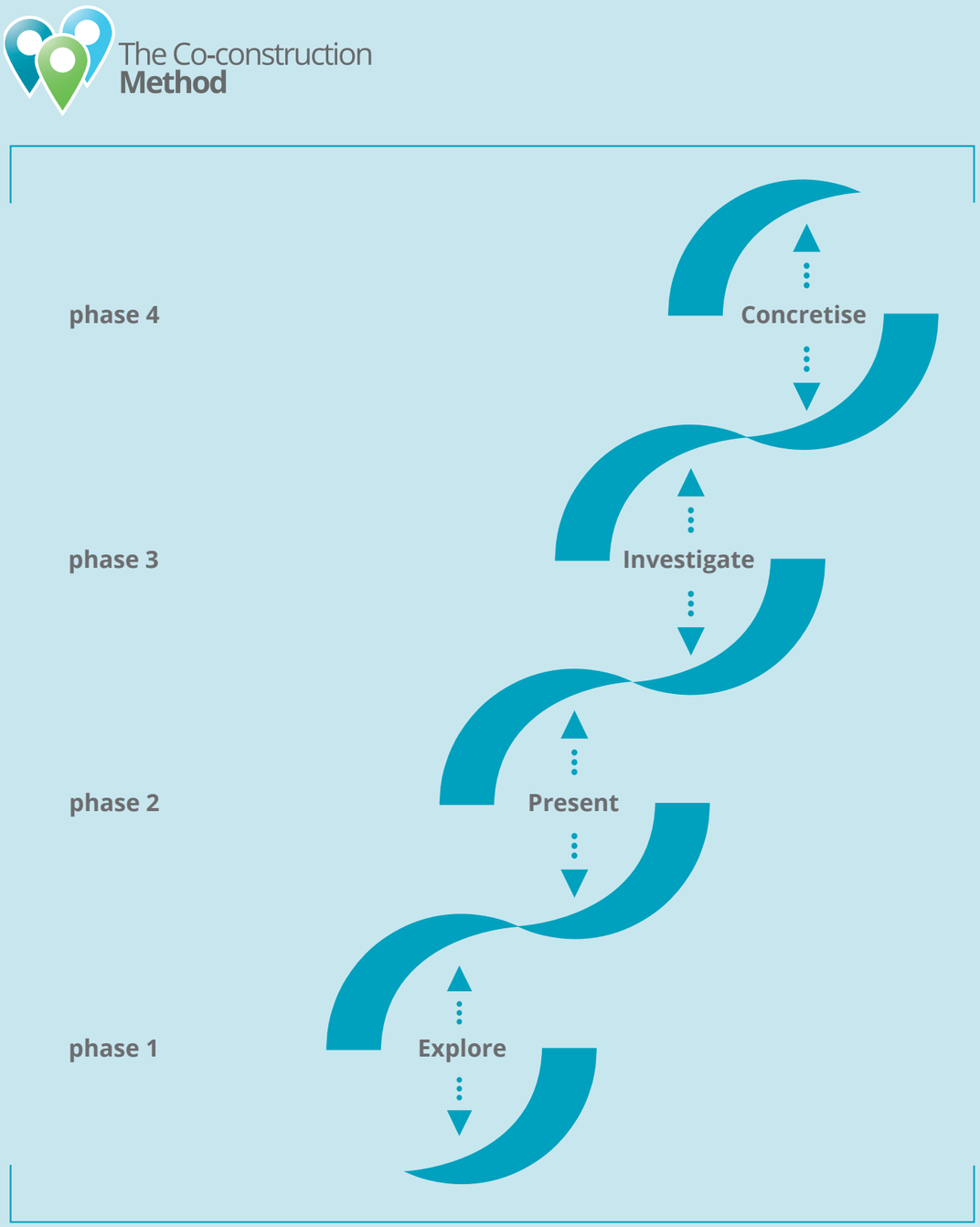


Figure 6–1: The iterative process: merging bottom-up and top-down approaches

behind), and provides some overall ideas on how to copy the process into different contexts (*To-do*). If you want to implement the process yourself, however, you should also consult our more detailed manual online, which includes further information for flow, facilitation and questions for the individual sessions.[4]

There are some general *To-do's* with regard to procedural aspects that should be considered throughout the workshop; it is essential to:

- create an explorative atmosphere in the group, invoking openness, trust, curiosity and engagement;
- harvest, save and broker the knowledge produced in the groups, e.g. via flipcharts, notes, group presentations, joint plenary sessions;
- maintain a continuous feedback process that allows the organising team to adjust the workshop design "on the go";
- realize the art of active listening on behalf of the organising team members, thus not interfering too much in discussions.

Phase 1 – Exploration phase

Exploring the stakeholders' experiences with RRI

Description:

Phase 1 warms up the group, whose members do not necessarily know each other beforehand, and introduces the notion of RRI. In small groups, consisting of workshop participants and one organising team member, participants deliberate on and discuss RRI in relation to their own experiences practicing responsible research and innovation within their fields. In phase 1, it is crucial to create an open and confident atmosphere that encourages participants to share challenges, conflicts and barriers they experienced when implementing responsible research and innovation. The challenges, conflicts and barriers collected in this phase create the basis for discussions in the next phases of the workshop, and are continuously addressed and expanded throughout the workshop, as will be shown in the next three sections. In order to be able to do so, it is necessary to put down the collected experiences in writing, e.g. on a flipchart, cards, on (digital) slides, etc., and have these notes present in the following phases. A rapporteur is chosen for each working group to present the findings in the following sessions, either to the plenary or the continuously changing members of the working groups.

Reasoning behind:

The workshop participants should be encouraged to share their ideas openly. They should not be pushed into one direction or another by presenting a definitive concept or idea. For Res-AGorA it is important to emphasize that the notion of RRI is in a state of flux and its development is open to change. Participants should be invited to explore together what RRI is all about while feeling welcome and safe in an atmosphere of mutual trust and understanding as well as being challenged in their positions.

To-do:

- Choose your area of focus for the workshop and find inspiration from our suggestions which broad-based stakeholders to involve (see Section 6.2 above on selecting stakeholders).
- You need to ensure that your process becomes seriously inclusive of diverse views and opinions. Thus, make sure the participants in your workshop are met with an open and encouraging approach.
- Be open about your own uncertainties and present them to the participants in a non-directive way. However, do not present and talk too much, but be ready to listen carefully and let the discussion unfold.
- Participants should present and discuss their experiences in the small working groups and then write down their findings, however, without the need to find consensus within or between the working groups. Make sure each group writes down its findings so as to encourage them to create ownership of the process.

Phase 2 – Presentation phase

Presenting dimensions and principles of RRI

Description:

The aim of phase 2 is to take a step back, leave the intense bottom-up group work for a while, and make way for an introduction to the various principles and dimensions of the Responsibility Navigator. First, the core objective, principles and dimensions of the Responsibility Navigator are presented in a short and effective visual way.

4 Please visit http://responsibility-navigator.eu/co-construction-method/.

Afterwards the participants share and discuss first impressions with each other seated in small groups, together with a member from the consortia. This phase is concluded by a plenary session together with the participants, summing up the first workshop day by sharing and deepening the insights gained regarding how their own experiences of RRI relate to the presented dimensions and principles.

Reasoning:
To recap, for Res-AGorA the objective of the workshops was to test findings of the project on the governance of RRI without imposing certain ideas and directions on the participants by immediately presenting them with the findings directly. Rather than imposing dimensions and principles of the Responsibility Navigator, it is essential to make sure that the participants' experiences are brought to the fore immediately (phase 1) and written down extensively. In such a way, the presentation of the Responsibility Navigator does not form the backdrop of the participants' experiences, but the other way around. At the same time, the participants should be provided with space for discussing and challenging the dimensions and principles, and get immediate reactions and criticisms off their chest.

The discussion about the overall idea of the Responsibility Navigator should be out in the open, without focussing on a broad and general discussion for too long. And last but not least, we wanted to give the participants the possibility to digest their impressions of the first day together with a meal and a good night's sleep, before beginning to work in-depth with the Responsibility Navigator in phase 3 the following day.

To-Do:
- Know your reasons for presenting the objectives, dimensions and principles of the Responsibility Navigator; however, make sure that the presentation of your objective is not done in a patronising way.
- Provide enough space for the participants to criticise and discuss their ideas directly with you. Air their immediate reactions to your objective, but do not linger on this level of discussion. Dive deeper into the discussion exploring different elements through discussing their feasibility and practicability in certain settings.

Phase 3 – Investigation phase
Making effective use of The Responsibilty Navigator's dimensions and principles

Description:
Phase 3 aims at deliberating on the usability and effectiveness of the Responsibility Navigator's dimensions and principles in-depth and with regard to the identified challenges, conflicts, and barriers to practicing RRI (day 1, phase 1). Therefore, the findings from day 1 are discussed in light of the various Responsibility Navigator dimensions and principles. The crucial take in this phase is to have the group rapporteurs from the previous day introduce thoughts and ideas on challenges, conflicts, and barriers to RRI to a different group of participants. This forms the basis for their thorough work with the Responsibility Navigator in phase 3. In this way, participants again communicate their experiences, open up and engage with experiences of other groups while discussing these in relation to the Responsibility Navigator.

Following this approach was the applicability of the dimensions and principles of the preliminary governance framework which were tested and further developed in the Res-AGorA workshops. This proved essential for the detection of gaps, advantages and shortcomings which further co-developed the framework which then became the Responsibility Navigator.

Reasoning:
By making a "de-tour" into the challenges, conflicts and barriers outlined in phase 1, the participants are inspired to include other perspectives than their own findings from the previous day, and they have to work on these with a new group of participants. The upcoming issues are then discussed through the filter and directions stemming from the Responsibility Navigator. This adds new perspectives on how to use the Navigator and at the same time develops the participants' own ideas on challenges, conflicts and barriers into a broadened, hopefully sharpened perspective.

To-Do:
- Make sure to mix up groups so that participants are encouraged to engage in discussions with a new set of people. Only one rapporteur should stay to explain observed findings on challenges, conflicts and barriers from phase 1 to a new group.
- Work with the Responsibility Navigator in the light of the participants' collected experiences in order to keep the discussion as tangible as possible.
- The participants in your workshop should not discuss the Responsibility Navigator dimension as such, but use the Responsibility Navigator dimensions to facilitate reflections on their own organisation / field in terms of RRI.

Phase 4 – Concretisation phase
Effectively practicing RRI

Description:
The aim of phase 4 is to make RRI tangible and closely relate it to concrete practices and institutional settings. At this stage it is important to deliberate on how to implement RRI in specific fields and institutions. Participants should think about how to address the issue of RRI in their respective organisations and fields, what expertise and resources are necessary to support RRI, how RRI strategies could be developed and what they could look like, etc.

This final phase of the workshop also includes reflections on the participants' assessment of the workshop and their learning outcome. Questions could include: What did they learn? What did they find confusing? What could be done differently in the future? These considerations are not only helpful for the participants' own learning processes, but indeed for the organising team of the workshops that may choose to further pursue RRI.

Reasoning:
Even if the workshop in itself provides a thinking process for responsible research and innovation, which is challenging, because of the many views and opinions brought into the same space and processed, this last phase is crucial for provoking and providing concrete recommendations and ideas for changes and strategies when RRI is implemented directly in the organisation. It again reconnects the possibly more abstract deliberations from phases 2 and 3 with the more concrete descriptions from the first phase by co-constructing solutions for real problems identified by the different stakeholders.

To-do:
- Encourage the participants to be as specific and precise as possible in spelling out how to implement RRI.
- Provide enough space for people to share their experiences and confusions gained during the workshop days. These experiences are valuable reflections and encourage the participants to sum up for themselves, what worked and what did not work. This develops their personal level of reflection on RRI.

6.4 Conclusion

The workshop design offers a coherent process aligned with a governance framework for RRI, the Responsibility Navigator. It offers a unique combination of flow, input, reflection, iteration and discussion, that per se, walks the talk of "making RRI happen". There are countless considerations underpinning this method and the carefully designed ways to approach stakeholders, to help them open up, to provide a serious space for reflection, and to bring forth invaluable knowledge into the enhancement and implementation process of RRI. The institutional settings in which it could be constructive to apply this design are characterized by actors who are directly concerned with R&I, such as funding institutions, universities, industry and companies conducting research, public administrations, international organisations and policy-makers concerned with developing research and innovation agendas. It is crucial to invite actors without research units and / or who are inactive in decision-making processes affecting R&I processes such as Civil Society Organisations (CSO), international organisations, and industry associations into the workshop process as important stakeholders, though tackling their core issues in this particular workshop process is of less relevance for them.

It is equally important to underline the importance of the timing of the reflective process. The workshop process should take place prior to the production or implementation of new strategies or even as part of revising old plans for R&I. The workshop design process is in essence an instrument for upstream reflection on research and innovation.

PART 3 EMPIRICAL PROGRAMME

EMPIRICAL PROGRAMME

The authors of this chapter

“The analysis of the 26 cases and the 13 lessons [...] provided essential empirical underpinning, supporting the development of the 10 principles of responsibility which formed the basis of the *Responsibility Navigator*.“

7

Res-AGorA case studies: drawing transversal lessons

Sally Randles, Jakob Edler, Sally Gee, Clair Gough

7.1 Introduction

A hallmark of the Res-AGorA project is the extensive and deep empirical programme consisting of 26 case studies. This empirical programme was motivated by the opening proposition of the Res-AGorA conceptual schema to consider responsibility in research and innovation as emergent, or “In-the-Making”. That is, as a historically unfolding process co-evolving with understandings of what it means to be responsible in any particular context (responsible to whom and for what?).

This drove us to design an inductive / deductive process, to investigate how responsibility is understood and operationalized by the actors themselves, not through our *a priori* researcher lenses or our own views on how responsibility should be understood and enacted. Analysing the cases allowed us to appreciate and reveal the contested normative underpinnings – by which we mean actors’ values and interpretations of “good” conduct – through which responsibility is framed and discursively presented by actors. In addition, the analysis showed how actors collectively negotiate, design and implement a variety of governance instruments, embedding these normative underpinnings into concrete processes and practices, and organisational and incentive structures.

Understanding this process as *de facto* responsible research and innovation (rri) we were also inspired by Rip’s concept of *de facto* governance understood as involving top-down steering and bottom-up governance experimentation, simultaneously (Rip 2010). In our case study programme we sought to reflect a full spectrum and variety of research and innovation contexts, situations and governance challenges faced by actors, into which interpretations of responsibility play. Though obviously not *representing* this variety in the case study programme, we rather sought to learn lessons by scanning transversally and triangulating the recurring and / or differentiated findings revealed across the intentionally heterogeneous body of case studies.

In this chapter we present the main transversal lessons derived from the case analysis. Before doing so, we summarise the methodology which enabled the team of case-workers drawn from all the consortium partners, to generate the suite of Res-AGorA case studies. To illustrate the diversity of cases, we provide a brief overview of the five case studies we decided to feature in this book. Out of the total of 26 case studies conducted, the selected five reflect the breadth and variety of research and innovation contexts and situations, that responsibility in research and innovation encounters, and that policy needs to be attentive to.

7.2 Methodology

The case studies were chronologically progressed in three stages. The staged approach operationalised our commitment to repeatedly iterate and refine the relationship between the conceptual building bricks that formed the research model (reported in Chapter 5), which deductively guided the case studies; and the learning that we derived inductively, or bottom-up, from the individual and collective case findings.

Stage 1 of the programme was loosely guided by an early version of the conceptual building blocks described in Chapter 5. The analysis from Stage 1 in turn helped to refine the conceptual model, which then more tightly guided the Stage 2 cases. Stage 3 was slightly different and combined finishing aspects carried over from Stage 1 and 2 with a new focus, moving from contexts of multi-actor arrangements in Stage 1 and 2 (think of the fracking controversy, reported here in Case Study 1 or national research funding prioritisation in Denmark reported here in Case Study 2), or a focus on individual governance instruments or mechanisms (think of the UK roadmap for synthetic biology reported here in Case Study 5), to single organisation contexts (for example, responsibility as understood and practiced by multi-national corporations reported here in Case Study 4).

The three stages of the case study programme are listed in the following tables.[1] The programme took place over an 18-month period from September 2013 to February 2015.

7.3 Analysis: drawing transversal lessons

A first step in the analysis of the first and second stage cases was to read across the body of cases in order to identify, in conversation with individual case authors, what we considered to be a number of critical *dimensions*: features which commonly recurred as descriptive and / or explanatory pointers, despite the variety of responsibility situations and governance challenges which the body of cases covered. We differentiated these critical features into *substantive* dimensions, which concern the techno-scientific domain at the heart of the case, the local political economic, cultural and institutional context, the landscape of actors involved, and the nature, object and framing of contestation; and *procedural* ones, which concern governance processes and procedures (see Table 7–4). The cases were then presented as a series of differentiated governance situations and challenges, analysed through the lens of the critical dimensions, in an interim analysis report (Edler et al. 2014).

Finally it was the task of the Manchester team at the end of Stage 3, to read across the full body of completed cases to draft and then stabilise, in conversation with colleagues from partner institutions, in particular colleagues from the University of Twente, a series of *lessons* aiming to assist actors who are practically and strategically involved in the governance of responsibility in research and innovation. The lessons became known as the Res-AGorA "13 Transversal Lessons" on the governance and institutionalisation of responsibility in research and innovation, and formed the main conclusion and output of a report for stakeholders and practitioners (Randles et al. 2015a).

The 13 transversal lessons are reproduced in Table 7–5 in their final form.[2] They are clustered into five groups. A first group considers participation and deliberation in governance processes, emphasising the importance of inclusion and the role of trusted intermediation. A second group concerns how knowledge is constructed, understood and mobilised into anticipative processes, with an eye to ensuring appropriate timing, recognising tensions between narratives to accelerate versus narratives to be more careful, attentive, systematic and thorough in the design and implementation of more trusted rri governance processes. A third group maintains that responsibility in research and innovation is more effectively transformative when normative goals are clearly articulated and integrated, and identifies the important role of boundary objects and boundary actors in affecting integration. A fourth cluster has become a defining feature of the Res-AGorA cases findings and

1 And appear on the Res-AGorA website at http://res-agora.eu/case-studies/, where each listing is linked to the written-up case report providing a resource for further in-depth reading. See also the case studies final synthesis report (Edler et al. 2015).

2 As they appear in the Policy Brief #1, Lessons from RRI-in-the-Making,December 2015 (http://res-agora.eu/assets/Res-AGorA-Policy-Note-1_RRI-in-the-Making-1.pdf).

Table 7–1: Stage 1 cases (pilot cases): September–December 2013, eight cases

Case 1–1	**Case 1–2**
Integration of RRI in policy advice – the case of synthetic biology assessments health; medical; food; agriculture; energy ▸ **Davy van Doren, Fraunhofer ISI**	*RRI governance in research infrastructures* material sciences ▸ **Mickael Pero, Fraunhofer ISI**
Case 1–3	**Case 1–4**
Fracking in Austria energy ▸ **Alexander Lang, IHS Vienna**	*Nanosafety governance in the Netherlands* nanotechnology ▸ **Bart Walhout, University of Twente**
Case 1–5	**Case 1–6**
Responsibilisation phenomena relating the EC code of conduct for responsible nanosciences and nanotechnologies research health; medical; generic technology ▸ **Daniele Ruggiu, Elena Pariotti, Guido Gorgoni, Simone Arnaldi, University of Padua**	*Occupational health protection in standardisation experiences as an example of self-regulation* health; medical ▸ **Alessia Muratorio, Guido Gorgoni, Elena Pariotti, Simone Arnaldi, University of Padua**
Case 1–7	**Case 1–8**
When "responsible" becomes "irresponsible": biofuels in the USA and Brazil energy; agriculture; food ▸ **Sally Gee, Jakob Edler, University of Manchester**	*RRI in Russia: where society is silent and the state controls the floor* ▸ **Evgeny Klochikhin, University of Manchester**

Table 7–2: Stage 2 cases (development): February–April 2014, ten cases

Case 2–1	**Case 2–2**
The responsibilisation and regulation of garage innovation open source 3D printing advanced manufacturing ▸ **Johan Söderberg, IFRIS**	*Linking responsible research and innovation on the farm: The case of participatory guarantee systems* agriculture; food ▸ **Allison Loconto, IFRIS**
Case 2–3	**Case 2–4**
The responsibilisation and regulation of garage innovation: DIY-drug innovation in the psychonaut subculture health ▸ **Johan Söderberg, IFRIS**	*Fracking in Austria and the UK – A comparative study* energy ▸ **Alexander Lang, IHS Vienna**
Case 2–5	**Case 2–6**
Responsible ▸ Irresponsible ▸ Responsible? Contestation & the re-design of governance instruments for US bioethanol energy; agriculture; food; livestock ▸ **Sally Gee, Jakob Edler, Manchester University**	*Anchoring knowledge transfer activities. The EC CoC and normative anchor points in laboratory practices in Italy* nano-toxicology ▸ **Simone Arnaldi, Alessia Muratorio, University of Padua**
Case 2–7	**Case 2–8**
Horizontal foresight to address societal challenges in Danish priority-setting for strategic research ▸ **Morten Velsing Nielsen, Danish Board of Technology**	*Integration of RRI in policy advice – A review of the UK synthetic biology roadmap* health; medical; food; agriculture; energy ▸ **Davy van Doren, Fraunhofer ISI**
Case 2–9	**Case 2–10**
Non-compulsory ethics committees at Austrian universities cross-disciplinary ▸ **Erich Griessler, IHS Vienna**	*Nanosafety governance in the Netherlands* nanotechnology ▸ **Bart Walhout, University of Twente**

Table 7–3: Stage 3 cases (completion, filling gaps & critical organisations): June 2014–February 2015, eight cases

Case 3–1	Case 3–2
Responsibility and reflexivity in engineering: professional societies and codes of ethics health; medical; food; agriculture; energy ▸ **Simone Arnaldi, Alessia Muratorio, University of Padua**	*Institutionalising RRI – the case of a large research organisation* ▸ **Kerstin Goos, Ralf Lindner, Fraunhofer ISI**
Case 3–3	**Case 3–4**
Governance structures affecting data protection in advanced manufacturing – how much room does Germany's ambition to lead the fourth industrial revolution leave for RRI? advanced manufacturing ▸ **Daniel Bachlechner, Timo Leimbach, Fraunhofer ISI**	*Practicing RRI in NanoNextNL* nanotechnology ▸ **Bart Walhout, University of Twente**
Case 3–5	**Case 3–6**
Critical organisation-types, The "Good University" ▸ **Sally Randles, University of Manchester**	*Critical organisations: research councils of UK* ▸ **Kalle Stahl Nielsen, Sally Gee, Jakob Edler, University of Manchester**
Case 3–7	**Case 3–8**
"Voices, visions and action of RRI": institutional entrepreneurship and de-facto responsible research and innovation ▸ **Sally Randles, Elise Tancoigne, Kerstin Goos. University of Manchester, IFRIS, Fraunhofer ISI**	*Critical organisations: Multi-national Corporations* ag-bio; consumer ▸ **Allison Loconto, IFRIS**

Table 7–4: Dimensions of situations as basis for selection of cases

Substantive and material dimensions	Procedural dimension
Actor landscape: range and variety of actors involved	Modes of actor mobilization
Locality vs. globality	Resource provision (money, people, knowledge)
Research / emerging technologies vs. innovation vs. orientation along societal challenges	Capacity building (inclusive knowledge)
Techno-science domains / nature of the underlying technology	Main source and origin of responsibilisation / lead
Nature and level of uncertainty about: ▸ societal consequences of knowledge / technology / innovation ▸ uptake of innovation in markets, consequences ▸ current / upcoming regulatory environment for an innovation	
Nature of the contestation (material and / or normative)	
Institutional and country settings (cultural, economic, institutional, regulatory, scientific and economic)	
Level of RRI intervention (Global / EU / national, hybrid networks, organizational level)	

Table 7–5: Thirteen transversal lessons on the governance and institutionalisation of responsibility in R&I

Overarching Lesson	
1	**Responsibilisation and deep institutionalisation**: this refers to a process of cultural change which internalises social values by embedding them into practices and processes. A holistic concept that brings the remaining twelve lessons together.
Participation and inclusion	
2	**Transformative interaction**: transformation is more likely to occur when the process is built on genuine engagement that is inclusive, open and transparent, fostering mutual trust and understanding from the initial framing of an issue onwards.
3	**Intermediation and moderation**: strong and trusted neutral brokerage is required to enable diverse communities (in terms of location, perceptions, interests, capacity etc.) to participate in a process that is perceived to be legitimate and credible.
Knowledge and understanding	
4	**Anticipation**: ethical codes that support a long term responsibility are based on consideration of alternative futures and can adapt to changing contexts to support a guardianship culture.
5	**Knowledge**: to be effective within responsibility discourses, evidence must be valid, adequate and trusted; hence it must be robust, transparent, inclusive, contextualised and sourced from a variety of stakeholders.
6	**Timing**: tensions across different temporal horizons must be managed recognising the dynamic nature of situations and contexts.
Integrating across scales	
7	**Multi-level governance**: this requires accounting for multiple levels of governance within and between organisations and political scales (e.g. regional, national, EU, global) and seeking synergies between top-down and bottom-up processes.
8	**Alignment**: aligning and synchronising the normative goals, objectives and procedures of instruments and measures across different levels to achieve consistency and clarity.
9	**Boundary objects**: shared objects (e.g. data) or processes (e.g. training) play an important role in translating between governance levels and supporting actors operating between boundaries in line with Lessons 7 and 8.
Institutional Change	
10	**Institutional change**: creating a responsible research and innovation culture requires both institutionalisation (stabilisation) of new, and de-institutionalisation (modification) of current, behaviours, structures and procedures.
11	**Capabilities**: systematically developing skills and competences that enable actors at all levels to fully participate in responsible research and innovation transformation processes.
12	**Capacities**: the means and resources to create conditions for responsibilisation and to build a collective capacity for RRI at a societal level must be established.
13	**Institutional leadership and entrepreneurship**: from individual actors as leaders and "change agents", to a broader culture of institutional entrepreneurialism, leadership is necessary to drive a range of normative societal, collective, responsibility objectives.

identifies that for transformative change which embeds articulated normative goals into actor practices and processes there is a need to build the capacities of organisations and systems and the capabilities of all actors to participate. The critical role of institutional entrepreneurs as leaders and champions who keep change processes "on track" was also identified.

By contrast, in some of the case studies, responsibility claims were found to be rather superficially implemented with little traction over more permanent or resilient institutional change (a finding we termed responsibility-wash); in others, new interpretations of responsibility were layered atop already existing understandings and practices of responsibility (a finding we termed responsibility-overload) and in a third case-type "business as usual" practices were newly labelled as Responsible Research and Innovation (a strategy we termed responsibility re-labelling). We offer the over-arching idea of responsibilisation as the compound objective through which actors' are entreated to embed normative goals of responsibility (see Chapter 5) and deep institutionalisation representing a compound concept capturing how this occurs in practice, as the over-arching learning lesson from our cases (Randles et al. 2014).

7.4 Five example case studies

In the chapters which follow we have selected five case studies from the total of 26, to exemplify the variety of research and innovation situations and organisational contexts covered in the Res-AGorA case-study collection. The five cases featured also exemplify how lessons were drawn from individual cases as input to the abstracted thirteen overarching lessons (above). Below, the unique contribution of each of the five featured cases in this book is briefly summarised.

Case Study 1: Fracking

Alexander Lang

Lang's case looks into hydraulic fracturing or fracking developments in the UK and Austria over the last decade. The main finding of the case is that despite similarities in terms of the nature of the technology under discussion, similarities around the risk / harm assessments, and similarities in the prevailing knowledge base in both countries, at the time of writing both the process and the outcomes have been markedly different in the two countries. Deeper investigation shows that the way the discourse developed differed in each country; with a polemicized, antagonistic discourse apparent in the UK with polarised "pro" and "con" positions fanned by media coverage which "took sides"; whereas a more neutral position was taken by the press and media in Austria. The actor constellations also differed. In Austria, though the process was far from inclusive and was largely driven by central government, economic and environmental interests (represented by the respective Ministries) held an equal role and power at the negotiating table. In the UK, however, central government and developers aligned in what was to become a pro-fracking position, on the grounds that economic development would provide jobs and new industry opportunities. In both countries an Environmental Impact Assessment (EIA) was demanded as part of the adjudication process, but in Austria the bar was set higher, in terms of requiring that the developer persuasively demonstrate that fracking would not cause harm to the environment. As a result, the domestic oil and gas company which was seeking a licence to undertake exploratory drilling in Austria withdrew from the process. By contrast in the UK, oil and gas companies supported by the government have been pushing the development of a shale gas industry despite its controversial nature and growing public opposition. In seeking to uncover deeper explanations for why the two cases, which share many of the same input characteristics, should produce such different processes and outcomes, we conclude that underlying differences in political ideology, the position taken by central government, and the way a controversy is framed, account for the differences. An important lesson for *de facto* responsible research and innovation (rri) drawn from this case, is that the outcome of technology controversies is not determined by procedural means alone: deep-seated ideological characteristics and power dynamics playing into the controversy play a significant role.

Case Study 2: Danish research priority setting

Morten Velsing Nielsen

Velsing Nielsen studied a deliberation process implemented by the Danish government to formulate and set priorities orienting national government research funding to address societal grand challenges. RESEARCH 2015, incorporated a deliberation exercise aimed at cross-disciplinary input at an early stage of the process, inclusive to a wide range of societal actors. The case highlighted a number of conundrums to the ideal of inclusiveness. Whilst the process generated a wide range of views, at some point these views are distilled to a necessarily narrow set of priorities. It is therefore not just the inclusivity step which is important, but who and how translates and selects the set of priorities from the diversity of views gathered, and whether this process is trusted as legitimate and just. As part of the study, the process was re-visited via interviews with the range of actors who had been involved or contributed to the deliberation process. They differed in their evaluation of it as a success or not, depending on their own perspective on the outcome and their own experience as participants in it. There were a number of critical voices expressing the view that inclusivity had not in fact been achieved, due to weaknesses in the procedural process. The case highlights the limitations of on-line mediation of deliberation processes, for example. Velsing Nielsen further reports that the process had a limited ability to create transformation in the values and behaviours of actors, and therefore had only minor impact on long term institutionalisation that he was able to identify.

Case Study 3: Risk assessment in NanoNext NL

Bart Walhout

Walhout's case reports on the aim to integrate a social science dimension related to responsible research and innovation: Risk Analysis and Technology Assessment (RATA) into the work of NanoNextNL, a large Dutch research consortium focussed on the development of Nanotechnologies. The mechanism to do so was focussed training days for PhDs within NanoNextNL, and an initial requirement to incorporate a dedicated research dimension on RATA, written up within the research theses of all the cohort of Doctoral Researchers attached to NanoNextNL. The idea was sound but encountered a number of challenges. The Doctoral students appreciated and gained from the new perspective of the training days. However, since the host supervisors and institutions were not deeply committed to the RATA objective, the Doctoral students found it difficult to meaningfully incorporate the RATA objective into the fabric of their projects. They found they were in a weak position institutionally to take the learning back into their host teams, especially under circumstances where supervisors had a low level of knowledge or buy-in to the RATA dimension. These difficulties were identified and raised at the mid-term review of NanoNextNL. Walhout reports on interviews with PhD researchers and Principle Investigators (PIs) which showed that in the second year of NanoNextNL there was still little to no awareness about the topics being covered in RATA, the requirement to comply with the EU-CoC or potential societal issues related to their research projects. He concludes that early-career training will not in and of itself, embed responsible innovation into the thinking and practice of research teams within host organisations. A pre-condition of awareness and commitment from the senior and professorial members of the team, along with the instituting of appropriate structures and processes would be a necessary to embed responsible innovation (however normatively defined) into the actors' reflexive thinking and decisions and organisational structures, processes and incentives, if long-term transformative change to researcher practice which integrates reflections and action on the societal dimensions of new technologies within technology assessment processes is the goal.

Case Study 4: Multi-national corporations

Allison Loconto

Loconto studies three multi-national corporations (mncs): Unilever, Nestlé, and Syngenta, all operating in the agri-bio sector. The companies were selected to enable cross-company comparison relating to the second societal challenge of the European Commission's H2020 programme: food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bio-economy. Loconto finds that all three mncs adopt sustainability as their anchoring concept. Further, the three mncs show considerable, and perhaps unexpected, convergence in their enactment of responsibility which can be extrapolated from their respective portfolios of concrete activities. For them, the act of making research and innovation responsible links to maintaining reputation and trust according to the norms and expectations of the many markets in which they engage and are entangled, since their core activity is bringing new technologies and products to market. The perceived expectations of a certain moral standard is perceived to be driven by a new actor, the ethical consumer, pushing back through value chains, together with complexes of heterogeneous actors

operating in institutional arrangements, collectively designing new voluntary governance instruments (such as Unilever's leading role in the Sustainable Commodity Roundtables). Similar examples were *de facto* in evidence right across the organisations' sets of activities, from technical development and research and development, along global value chains, to end-consumers and with an eye to the policing scrutiny of NGOs and other monitoring organisations with whom they increasingly collaborate to design and gain acceptance for new responsibility governance instruments. The term RRI was not used by the mncs, but the different elements were implicitly incorporated, although priorities differed, and different elements came under the jurisdiction of different parts of the organisation. The long institutionalised concept of Corporate Social Responsibility (CSR) resonated much more and was more deeply embedded into the mncs' understanding of social responsibility governance and working practices than RRI.

Case Study 5: RRI in the UK Synbio Roadmap

Davy van Doren

Van Doren's case describes how RRI has been integrated within strategic considerations for UK national policy on synthetic biology by tracing the writing of a specific RRI section as a "core theme" into the roadmap for synthetic biology (synbio). In addition, he follows the implementation of the roadmap by the synthetic biology leadership council (SBLC) since the publication of the roadmap in 2012.[3] The document and underpinning strategy focus predominantly on commercialisation, market development and competitiveness. The roadmap's normative leaning to the acceleration of industrialisation seems to distinguish it from more precautionary approaches. Van Doren reports that although the governance of RRI has been a priority area for the SBLC, there is little evidence that regulatory frameworks have been recently reviewed, challenged or revised responding to expressed concerns. Furthermore, despite public disapproval within the UK on self-regulation, the SBLC presents self-regulation by the synthetic biology community to be concomitant with responsible innovation. Also, there has been debate within the SBLC regarding a trade-off between RRI and the maturation of the synthetic biology sector in the UK, rather than as a supportive structure within its defining architecture. Nevertheless, the inclusion of RRI in the UK roadmap proved a pivotal signal for the UK Engineering and Physical Sciences and the Biotechnology and Biological Sciences Research Councils (EPSRC, BBSRC) to insert a pre-requisite within major research calls tasked with selecting a small number of focussed synthetic biology research centres within universities in the UK. RRI was required to be an obligatory requirement, which involved the inclusion of social scientists with expertise in responsible innovation and the societal dimensions of the development of new technologies into their submitting teams' proposals. This is a promising device for embedding responsible innovation into the research base of a new technology with a mid-term timescale. The centres were launched in 2014 / 2015 with five years' funding. Consistent with the emergent nature of both synthetic biology and responsibility in research and innovation, the resulting landscape of RRI in the newly commissioned centres in the UK exhibits considerable variety on both counts : a) in the interpretation of synthetic biology, and b) in the interpretation of RRI. Further, the levels of resource commitment to responsible innovation included in each of the successful centres proposals vary considerably. It is early days to assess whether and how these very recent developments will gain traction on the future trajectory of synthetic biology in the UK.

3 A draft revised roadmap, known as REFRESH, is currently out to consultation.

7.5 Concluding remarks

The analysis of the 26 cases and the 13 lessons reported in this chapter provided essential empirical underpinning, supporting the development of the 10 principles of responsibility which formed the basis of the Responsibility Navigator. They also provided one of several inputs into the stakeholder co-construction workshops. Finally, the body of case-work was drawn upon in order to construct the fictive cases or practical illustrations which support the 10 principles of the Responsibility Navigator (see Chapter 11). The five case studies summarised in this chapter illustrate the range of research and innovation situations and governance challenges and are selected for this reason from the 26 case studies. The five cases are discussed further in the five chapters which follow showing the richness, tensions, context-specificity and complexity of challenges raised in each case.



The authors in this chapter

“The validity, veracity and comprehensiveness of the presented evidence are still subject to intense questioning, indicating disagreement on whether the available knowledge provides a sufficient basis for informed decision-making.”

Case Study 1 Fracking

Fracking in the UK and Austria: from contestation to constructive interaction?

Alexander Lang

Introduction[1]

Hydraulic fracturing or *fracking* has been gaining significance and causing controversies over the last decade. Since the mid-2000s, the United States of America have been experiencing a so-called *shale gas boom*, resulting in a swift increase of domestic natural gas production and falling energy prices (US EIA 2012, 2014). Fracking has been crucial for this development: Rock formations are fractured by high-pressure injection of a composite fluid into a well, enabling the flow and exploitation of otherwise tightly stored gas (IEA 2012: 33). However, the risks and impact assessments of fracking as well as forecasts of the economic revenue expected from shale gas production are varying and contradictory. Proponents and opponents of the technology and its field of application are engaging in heated discussions in the media, political arenas, or in direct confrontation (Lang 2014a: 4–10).

This case study examines fracking for shale gas production in Austria and the UK.[2] Although the debates in both cases show similar characteristics, the position of certain key actors, the governance approaches, the unfolding of events and their outcomes differ. In Austria, a domestic oil and gas company abandoned its plans to produce shale gas using a newly developed and allegedly clean fracking approach after public protests led to a legislation amendment in 2012 (UVP-G 2012), making an Environmental Impact Assessment (EIA) mandatory for all fracking operations (Lang 2014a: 10–15). In contrast, in the UK, oil and gas companies supported by the government have been pushing the development of a shale gas industry, despite its controversial nature and growing public opposition. After the first application of fracking for shale gas production in 2011, which caused earthquakes, and was followed by an investigation and the implementation of a monitoring scheme (Green et al. 2012, Davey 2012), no new wells have been fracked in the UK. Nonetheless, companies and the government are still pursuing shale gas production (Gosden 2015, Harvey 2015).

This chapter traces the contours of the societal contestation of fracking in Austria and the UK. We analyse how different actor groups make sense of the technology, its

1 This chapter is based on two comprehensive case studies conducted within the Res-AGorA project (Lang 2014a, 2014b).

2 The Austrian case is located in the Weinviertel, a region in the county of Lower Austria; the UK case is especially concerned with incidents around fracking operations in various parts of England. This chapter refers to “Austria” and “the UK” for simplicity, and because fracking in both countries is regulated and discussed at the national level.

implementation in shale gas production, and how they define responsible development. We show how governance attempts and measures deal with fracking and the arising public controversies, but also how they fail to do so in a constructive way. In doing so, we shed light on the challenges, barriers to, and opportunities for practising and promoting Responsible Research and Innovation (RRI), and focus especially on its core principle of constructive and transformative interaction.

The study follows a qualitative approach of sociology (Flick et al. 2004) and is based on comprehensive desk research and a comparative analysis of public and political discourses on fracking and shale gas production in Austria and the UK. Data was collected through systematic desk research and sources included newspaper articles, policy documents, strategy papers, blog entries, and webpages.[3]

Conditions for RRI in the making: actors and interpretations

In order to be able to gain a deeper understanding of the fracking controversy and the impact of different governance measures on the heated public debate, it is necessary to examine the societal conditions, i.e. the landscape of engaged actors, their interpretation of the technology, its implementation, and its impacts in a specific situation.

Actors' landscape: proponents, opponents, and in-betweeners

The actor groups involved can be categorised as proponents, opponents, and in-betweeners, depending on how they understand and evaluate fracking, and how they define a responsible way of dealing with it. Whereas proponents want fracking for shale gas to be implemented because of its alleged benefits, and opponents try to prevent fracking because of its possible negative impacts, in-betweeners are societal actors without a clear pro or contra position. Their decision is contingent on further information about the impacts of fracking and on the implementation of proper regulation and control mechanisms.

In Austria and in the UK, societal actors with a positive attitude towards fracking include oil and gas companies and companies from related industry branches, business associations, and special interest groups, as well as the researchers and engineers involved in the further development of fracking. Unlike the situation in Austria, in the UK, these actors were supported by the country's coalition government of the Conservative Party and the Liberal Democrats. Furthermore, several British newspapers have taken a clear position in favour of fracking (Jaspal and Nerlich 2014), or started pro-fracking campaigns (Davidson 2014); in Austria, newspapers present a more neutral attitude.

The societal actors opposing fracking include established environmental groups, local grassroots anti-fracking movements, and the respective Green Parties. In the UK, there are also newspapers that present fracking in a negative light (Jaspal and Nerlich 2014).

In-between these two standpoints are some political parties, e.g. the UK Labour Party, and research organisations investigating the impacts of fracking. In Austria, the Federal Government – a coalition of Social Democratic and the conservative People's Party – has assumed an intermediate position. As will be described later, the presence of a powerful political intermediary makes a large difference when dealing with the contestations surrounding the introduction of a new technology.

Diverging interpretations of fracking for shale gas

The perceptions and reasoning of the different actor groups encompass a variety of issues, ranging from the basic characteristics of the technology of fracking, through its environmental, economic, and societal impacts, to its regulation and the existing control mechanisms.

Old versus new: Whereas its proponents depict fracking as an established technology, which has been used and developed over decades, its opponents portray it as a fairly new technology. They argue that state-of-the-art fracking combines several technologies in a novel way and that the possible scale of operations has increased tremendously. Thus, they deny that it is possible to draw on decades of experience with fracking, as its proponents claim.

Safe versus unsafe: Proponents acknowledge there are certain environmental and health risks associated with fracking, but estimate them to be manageable and reducible to a minimum through best practice and compliance with existing regulation. Beyond that, they claim that natural gas from shale gas production is the cleanest fossil fuel available, which could be used as an interim energy source on the way to renewable energy production, instantly contributing to the reduction of greenhouse gas (GHG) emissions.

Opponents depict fracking as a technology associated with severe environmental and health risks because of induced seismicity, pollution of water, air, and soil with chemicals from the fracking fluid, toxic material washed out of the fracked rock formations, or fugitive emissions. They do not believe these risks can be eliminated by best practice and technological development, such as a clean fracking approach. On a global scale, they see shale gas production as a delaying factor in the energy transition and a source of GHG emissions.

Sufficient versus insufficient regulation: Assessing the environmental risks of fracking is also based upon the evaluation of existing regulations, their means of enforcement, and the actual compliance of oil and gas companies. Proponents state that there is sufficient regulation in place, that operations are monitored properly, and that companies as well as individual engineers want to act responsibly and are trained to do so.

Opponents criticise the existing regulation as too weak and not clear enough, thus providing loopholes for misconduct. Furthermore, they attest a lack of factual control by governmental bodies, e.g. in the UK, where monitoring is often done by operating or hired companies.

Economic benefits versus disadvantages: Proponents purport that fracking for shale gas production is essential for economic growth and to remain competitive on global markets. This is related to the vision of shale gas production as a means of lowering energy prices and thus (re) strengthening businesses. They claim local economies and populations stand to profit due to the revenue from taxes, creation of jobs, and lowered household energy costs. Furthermore, they also portray this supply of natural gas as a political issue and argue that domestic gas production will secure the supply of energy by decreasing the dependency on foreign fuel sources.

Opponents, on the other hand, predict an economic and social decline because of fracking. They fear that local and sustainable branches of the economy, e.g. tourism or agriculture, and the overall quality of life will suffer from fracking operations, because of environmental pollution, alteration of the landscape, and increased heavy traffic. They doubt that fracking is essential for economic growth and sinking energy prices, and highlight critical prognoses of a "shale gas bubble" that is about to burst. They disagree with the fracking proponents' view of greater independence from foreign fossil fuels, and highlight the problems of being dependent on large, profit-oriented oil and gas companies instead.

De facto governance of fracking: challenges and approaches

There are major challenges to achieving constructive interaction given the context of hostile actors with such a highly polarised interpretation of fracking. These include aligning measures to the concerns of stakeholders, the level of distrust concerning the execution of existing governance mechanisms, and knowledge contestation. However, we will show that the governance of fracking can also be addressed in a way which could be assessed as a step towards RRI.

Responsible regulation and sufficient control?

In both Austria and the UK, there are several governance arrangements that apply to fracking for shale gas, including hard[4] and soft laws.[5] As fracking and shale gas production operations evolve, these governance measures are subjected to change on the one hand, and, are being

3 A comprehensive list of sources can be found in Lang (2014a, 2014b).

4 For Austria, see Lang 2014a: 16–19); for England, see Department of Energy and Climate Change (DECC 2013).

5 In the UK, there is a guideline by UK Onshore Oil and Gas (UKOOG 2013, 2013a) that was issued in cooperation with the DECC, Health and Safety Executive, and Environment Agency, and that serves as a reference point for fracking operations. The Austrian oil and gas company OMV published strategic documents covering various CSR aspects (OMV 2011, 2012, 2012a) as well as health, safety, security, and environmental issues (OMV 2012b). However, all of these are not legally binding.

challenged by different societal and political actors within the debate on the other hand.

The Austrian federal government took up a position in-between the proponents and opponents of fracking and tried to find a consensus. Making EIA mandatory neither fulfilled the demands of proponents (permission), nor opponents (prohibition). Instead, it postponed the final decision. Although it is not clear whether this decision and its outcome – putting fracking plans in Austria on hold – is *responsible*[6] or not, the now obligatory EIA does promote the inclusion of the affected local population and consideration of the wider impacts of and alternatives to fracking operations. These features can be regarded as one step towards RRI.

In the UK, in contrast, the government has been proposing and pushing fracking argumentatively, by adapting legislation, and by introducing supporting administrative bodies. The government established an Office of Unconventional Oil and Gas to help the industry by simplifying the regulatory process (DECC 2012, 2013). In 2015, it passed the Infrastructure Act, which, among other things, allows companies to drill 300 metres horizontally and below private property without seeking permission of the landowner. The UK government has also pushed financial incentives for local councils, i.e. 100,000 GBP for initial well drilling, 100 per cent of business rates from fracking operations, and one per cent revenue from gas production (UKOOG 2013a).

The approach of the UK government and the oil and gas companies has aggravated public controversy by not adequately addressing the existing criticisms of fracking regulation. Opponents depict the financial incentives as bribes to local councils, which might then be tempted to turn a blind eye to environmental and health concerns. This measure does not address their doubts, including fears of losing local and more sustainable branches of the economy, and triggers the criticism of "tame" safety and environmental regulations. In general, opponents argue that there is a lack of independent monitoring and control, that governmental bodies are inadequately equipped to fulfil this function, and that operational guidelines are insufficient. Anything that can be construed as a "bribe" of local authorities, which play an important role in granting permission to drill and frack, is detrimental to the aim of safeguarding operations.

Knowledge contestation

In their interpretation and assessment of fracking, different actor groups incorporate different stocks of knowledge, because they vary in their evaluation of the available studies, reports, etc. Although both proponents and opponents contest the research methods, data, and results that contradict their own position, the latter more often highlight allegedly flawed research results.

While there are few scientific studies or reports on the specific situation in Austria, there are several for the UK, including reports by the Royal Society and Royal Academy of Engineering (RS / RAE 2012) and Public Health England (Kibble et al. 2014). Nevertheless, this presumed information advantage has not resulted in a more fact-based and calm debate on fracking here. The validity, veracity and comprehensiveness of the presented evidence are still subject to intense questioning, indicating disagreement on whether the available knowledge provides a sufficient basis for informed decision-making.

The adverse attitude of opponents towards studies in favour of fracking is supported by several circumstances: Opponents highlight the personal and financial links between researchers conducting assessments on various aspects of fracking and the oil and gas industry, and portray them as impartial and not trustworthy; in the UK, they use the derogative term "Frackademics". The same applies to research conducted in or authorised by organisations or public authorities linked to political actors with a clear pro-fracking position. Opponents also deem the existing data and research results neither comprehensive nor objective, because they state that certain aspects have not been covered, e.g. the wider impact of shale gas production on climate change or the local economies (Tillmann et al. 2014), and that data is often collected and provided by oil and gas companies.

6 Neither proponents nor opponents assess this decision positively. The former criticise the cessation of operations they deem necessary, and the latter fear renewed attempts to produce shale gas in Austria at a later point in time.

When introduced into the already polarised debate, information that meets some of these criteria tends to increase the societal tensions and conflicts between the involved actors rather than contributing to constructive interaction. Researchers producing studies of this kind, as well as actors referring to them, are accused of partisanship and hiding strategic considerations under the pretext of science, which, in some circumstances, leads to mutual recrimination and eventually a communicative blockade.

Conclusion and lessons for RRI governance

Several matters emerge from looking at the cases of fracking in Austria and the UK that have to be addressed in order to navigate the governance of research and innovation towards RRI. The divergent interpretations of fracking and its impacts lie at the heart of this controversy. The continued contestation of definitions, scientific knowledge, and other information impedes or even prevents constructive interactions between opposing actors, and enhances the division. Looking at the critical opponents' assessment of UK government's governance approaches, a deep-seated distrust of government and the companies involved becomes apparent.

Starting from these analytical results, it is possible to draw more general lessons for RRI governance, and especially for facilitating and enhancing communication between stakeholders involved in debates on R&I developments and decision-making:

- RRI governance measures have to recognise and consider the diverse and diverging interpretations of the issue at stake. Otherwise, in addressing one aspect (e.g. financial participation), they might provoke outrage concerning another important one (e.g. safety and environmental protection).

- Adopting resolutions, laws or guidelines that regulate the implementation of a certain technology are not enough to address societal concerns. It is also necessary to have an authority that monitors and controls companies' compliance with these rules. In this regard, the independence of this authority is essential to ensure societal confidence in its effectiveness.

- The neutrality of researchers and research organisations conducting assessments of the impacts and risks of a technology is crucial to generate accepted knowledge that can serve as the base for meaningful interaction between opposing societal groups. This could be ensured by the independent funding of research by a trusted body not serving the specific interests of certain stakeholders. The research on different aspects and impacts of the technology must have a broad scope aligned to the demands of the stakeholders.

- Aiming to facilitate meaningful interaction does not mean that activities should strive to eradicate controversy. As observed in the Austrian case, public and political controversies can be a driving factor for legislative changes promoting RRI. In this regard, a powerful actor taking up a neutral stance in-between conflicting groups is beneficial as a mediator, because it has the capability to undertake change along a middle way.



The Danish Government 2006 Page 25

“[A] broad-based mapping should be regularly carried out to identify the research needs that societal and business developments create as well as the capabilities of Danish research institutions to meet these needs.”

Case Study 2 Danish priority-setting for strategic research

Deliberation to address societal challenges

Morten Velsing Nielsen

RESEARCH2015 is a priority-setting exercise aimed at addressing societal challenges in national, government-funded strategic research in Denmark through cross-disciplinary deliberation and the broad inclusion of societal actors. While much hope is attached to such priority-setting exercises to improve decision-making, experience reveals the challenges of finding good practices. The study finds that broad inclusion in priority-setting is a delicate balancing act, where many different factors have to be considered. While RESEARCH2015 clearly creates some constructive interactions between actors, other actors and viewpoints never become part of the core process. The process also has a limited ability to transform the values and behaviours of actors, and therefore only a minor long-term impact. Finally, the exercise succeeds in being instrumental for policy-making, but fails to include perspectives which do not fit this objective. This raises the question of how best to achieve a balance between influencing policy-making and creating an inclusive and creative priority-setting exercise that brings together a variety of perspectives.

Introduction to RESEARCH2015

Since 2000, Denmark has an increased focus on improving its international competitiveness, and one key aspect has been to give more attention to science policy (Aagaard and Mejlgaard 2012). In 2005, the Danish government created a globalisation council, who suggested strengthening the basis for political decisions on strategic research:

“A broad-based mapping[1] should be regularly carried out to identify the research needs that societal and business developments create as well as the capabilities of Danish research institutions to meet these needs.” (The Danish Government 2006: 25)

This started the RESEARCH2015 process, which was developed and facilitated by a team of three people at the Ministry for Research, Technology and Innovation. The main objective was to develop a more structured and transparent approach to priority-setting across research and innovation institutions. Because experiences with deliberation for research priority-setting were limited in Denmark, the Ministry decided to construct their own model using a mix of different known methods.[2]

1 The official translation uses the word survey; however, mapping is much closer to the original text in Danish.

2 Some inspiration was found in similar exercises in other European countries. For a comparison to other European priority-setting exercises of this type, also referred to as horizontal foresight, see the full case study report on http://res-agora.eu/assets/TEKNO-1-Stage-2.pdf.

This consisted of three distinct phases:

1. In phase one, the OECD was selected for a horizon scan of international societal challenges to provide a knowledge base for RESEARCH2015. Then an open call for input was issued and facilitated through a web tool, which resulted in individuals and organisations suggesting more than 500 topics for strategic research.

2. Phase two grouped these many suggestions into themes. The Ministry decided this phase should be steered by an independent team of eight experts in consultation with a user panel of more than 50 individuals representing societal organisations.

3. In the third phase, the Ministry took over the steering role to narrow down the number of themes, and to ensure that each suggestion was well founded. This was done in consultation with key actors. The final report to be used by parliament provided a knowledge foundation for how to divide funding, and featured 21 themes for strategic research (VTU 2008).

This chapter analyses the RESEARCH2015 process using the Res-AGorA research model.[3] The empirical work consisted of eight interviews with central actors, who were selected to reflect the full diversity of actors included,[4] as well as an analysis of the documents giving a detailed overview of RESEARCH2015.[5]

Conditions for RRI in the making

Diversifying steering to secure legitimacy of input

RESEARCH2015 can be seen as a governance instrument which intends to create a better knowledge foundation for the governance of strategic research by widening inclusion. There was no enforcement system built into the process; instead, it attempted to achieve its goals by building consensus within the process. This was especially apparent in the third phase, which only included stakeholders key to implementing the results. RESEARCH2015 was a new initiative and therefore not linked to other governance arrangements in a formal way. The main target audience, from the facilitators' point of view, were key decision-makers for strategic research in the Danish public sector comprising politicians, a public research council, and universities to some extent. The Ministry chose multiple types of steering. The first hearing phase was conducted with the least possible steering. This resulted in chaotic inputs, which the expert group found it hard to work with, but which also included novel suggestions for strategic research. The second phase was steered by the expert group, who developed themes related to their own disciplines. In the third phase, the Ministry took control of the steering to compile the final report.

Inclusion in RESEARCH2015

The first open hearing gave everyone the opportunity to provide input, yet most input still came from research organisations and organisations representing industry, as well as individual researchers employed at universities. Only a few individual citizens and companies made suggestions. The difference to other priority-setting exercises in Denmark was therefore the number of actors involved rather than their type. Of the eight independent experts in charge of the second phase, four were from universities, three from business and one from a private research foundation. These were the only actors who followed the process over a longer period of time, while others contributed just once or twice. The user panel consisting of 57 representatives of societal organisations gave their input via a one-day workshop held with the expert group. In the third phase, ministries and public research councils helped adapt and write the final proposals. In this phase, comments were still given by a number of organisations. Three different criticisms were expressed in regard to inclusion. First, that industry and the natural sciences were underrepresented, especially considering their importance to strategic research in Denmark. Second, that the hearing failed to include actors from outside traditional research institutions. Third, that a structured and facilitated inclusion of the general public could have provided valuable input.

De facto governance practices

Creating constructive interaction

The inclusion of actors in RESEARCH2015 went beyond the normal scope of priority-setting in strategic research. The official evaluation (VTU 2009) shows general satisfaction with the way different inputs were discussed and received, even if some feel that the final result was skewed towards traditional research and innovation. A more thorough and systematic inclusion of new actors that gave them a clear understanding of the different ways to affect the process could have potentially given more weight to novel suggestions for strategic research. The analysis shows that the process increased discussion of the issue, and the main criticism from actors did not concern the amount of discussion, but how different purposes and interests were weighted within it. A main objective of the extensive process was to form a robust knowledge base. However, the quality of the knowledge given weight in the process was a point of disagreement. An example of this is the OECD horizon scan, which some business actors thought was crucial, while actors from academia found it to be of poor quality. Actors also differed when it came to the learning gained from being part of the process. Some experts thought the process included significant learning, while others felt they had been excluded. Several people emphasised that such processes tend to draw on the same actors who have accumulated experience in working across disciplines and between institutions.

Creating transformation

The official evaluation (VTU 2009) shows a significant impact of the exercise on policy-making and on the strategies of the strategic research council, which is often seen as the most important criteria of success for this type of priority-setting (see Calof and Smith 2010). However, several actors emphasised that this impact was caused by over-including traditional research and innovation actors, and not allowing enough scope for innovative and different inputs. In other words, such a narrow definition of success does not take into account who organises and manages such processes and to what end. As this process was run by the Ministry in response to a politically set target, adaptation to the political context is to be expected. However, this cannot in itself be regarded as a success if it is done without respect for the autonomy of the process. This point echoes the argument made by Stirling (2008) that processes with a clear instrumental purpose can have a tendency to favour strong actors. Some level of consensus was built and a political impact was achieved, but it is difficult to identify any transformation of how actors work to prioritise strategic research. Several actors emphasised that it was constructive to have broad inclusion, the focus on societal challenges, and the possibility to learn from many different actors, yet no transformation in values or behaviour can be identified. This is not a surprising result considering the process included strong interests within research and innovation and was concluded in a relatively short time. The process was the first of its kind in Denmark. That the process was reviewed positively and that learning occurred can be seen as important first steps to developing new practices and understandings.

Drawing lessons for Res-AGorA

Developing a common knowledge foundation

The OECD horizon scan functioned as a knowledge base for the discussions of societal challenges in RESEARCH2015, yet there were very different opinions about the quality of this document and its validity as a knowledge foundation for the exercise. The scan was therefore not used extensively, despite its status as the main analytical document in the process. The knowledge base actually consisted mainly of the knowledge shared among the participants. During the process, a member of the expert group suggested creating a theme concerning sociological reflections on the quality and usability of the knowledge created through research, but this was not taken up by the Ministry.

Understandings of responsibility

The RESEARCH2015 process was initiated as part of the Danish globalisation strategy to improve its competitiveness. For research to contribute to this aim, and be regarded as strategic research, it needs to focus on an area with significant societal challenges, and indications that scientific solutions are needed and capacity exists within Danish research. There was no disagreement on these overall criteria. Responsibility is understood in the documents as improving competitiveness through

3 See the Chapter on the research model for an explanation of RRI in the making and *de facto* governance.

4 Interviewees included an academic expert in priority-setting, facilitators from the Ministry for Research, Technology and Innovation, university representatives, industry representatives, and research council representatives and also represented different academic disciplines.

5 This consists of 60 documents detailing the process, including meeting summaries, email inputs and draft reports.

strategic research to sustain growth and welfare. However, a difference in understanding could be detected between those emphasising innovation and technical expertise as the means to create competiveness, and those focusing on the need for research to bring about broad societal benefits and social cohesion.

Balancing inclusion and influence

One of the criticisms that emerged during the official evaluation was that the process did not bring anything new to the table (VTU 2009: 8). A legitimate question could therefore be whether existing strategic research ideas have been sufficiently challenged in the process. Innovation could have played a bigger role, giving more room and weight to ideas from outside traditional research institutions. Instead, the process focused on themes able to generate consensus among participants, and to which Denmark could make a significant contribution through existing research environments. This approach seemed inadequate to business actors who emphasised the need for Denmark to move into new areas of strategic research. An initial analysis concerning the current standing of Danish strategic research might have clarified the need to define new areas of research.

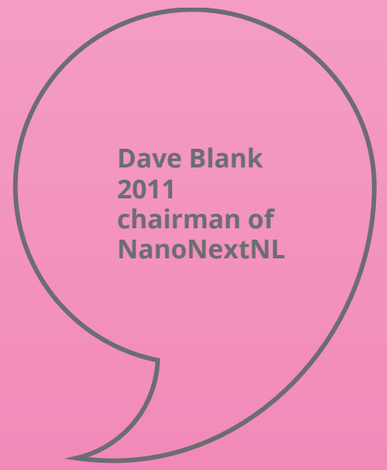
Balancing clear structure with decentralised steering

Having a clear structure and purpose was important to actors in RESEARCH2015 and one of the suggestions of how to improve it was to create a better structure for the initial hearing of actors. Structuring the exercise is also part of steering, in which it is important to create a reasonable balance between top-down structuring and room to manoeuvre for the participants. The Ministry decided to let the expert panel steer the second phase, yet subjected the work of the experts to another extended review in the third phase, which the experts found problematic. This makes it unclear how much each of the three phases contributed to the final results. In the follow-up to RESEARCH2015, the Ministry asked organisations to submit joint proposals including suggestions from all their sub-organisations. This approach resulted in thoroughly developed proposals, but some transparency is lost when content is developed outside the process.

Conclusion

RESEARCH2015 is regarded by actors as a positive step for research priority-setting and as being a more inclusive, interdisciplinary, and transparent process than past processes. But there is little agreement on which parts of the process were useful. A more structured and transparent approach to the relationship between the phases might have clarified the influence of different actors, and brought into the open discussions which took place behind closed doors, first in the expert group and then in the Ministry. While there were plenty of disagreements, most were not dealt with during the process, making it hard to identify the central issues dividing actors. Some research themes were introduced, taken away, and then re-introduced, but it was not transparent how these decisions were made and on what grounds. The results of the process had a clear impact on policy-making, yet the analysis shows that this cannot be seen as a success in itself. If the impact comes at the cost of diversity in perspectives, then it contradicts the values of inclusiveness and long-term thinking that such processes should promote.





“Every researcher in this field has to consider the consequences.”

Case Study 3 NanoNextNL

Integrating risk analysis and technology assessment in NanoNextNL

Bart Walhout

Introduction

NanoNextNL is a Dutch research and innovation consortium with a special research theme: Risk Analysis and Technology Assessment (RATA). While the strategy of including a “parallel research” programme is no longer unusual, an important challenge is to organise such research as an *integrated* activity and to *mainstream* concrete approaches to integration across large research programmes. In this chapter we report on an exploratory analysis of the integration and underlying conditions of RATA in NanoNextNL. We will highlight the learning processes, which occurred along the process of implementing this encompassing ambition in practice. We argue that since such learning processes are inherent to attempts on mainstreaming, governance strategies and arrangements should be set up in a way to facilitate learning – about what has to be integrated, as well as how to organise this effectively.

“Every researcher in this field has to consider the consequences”. With this statement Dave Blank (2011), chairman of the executive board of NanoNextNL, marked the ambition set for NanoNextNL. This chapter discusses how this ambition has been realized in the attempts to organise Risk Analysis and Technology Assessment (RATA), not only as a separate research theme, but as an integrated activity. The next section discusses frame conditions: RATA’s design as a research theme and the actors involved in integrating RATA. Section 3 discusses how the actual integration has been unfolding and Section 4 discusses this process as a learning process with regard to its constructive and productive qualities. Section 5 ends with lessons for governance.

The research for this chapter draws on a variety of sources. As a parliamentary Technology Assessment practitioner at the Dutch Rathenau Instituut, I have been closely following the emergence of NanoNextNL, the RATA research theme in it and the (political) discussions about it. Most of the analysis, however, draws on my role as “observing participant” in being part of the RATA research theme myself. Furthermore, document analysis, interviews and feedback from key individuals, often figuring in the analysis below, have been documented in a case study report for the Res-AGorA project and published in a book chapter (Walhout and Konrad 2015). Part of the observations also draw on interviews conducted by Colette Bos, a fellow PhD researcher at NanoNextNL, documented in a co-authored publication (Bos et al. 2014).

Frame conditions

Situating RATA in NanoNextNL

NanoNextNL is a Dutch national R&D programme on micro and nanotechnology, involving 130 partners covering universities, research centres, multinationals, SMEs and medical centres, and running from 2011 until 2016. The programme is explicitly positioned as an innovation programme, succeeding the earlier national programme NanoNed, which was mainly research oriented. Due to parliamentary discussions about nanotechnology the Dutch government had pushed for including "risk research" in the research agenda (Cabinet 2006). Later on, the Dutch parliament demanded to allocate at least 15 per cent of the budget to this type of research (Parliamentary Papers 2009). With that political warrant and a later broadening with Technology Assessment, RATA started as a large research theme in NanoNextNL.

Just like the other themes on the research agenda, RATA was organised as a collection of mainly PhD-research projects, structured and performed according to the academic and institutional setting in which each project is located. However, as a special theme, RATA has been positioned as a cross-cutting theme, supposed to interact with all other research themes and renumbered to theme number one in the final proposal. These moves happened against the backdrop of increasing political and public attention towards nanotechnology. For example, the statement of Chairman Dave Blank, quoted at the start of this chapter, comes from an interview on the occasion of the closing event of a series of public dialogues about nanotechnology in the Netherlands. In the background was also the requirement to comply with the European Code of Conduct for Responsible Nanosciences and Nanotechnologies Research (EC 2008, hereafter referred to as the "EU-CoC"). In the final grant decision letter (Ministerie van Economische Zaken 2011) this requirement had been operationalised by requiring that every PhD thesis delivered by NanoNextNL should discuss potential risks.

The actors involved

NanoNextNL is managed by an executive board, supported by a programme office and a business director. Supervision and feedback is organised by a supervisory board, with members of the main partners, and an international advisory council, consisting of nanoscientists from public research labs as well as industry representatives. Furthermore, progress and output have to be reported to the executive agency of the Ministry of Economic Affairs, RVO (the Netherlands Enterprise Agency).

The business director and executive board members have a natural science or engineering background and represent the most important organisations in the NanoNextNL consortium. The executive board has been acknowledging the importance of RATA publicly, including its potential to boost credibility and help to realize the commercial potential of the research in NanoNextNL. The management of RATA consists of the RATA programme officer, the RATA theme coordinator and the RA and TA programme. For all of these people, their tasks and responsibilities in NanoNextNL are only part of their job as researchers or research managers in their home organisations.

For the integration of RATA, the main "target groups" are the research projects in the other NanoNextNL research themes. Interviews with PhD researchers and Principle Investigators (PI) show that in the second year of NanoNextNL there was still little to no awareness about the topics being covered in RATA, the requirement to comply with the EU-CoC or potential societal issues related to their research projects (Bos et al. 2014).

De facto integration of RATA into NanoNextNL

The above discussion of frame conditions shows that RATA had developed different faces, evolving from a separate *research theme* to an *integrated activity*, partially pushed by public and political debate, and resulting in an additional *obligation* to pay attention to potential risks in every (PhD) project. How these different, but connected ambitions had to be realized, did not become part of the consortium agreements.

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

A the RATA theme,
B educational and supporting activities for the researchers in the other themes, and
C the required paragraph in each PhD thesis (Gielgens 2011).

According to the programme office, this would be a reasonable and legitimate approach, since all three elements would be implemented following a strategy that would fit the situation and needs of the individual researchers. In this view, *inspiration from* and *interaction with* RATA would be more effective than telling people what they are already doing. Consequently, the programme office has been stimulating both lines by developing a two-day RATA course for the PhD researchers and by supporting networking activities of the RATA management in NanoNextNL.

RATA course for PhD researchers

The two-day RATA course was intended as an introduction to RATA and to support PhD researchers by identifying a RATA-related sub-topic, which they could discuss in the required part of their thesis. However, while the course was being developed, this RATA obligation was renegotiated with RVO and limited to the PhD students located in the programmes deemed relevant for RATA. In approaching PhD researchers and their supervisors the programme office repeatedly encountered reluctance or even resistance to participation, sometimes reflecting broader concerns about increasing demands on scientific practice in general (Bos et al. 2014).

Participant evaluations indicate that the course has been very helpful in providing participants with first ideas how to think about societal aspects of their research. Moreover, initial reluctance and resistance among the participants often turned into enthusiasm during the programme. The course, however, could only provide a first introduction, thereby giving little means to the participants to develop follow-up actions once they were back working on their research projects. The RATA programme officer and the course leaders attempted to bridge that gap by offering RATA coaching. About ten PhD students signed up for this and were linked to a researcher from the RATA theme. Actual follow-up of the course has so far been realized in a couple of PhD-research projects.

RATA collaboration

Facing the lack of awareness, reluctance and resistance among the "target group", the RATA management participated and presented other research themes at programme meetings and initiated a series of RATA dinners, to which theme coordinators and programme directors were invited. These meetings paid off in terms of gaining awareness and first explorations of opportunities to collaborate (NanoNextNL 2013a). However, collaborative activities have not been reported so far.

The researchers in the RATA theme have been working at a relative distance to the programme level activities, focusing on the progress in the individual research projects in the RATA theme. From the RATA research theme three of about thirty projects scheduled interactive events with NanoNextNL researchers from other themes. In addition, a couple of programme level activities have been organised. RATA also has been more explicitly profiled at the annual conferences, by separate sessions and booths.

Learning from RATA

While RATA as a *research programme* even overachieved its performance indicators, requirements to fulfil the RATA *obligation* have been reduced and efforts to *integrate* RATA throughout the programme have resulted in a limited number of interactions. Nonetheless, the very attempts to integrate RATA have been visible. The strong commitment to both business creation and RATA (no matter if at a somewhat superficial level), and the enforcement of formal obligations (even while negotiated), actually created a considerable awareness among NanoNextNL researchers of RATA as an inseparable element of the NanoNextNL identity. In addition, "diplomacy" of the RATA management paid off in the form of changes of attitudes at (research) management level and of PhD researchers in the RATA courses.

Productive? Integrating RATA as a distributed problem

An important factor in this outcome is the distributed character of NanoNextNL. Although NanoNextNL exhibits a corporate identity and governance structure, it mainly functions as a multidisciplinary, collaborative

interinstitutional expert network, organised in a familiar mode of research funding through public-private research consortia. Having an integrated RATA theme in such a programme is a fairly new structure and requires dedicated integration work. The executive board was supportive of RATA, however, without an articulated vision on how the integration of RATA would have to be accomplished. As key representatives of the Dutch nanotechnology community, the executive board was particularly concerned with living up to the promise of nanotechnology by demonstrating business potential.

The integration work has been mainly left to the RATA management, which heavily relied on opportunities for networking and advocacy. The members of the RATA management had to get to know each other first, as well as many of the executive board members, programme officers, theme coordinators and programme directors in NanoNextNL. This has come at the cost of mobilizing the RATA research theme itself, consisting of multiple disciplines. While annual meetings have contributed to the RATA identity, the RATA project leaders were not closely engaged in the quest for integrating RATA into NanoNextNL. Consequently, the RATA research activities concentrated on local project dynamics and kept a disciplinary focus.

Constructive? Integrating RATA as a learning process

For RATA as an *integrated* activity, those in charge of the research projects and programmes (researchers, theme directors, etc.) have to learn which societal aspects and dimensions are at stake. In addition, how such an integrated activity can be conducted in practice, requires learning as well: in terms of training researchers and of building support from supervisors, programme directors and theme coordinators, the programme office and the executive board. Crucially, this kind of learning is largely improvised, due to the relative novelty, to changing interpretations and expectations, and because of the distributed (network) character of research consortia like NanoNextNL.

An important factor which shapes the learning process is the way in which responsibilities with respect to RATA were understood in relation to how RATA has been framed as an activity. While Risk Analysis (RA) *expertise* actively has been offered in NanoNextNL meetings and in the PhD course, RA itself mainly has been presented as *research*, thereby emphasizing knowledge rather than the interactions needed to develop targeted *knowledge*. For Technology Assessment (TA), executive board members as well as participants of the RATA course repeatedly kept framing TA as having to do with public *acceptance*, to be addressed by communication and dialogue, despite efforts to emphasize aspects of *anticipation* and *societal embedding* in a broader perspective. These framings of RA and TA have reinforced expectations that RATA, as a research theme, would *sort out* societal issues, instead of doing so by *finding out* together. Similarly, enrolling PhD researchers in the RATA course has been accepted, but involving their supervisors did not take off.

Lessons for research governance

Living up to the ambitions of Responsible Innovation, requires governance strategies and accountability structures that facilitate learning by dedicated integration work. From the case of integrating RATA into NanoNextNL we can draw three conclusions:

Firstly, because integration, and even more so the mainstreaming of it at programme level, is a learning process, it should be designed as such. This implies that learning about societal dimensions and societal embedding is not only organised at the level of individual researchers, but also collectively, including the question how such learning should be facilitated. In addition, change agents are important and should be carefully supported. In the case of NanoNextNL, the designated change agents were mainly the members of the RATA management. However, their abilities to "make change" have been limited by a lack of opportunities for an in-depth exchange.

Secondly, incentive and accountability structures are crucial. Learning is channelled by obligations and commitments. Hence, processes of learning are affected and conditioned by evaluative structures. Realizing a beneficial structure is, however, far from straightforward: approaching RATA as a learning process requires reflexivity, vision and support, all the way up to executive boards, consortium agreement negotiations and funding procedures. In this respect it is interesting to note that RATA as an *obligation*, however narrowed down, did positively contribute to the integration of RATA as an *ambition*.

Thirdly, learning involves trade-offs between developing generic capacities and dedicated collaborative efforts. Identifying the societal and risk dimensions to be considered and how these can be addressed for all research projects, quickly puts a strain on the resources and capacities available. Moreover, a well-known feature of societal dimensions in research and innovation is that these are partly potential or unknown. Therefore, identifying societal dimensions benefits from stimulating reflexive and anticipatory abilities. At the same time, learning also has to be made "relevant" and tailor-made. It is hard to see how such balancing can be done without a strong and self-aware core, in our case the RATA research theme. But the RATA research theme had not been designed to serve interaction, a situation enforced by the same incentive structures as those withholding researchers from the other programmes (like being absorbed by their usual research work and disciplinary requirements). In addition, the integration of RATA has remained a mainly internal affair. Even with such a core, learning about societal aspects benefits from interaction with outside actors. This, again, requires commitment as well as capacity from executive boards and programme and project leaders, to facilitate and evaluate such learning processes.

Commission
of the
European
Communities
2006

“[Corporate social responsibility was defined as] a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis.”

Case Study 4 ⅄ Critical organisations

Multi-national corporations

Allison Loconto

Introduction

Sustainability is considered to be a fundamental aspect of responsible research and innovation (Von Schomberg 2013). The European Commission has further framed this issue as the second societal grand challenge on the horizon (food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bioeconomy). A programme of research and innovation that contributes to more sustainable agri-food systems is required to respond to this challenge. According to a 2011 study by the United States Department of Agriculture (USDA), the private sector spent 19.7 billion US dollars on food and agricultural research (56 per cent in food manufacturing and 44 per cent in agricultural input sectors) and accounted for about half of total public and private spending on food and agricultural research and development (R&D) in high-income countries. While there are publicly regulated responsibility and accountability mechanisms in place for the expenditure of public R&D funds, private R&D is regulated through internal company controls and in those spaces of hybrid control where public and private funds mix. Innovation processes are less regulated as they often occur outside of official R&D departments within organisations or through partnerships with start-ups, universities or other private organisations. Most mechanisms that are used to regulate private research and innovation are therefore voluntary instruments that are tied to international, sector-specific, professional or national agreements.

In this chapter, I focus on how multi-national corporations (MNCs) are justifying the responsibility of their vision and technologies that will ensure food security for a growing population. I pay close attention to how responsibility is distributed between actors in the institutional arrangements and which instruments are used to govern actors’ responsibility. MNCs are critical organisations within the existing responsible research and innovation (rri) landscape as they are both highly invested in conducting research and innovation in the agricultural sector and are also carrying out this research through an innovation process to introduce new products and technologies to markets from within a single organisational environment. I explore three different MNCs – two of the leading food manufacturers (Nestlé and Unilever) and one of the leading agricultural input manufacturers (Syngenta). These three organisations are among the leaders in their sectors and have each made “responsibility” a fundamental aspect of their innovation agenda. I conduct a cross-comparison of these three organisations in order to identify “RRI in the making” within private-sector research in the food and agriculture sector.

Research for this case study draws on a multi-sited ethnography that was conducted between 2007 and 2010 and focused on Unilever's engagement with the Rainforest Alliance voluntary standard (Loconto 2010). Between 2013 and 2015 as part of the Res-AGorA project, the author conducted participant observation in expert meetings on sustainable agriculture, sustainability standards and sustainable value chains (5). In 2014, the author conducted interviews with executive managers in the three companies (seven from Syngenta, one from Unilever, and three from Nestle). Each company's core programs, websites, news articles and annual reports were continuously analysed throughout the research period.

Results: RRI in the making

Defining responsible research and innovation

Within these three case studies, the term RRI is not used, but the principles behind the concept exist and are defined within the wider governance landscape of the well-known concept of corporate social responsibility (CSR) (see Carroll and Shabana 2010). The notion of CSR has long been in use in the field of management studies, it is well institutionalised within large companies and it has been the main pathway through which MNCs have begun to expand their consideration of and collaboration with a broad range of stakeholders (particularly civil society groups). At the European level, CSR was defined as:

"a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis."[1]

The precise framing of CSR differs by MNC, but each company includes elements of the following three frames of responsibility.

Regulatory compliance

The notion of regulatory compliance is best illustrated by Syngenta's approach to "Responsible Agriculture", which includes regulation and registration, product safe use and stewardship and resource efficiency and biodiversity. Within Syngenta, there is a "Regulatory Policy Division" that supports the work of around 400 staff around the world that spend their time registering molecules and active ingredients in all of the different countries where the products will be sold. Interviewees explained that they were acting responsibly because they were going through this process. They explained that many companies who make generic brand products do not register the molecules or active ingredients before putting them on the market, particularly in developing countries. Many unsustainable agriculture practices can be linked to this because farmers are gaining access to inferior products and using them improperly. Their responsibility ended with the compliance to regulatory requirements, what farmers did with Syngenta products after they had purchased them and had read the labels was the farmers' and extension systems' responsibility. However, Syngenta does carry out toxicovigilance programmes in 100 countries, which provide medical advice for treating health effects related to "improper use" of their products.[2]

The Business case

Making "the business case" for responsibility was another dominant purpose for mobilizing resources and personnel in an attempt to realise responsibility in research and innovation. Making the business case basically means that any research and innovation activity should contribute to the bottom line of the core business. In a discussion about rri at Nestlé, which is not a term that is used in their company, an interviewee noted that "the last phrase of von Schomberg's statement is the key; research and innovation isn't there purely for their own sake, but for the marketable products." Nestlé's "Corporate Business Principles" incorporate the ten principles of the UN Global Compact[3] and lay out the responsibilities that the company has towards: consumers, employees, suppliers and customers and to the environment. Nestlé's main responsibility within its R&I processes is thus to ensure that its commercial products deliver nutrition, health and wellness: "With the world's largest private nutrition and food research capability, we are continuously creating nutritional value and health benefits across our product range."[4] This work includes investment in nutrition, labelling and communication and primary research into nutrition and other types of research related to their core lines of business: cocoa, palm oil and sugar (for chocolate), coffee (Nescafé), water (infant formula) and other raw ingredients.

Mainstreaming

The framing of mainstreaming of responsibility and sustainability throughout the company is an aspiration that has been encouraged by Porter and Kramer's most recent business mantra "creating shared value" (Porter and Kramer 2011). The idea is that the success of a company and the health of the communities around it are interdependent, and that economic growth and progress come from capitalizing on these interdependencies. It brings the notion of stakeholder participation to a different level of engagement. Unilever's approach for the past 15 years has been a successive restructuring of the company to ensure the incorporation of sustainability throughout their different product lines. While the global sustainability group consists of twelve people, Unilever has identified "sustainability champions" in every R&D unit of the company, which ensures mainstreaming of this effort:

"R&D find new sustainable technologies, marketers listen to consumers to help us make sustainable products consumers desire, supply chain implements our technologies and ideas in our factories, and ensure we source and manufacture in a sustainable way."[5]

They have driven this CSR approach from the company leadership by setting ambitious targets along ten year timelines, including the ambitious goal of halving the environmental footprint of making and using their products by 2020. This is branded as the company's Sustainable Living Plan.[6] This mainstreaming approach has propelled them to being considered as one of the world's top green companies.[7]

Instruments for pursuing rri

The MNCs in this case span countries and continents, conducting research and making innovations in as many as 14 different countries at the same time and selling products around the world. There are three unique sets of actors who are found across the three companies – R&D units, corporate affairs, and foundations – and who are responsible for different aspects of the research and innovation processes. For example, R&D units focus on fundamental and product-related R&I, corporate affairs manage the relationship between CSR and responsibility within R&I processes and foundations expand on the core framing of each company's vision of responsibility to conduct research and development with a specific philanthropic focus on developing countries. Forging partnerships is fundamental to how these MNCs pursue RRI. Partnerships take different forms, depending on the department that leads the effort. Partners include suppliers, start-ups, universities, donors, private research companies, NGOs, public actors (including extension) and intergovernmental bodies.

Reporting requirements and the identification of existing instruments is the dominant approach taken by the three MNCs to pursuing rri. There is a mix of existing instruments currently in use internally in these companies and it includes human resource incentives, private soft regulation (private standards), public voluntary laws and directives, and compliance to mandatory regulations as the foundation of their responsibility. External instruments include the Dow Jones Sustainability Index[8] which encourages competition between companies on responsibility indicators; and The Declaration of Abu Dhabi, which was launched and signed by all three MNCs in 2014. It is a pre-competitive approach to developing a set of common good agricultural practices (GAP) globally.

Existing instruments are most effective in two spaces of interaction:

1 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52006DC0136:EN:HTML (accessed 10 January 2016).

2 Non-financial performance discussion 2014, including The Good Growth Plan and Corporate Responsibility performance, http://www.annualreport.syngenta.com/assets/pdf/Syngenta-non-financial-performance-2014.pdf [accessed 11 January 2016].

3 Nestlé's Corporate Business Principles, http://www.nestle.com/aboutus/businessprinciples (accessed 22 October 2015).

4 Nutrition, health and wellness, http://www.nestle.com/nutrition-health-wellness (accessed 29 October 2015).

5 Interview Stefano Giolito (Global Director of Sustainability), http://www.unilevergraduatesblog.com/2011/12/interview-global-director-of-sustainability-stefano-giolito/ (accessed 14 November 2015).

6 About Unilever, Responsible Business, https://www.unilever.com/about/who-we-are/about-Unilever/ (accessed 22 November 2015).

7 Top 10 Green Companies in the World 2015, http://www.newsweek.com/green-2015/top-10-green-companies-world-2015 (accessed 14 November 2015).

8 DJ Sustainability Index, http://www.sustainability-indices.com/ (accessed 22 November 2015).

1. the scientific community and
2. international multi-stakeholder initiatives.

First, in all three MNCs, interviewees reported that their scientists are first and foremost scientists and therefore they follow the ethics of the scientific communities and professional organisations in which they were trained. Furthermore, they are constantly publishing in peer-reviewed scientific journals and must follow the protocols and responsibility requirements of any other scientist in the academic community.

Second, voluntary standards are used for sustainable sourcing strategies by each of the companies, however, the MNCs are also involved in what might be called industry "technical standards" committees whereby they are involved in setting the international standards for pesticide residue levels (Syngenta – The Joint FAO / WHO Meeting on Pesticide Residues [JMPR]), analytical methods for safety in food and beverages (Nestlé – AOAC INTERNATIONAL) and standards for palm oil (Unilever – Roundtable on Sustainable Palm Oil). Additionally, these companies have all been involved in the UN Global Compact's Food and Agriculture Business (FAB) Principles, which are pushing for responsible agribusiness and contribute to the post-2015 Sustainable Development Goals. In these spaces MNCs are engaging with NGOs and governments to define the metrics used to evaluate their responsibility for the products of their R&I processes.

What are the effects of rri?

In all three companies there has been a gradual shift in their CSR policies from being ad hoc "window dressing" style programmes to embedded approaches to how they do business. This has differed in each company, but has generally included integrating CSR objectives into key performance indicators (Syngenta, Unilever) and introducing design tools that can change the relationships between designers and researchers (Nestlé). There is also a movement towards shifting some research centres to developing countries. In some cases this is an attempt to be closer to the crop production areas (e.g. coffee, cocoa, tea), in other cases this may be to be closer to collaborating partners who are working on specific technologies, yet still in others it may be a way to conduct research that is not condoned elsewhere.

The work that MNCs are doing to align their governance instruments is moving them into the direction of productive responsibilisation of RRI. However, it would be naive to declare that all of these MNCs have transformed their actions; the profit motive and the notion of "good business" is the fundamental organisational principle for all activities within MNCs. Therefore, they work from the assumption that they must keep the business growing and profitable with all that they do. If they receive public backlash, or significant signs that their products will not make it to market, they will make changes to their R&I programme. However, these actions are part of the design process and not necessarily the results of efforts of a concerted responsibilisation process. Unilever is the most far advanced company in this direction as its mainstreaming approach has indeed made the whole organisation more responsive towards meeting its sustainability goals.

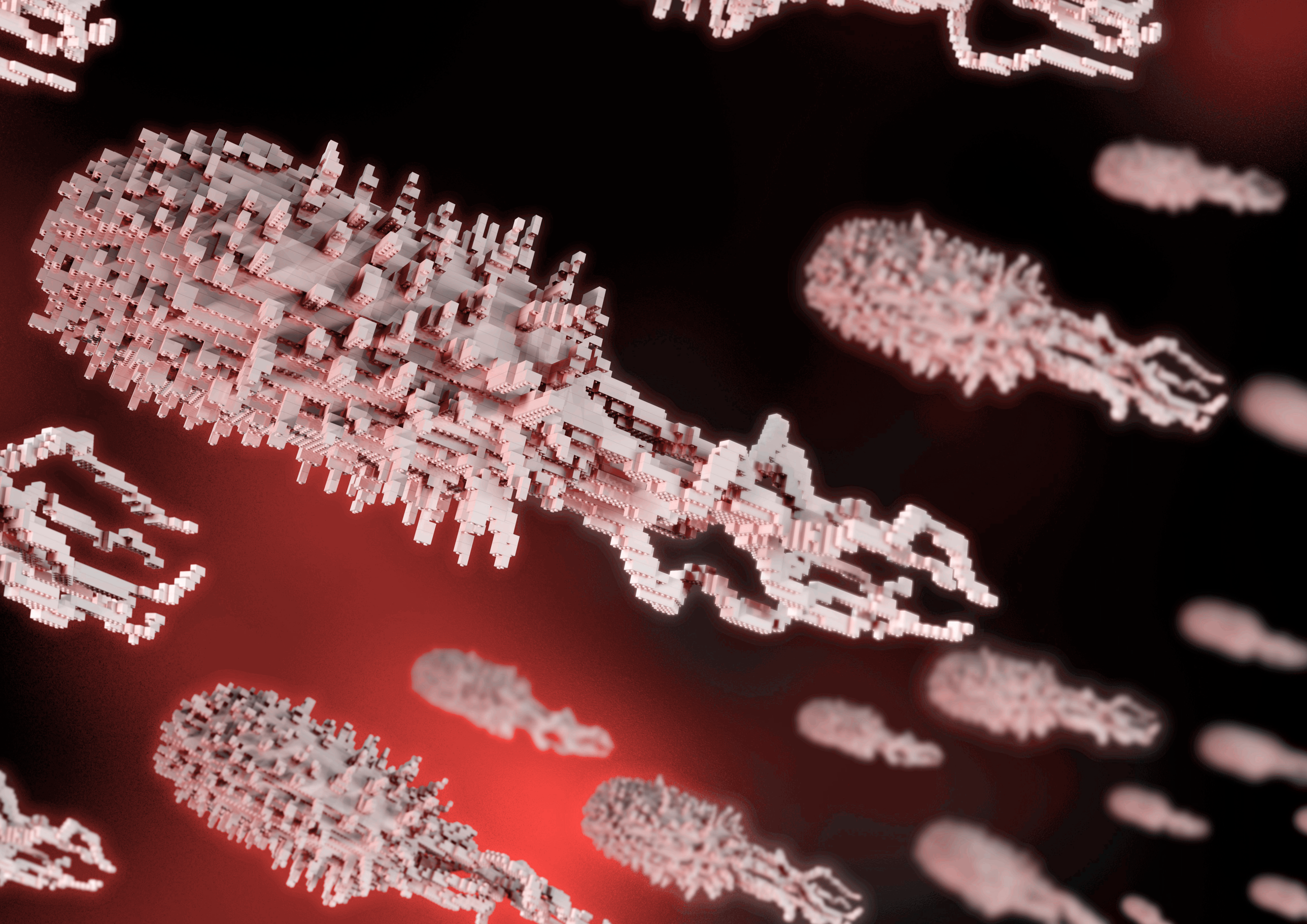
In line with existing research that explains the civil society dynamics of new social movements that rely on "naming and shaming" tactics (Bartley and Child 2014), all three MNCs have become very responsive to stakeholder pressure. I classify Nestlé and Unilever as productively managing this contestation while Syngenta has made strides, but has not yet reached the same level of contestation management. This may be explained, in part, by the nature of Syngenta's products (inputs rather than consumer goods), the severe public backlash against the company's direct competitors that makes dialogue difficult (Monsanto and Dupont), and the only recent move towards engaging in standards and multi-stakeholder initiatives (as an individual company and not through the CropLife lobbying arm).

RRI lessons learned

MNCs provide a very unique type of organisation that can influence the way in which RRI is defined, constituted and taken up by other actors. The unique positioning of research within a private company, who is responsible not only for conducting new research but also product development and commercialization of innovation, offers insights into how existing tools are being used and how any new governance instruments for RRI would need to be positioned in order to gain influence.

Through the analysis of these three companies' approaches to responsibility, it is clear that the concept of Corporate Responsibility (or CSR) is very strong and quite well-embedded into the organisational structures of the MNCs. While the companies do take slightly different approaches to the actual placement of CSR incentives either within their Human Resources systems, as an approach to public relations and engagement with NGOs or other private sector actors, and in relation to meeting regulatory requirements, it is clear that CSR and existing regulatory regimes already provide a number of tools that are being used by these companies. CSR tools are often more important for the innovation processes than for the research processes, as the scientists working within these companies view themselves primarily as scientists, and thus are also bound to the ethics and peer-review systems used in scientific communities.

The lesson for governing "RRI in the making" is clear: RRI needs to be understood differently in terms of thinking outside of fixed regulatory environments and towards fluid systems where there are portfolios of existing governance instruments. This case shows very clearly how rri issues are closely tied to economic interests in terms of the need to commercialise products that emerge from innovation processes; and to the strategic interests of balancing controversy with brand reputation, company sustainability with global societal challenges of sustainable agriculture and food security. The preferred tools from these three companies are: internal codes of conduct, voluntary standards and certification, reporting and indicators, multi-stakeholder dialogues and regulatory compliance. These instruments promote normative visions of responsibility in terms of individual and corporate liability for "irresponsible" practices, participation, transparency, capacity building and capabilities strengthening. The three MNCs recommended an additional principle – that of "shared benefits" – as something that should be included in RRI. This principle suggests an expansion of responsibility towards a form of outcome legitimacy or, perhaps more appropriately in these cases, towards a responsibility for maintaining the philanthropic aspect of CSR within concepts of rri.



Technology Strategy Board 2012 Page 22

“[...W]e consider how to advance synthetic biology technologies so that they are fit for use in a broad range of potential applications and markets.”

Case Study 5 Synthetic biology

The integration of RRI into a roadmap for synthetic biology

Davy van Doren

Introduction

The responsibilisation of emerging technologies is confronted by various challenges. Unstable techno-scientific demarcation, empirical uncertainty and novel normative beliefs illustrate the likelihood of conflict, divergence of perspectives and barriers to defining responsible research and innovation (RRI). This chapter presents empirical insights into how responsible research and innovation has been integrated with strategic considerations for national policies on synthetic biology. Based on a case study[1] of the UK experience on the development of a synthetic biology roadmap, it was observed that the explicit integration of responsible research and innovation was an important element for shaping governance. However, it was observed that this kind of integration is strongly dependent on adhered principles, predefined problem framings and selected sources. As such, the study illustrates the relevance of context-dependency regarding the interpretation of RRI, and indicates challenges for its comprehensive implementation within domains of innovation.

A synthetic biology roadmap for the UK

Within the domain of biotechnology, synthetic biology is an emerging technology characterised by an increased systematic use of engineering principles. Due to observed limitations in defining, characterising and specifying impacts of synthetic biology, institutional reactions in Europe have been scarce and reserved. However, the UK has followed a more active and innovation-driven strategy. Here, synthetic biology’s institutionalisation has been initiated by two research councils[2] and has resulted in an

1 The case study consisted primarily of document analysis and stakeholder interviews. The document analysis included: a synthetic biology roadmap for the UK (Technology Strategy Board 2012), the roadmap landscape schematic (see https://connect.innovateuk.org/web/synthetic-biology-special-interest-group/roadmap-for-synthetic-biology), the UK government response to the roadmap (see https://www.gov.uk/government/publications/response-to-a-synthetic-biology-roadmap-for-the-uk-letter-from-david-willetts-mp-to-dr-lionel-clarke), the Synthetic Biology Dialogue report (Bhattachary et al., 2010; videos from the launch event, see http://www.bbsrc.ac.uk/society/dialogue/activities/synthetic-biology/findings-recommendations.aspx), and minutes of the Synthetic Biology Leadership Council (see https://connect.innovateuk.org/web/synthetic-biology-special-interest-group/sblc-meetings) (all documents accessed on 10 November 2015). Interviews have been conducted with actors that were involved in the development of the UK synthetic biology roadmap, as well as with stakeholders that are or have been involved in the investigated initiatives.

2 I.e. Biotechnology and Biological Sciences Research Council (BBSRC) and Engineering and the Physical Sciences Research Council (EPSRC). An important hallmark was the formation of BBSRC’s Bioscience for Society Synthetic Biology sub-panel in 2007.

increasing number of funding schemes, research activities and public reports. "A synthetic biology roadmap for the UK" (Technology Strategy Board 2012), an assessment produced at the request of the UK Department for Business Innovation and Skills, can be considered a milestone in this development. As responsible research and innovation is explicitly mentioned as an important pillar within the published version, important insights can potentially be obtained regarding how the responsibilisation of innovation has been addressed and constructed for synthetic biology in the UK.

The UK synthetic biology roadmap was compiled by a coordination group. The coordination group included mainly representatives from industry, research and market development, and was stated to be "[…] an independent panel [… that was] set out to reflect a representative view drawn from across the UK community" (Technology Strategy Board 2012: 3).

In addition, two workshops attended by over 70 participants were conducted with the intention to represent stakeholders from industry, academia, regulatory bodies, funding agencies and policy makers (Technology Strategy Board 2012: 14).

Responsible research and innovation

The roadmap prioritises responsible research and innovation as one of its core themes[3] and provides directions for the implementation of responsible research and innovation. The roadmap states that there is a "[…] need to continue practising responsible research and innovation at all stages […]" (Technology Strategy Board 2012: 19) and that synthetic biology should be developed in a "[…] socially responsible fashion" (Technology Strategy Board 2012: 5). It is stated that responsible research and innovation for synthetic biology has three requirements (Technology Strategy Board 2012.:21):

"[…] that inescapable uncertainty is acknowledged and measures are put in place to ensure safe, rapid and effective responses to any unforeseen problems." (Technology Strategy Board 2012: 21)

"[…] that the UK maintains and develops its regulatory and enforcement regime for environmental, health and security risks relating to synthetic biology and that it does so from an international perspective […]." (Technology Strategy Board 2012: 21)

"[…] that 'engagement' means genuinely giving power to a wide range of diverse social groups, including those who will be the end users or presumed beneficiaries of the technologies, taking their concerns seriously, and enabling them to participate throughout the whole pathway of technological development […]." (Technology Strategy Board 2012: 21)

Although there was no public engagement during the development of the roadmap, it advocates broad deliberation. Concerning the current situation of synthetic biology in the UK, the roadmap states that engagement of diverse social groups should occur throughout the whole trajectory of synthetic biology's development. The roadmap also refers to the UK synthetic biology public dialogue (Bhattachary et al. 2010) and recommends "'Open door' mechanisms for dialogue" by means of multidisciplinary centres, overarching networks, a leadership council (Technology Strategy Board 2012: 5) and additional future activities of stakeholder and lay involvement (Technology Strategy Board 2012: 34 footnote). Alongside responsible research and innovation, other main aims of the roadmap include the identification and stimulation of:

"Initiatives that will help companies develop new products, processes and services of clear public benefit", as well as to "generate economic growth and create jobs." (Technology Strategy Board 2012: 4)

Direction

According to the roadmap, research and development in the UK is well placed as it "[…] is protected and enabled by […] regulatory frameworks that are recognised around the world as robust and proportionate […]" (Technology Strategy Board 2012: 9), and that synthetic biology in the UK "[…] routinely takes account of social and ethical issues […]" (Technology Strategy Board 2012: 5). Based on this observation, the roadmap has chosen an approach of driving innovation and focusses in particular on responsible market development and commercialisation:

"[…] we consider how to advance synthetic biology technologies so that they are fit for use in a broad range of potential applications and markets. Implicit in this activity is the desire to increase growth in the UK economy, generating wealth and creating jobs, consistent with the ongoing practice of responsible research and innovation […]." (Technology Strategy Board 2012: 22)

In line with the approach taken, responsibility seems to be mainly allocated to future activities. The roadmap states that potential products based on synthetic biology need to be able to demonstrate "[…] clear public benefits […]" or "[…] solutions to compelling problems […]" (Technology Strategy Board 2012: 19). With regard to future synthetic biology developments, the roadmap urges synthetic biology researchers to aid regulators in the optimisation and development of regulation (Technology Strategy Board 2012: 21). Also, the roadmap highlights the role of future training programmes to tackle evolving social and ethical issues (Technology Strategy Board 2012: 18 and 31).

Implementation

Within the UK, the implementation of the roadmap is mainly coordinated by the synthetic biology leadership council (SBLC). The synthetic biology leadership council, established after the finalisation of the roadmap and containing many of the same actors of the original coordination group, has convened in a series of meetings since the publication of the roadmap in 2012.[4]

Besides conducting discussions and actions related to the various topics, which are addressed within the roadmap's recommendations, initiatives concerning responsible research and innovation – that are mainly managed by the Governance Subgroup[5] – have also been observed. A central concern has centred on constructing a potential complementary function for the synthetic biology leadership council regarding its approach towards responsible research and innovation. As most funding and research was believed to focus on responsible research rather than on responsible innovation, as well as being strongly driven by public engagement and stakeholder involvement, activities are being planned to support capacity building in responsible innovation.

A reflection

The chosen orientation by the UK roadmap towards market development does not come as a surprise. This orientation was supported by a regarded appropriateness of existing regulatory frameworks for synthetic biology, as well as by an expressed belief that responsible research and innovation practices are relatively weakly established in industrialisation efforts compared to responsible research and innovation uptake in academic circles. This belief has also resonated within the House of Commons Science and Technology Committee, which concluded a need to capitalise nationally and internationally on the UK's strong research base in synthetic biology (House of Commons Science and Technology Committee 2010). Despite the implicit normative stance towards market development, much of the discussed content shows similarity to previously made arguments in literature. Also, a limited recording of used references makes the distinction between insights produced in- and outside the roadmap process difficult.

Nevertheless, the orientation towards market development taken by the roadmap is likely to have influenced the selection of sources. The approach applied to stakeholder inclusion, which focussed on the later phases of innovation, has led to the exclusion of various domains associated with synthetic biology and affected the comprehensiveness and output of the overall exercise. Although the roadmap acknowledges this limitation and recognises a need for continuous broadened engagement, it remains doubtful to what extent the interests of non-involved actors have been sufficiently addressed. Due to a focus on the primarily technological dimension of synthetic biology, the scientific dimension seems underrepresented within the roadmap's discussion and recommendations. Although contestation of responsible research and innovation's delineation internal to the roadmap process was arguably limited, existing external debates seem

3 In addition to other core themes of (1) foundational science and engineering, (2) developing technology for commercial use, (3) applications and markets, and (4) international cooperation.

4 For SBLC members, see https://connect.innovateuk.org/web/synthetic-biology-special-interest-group/sblc-members. For SBLC meetings, see https://connect.innovateuk.org/web/synthetic-biology-special-interest-group/sblc-meetings (accessed 10 November 2015).

5 See https://connect.innovateuk.org/web/synthetic-biology-special-interest-group/governance-sub-group (accessed 10 November 2015).

under-represented. These include issues of environmental protection, intellectual property regimes, safety and security, ethics and public acceptance, as well as fundamental challenges of uncertainty and knowledge limitation (Schmidt et al. 2009, Henkel and Maurer 2009, de Lorenzo 2010, Kwok 2010) . Regarding the compositional similarity between the coordination group and workshop participation, the generated added-value remains unclear. In general, a more complementary and comprehensive stakeholder inclusion might have improved the consideration of subjects relevant to responsible governance of synthetic biology.

An important issue concerns the lack of active public engagement. Despite the short-term depicted need of satisfying public concern within the produced roadmap schematic, such prioritisation does not seem well established in the vision's recommendations. Although public awareness and concerns are addressed to a certain extent with respect to the recommended creation of a UK-wide synthetic biology community, they are lacking in the context of responsible market development. In contrast to alternative approaches where contestations could be more actively and explicitly deliberated for safeguarding responsible research and innovation, the roadmap implicitly assumes that an approach based on the facilitation of innovation can induce positive externalities for sustainable development and the adoption of required responsibilities. The systematic usage of deliberation in synthetic biology governance remained undetermined, as well as how to account for evolving perceptions and interpretations of responsible research and innovation. How, and to what extent, recommendations for broad deliberation could implement, monitor and legitimise responsible research and innovation, have remained mainly unspecified.

Responsibilisation of innovation

With regard to the previously institutionalised dialogue in the UK on synthetic biology (Bhattachary et al. 2010), at least two conclusions seem relevant for responsible research and innovation in synthetic biology. First, that enabling scientists should reflect on their motivations and responsibilities. And second, that societal and public concerns should be integrated into research funding processes early on, in support of a required framework of international adaptive governance. Although the roadmap refers to the dialogue through its influence on funding policy within the research councils it addresses, these two conclusions seem to have been addressed only to a limited extent. Due to the strong orientation towards future innovation and market development, indications towards the establishment of internal and external accountability are limited.

The prioritisation of responsible research and innovation was also underlined in the governmental response to the final roadmap. Although the governance of responsible research and innovation has been a priority area for the synthetic biology leadership council, there is little evidence that regulatory frameworks have been recently reviewed, challenged or revised as a result of generally expressed concerns. Despite public disapproval within the UK on self-regulation (Bhattachary et al. 2010), the synthetic biology leadership council has claimed that the present self-regulation by the synthetic biology community follows a strategy of responsible innovation. Also, there has been a debate within the synthetic biology leadership council regarding a trade-off between responsible research and innovation and the maturation of the synthetic biology sector in the UK. In relation to discussions on the implementation of the Nagoya Protocol – an international agreement aimed at sharing the benefits from the utilisation of genetic resources in a fair and equitable way[6] – there has been critical resistance regarding framework conditions that could drive responsible innovation at the cost of discouraging potential venture capitalists, multinational companies and SMEs from investing or innovating.

Despite the explicit elaborations made on the responsible research and innovation concept within the synthetic biology leadership council, it is still not clear under which circumstances its realisation is or should be driven. Although the synthetic biology leadership council concluded a need to complement other activities carried out in the total landscape of responsible research and innovation, there are limited indications that such coordination has taken place. It is still not obvious to what extent a catalytic reaction might be expected from responsible research and innovation initiatives, or to determine the current magnitude of responsible research and innovation's realisation within practices and organisations associated with synthetic biology .

Conclusion

The synthetic biology roadmap constitutes an important step for the UK to become a leader in synthetic biology research and development in Europe. It has been influential in providing strategic leadership nationally and internationally, as well as explicitly establishing responsible research and innovation as an important strategic pillar. Its general positive and optimistic attitude towards synthetic biology, in combination with a scarce elaboration of existing controversy and uncertainty, might have provided a strong signal to decision makers to facilitate the development of this field. In this regard, the roadmap seems to have deviated from a traditional European approach based on open deliberation and precaution, towards one that embraces accelerated technological advance more strongly. The roadmap's focus on industrialisation, market development and driving innovations seems to have considerably affected the balance and representation of issues related to responsible research and innovation. However, it remains unclear how, and to what extent, the roadmap has influenced ongoing practices of synthetic biology – both in relation to techno-scientific development and policy recommendations. With regard to organisational change towards responsible research and innovation for synthetic biology, an assessment of the roadmap's contribution is difficult to make. Although the concept responsible research and innovation might have been picked up and implemented more explicitly as a result of the roadmap exercise, it remains unclear to what extent its symbolic nature has actually changed reality. Due to a lack of concrete and specific directions for the integration of responsibility into practices, a movement towards the generation and allocation of specific responsibilities to actors involved in the arena of synthetic biology has been restricted. Therefore, it remains uncertain to what extent practical alignment of the roadmap's vision on responsible research and innovation will occur.

6 See also https://www.cbd.int/abs/ (accessed 10 November 2015).

The authors in this chapter

“An RRI agenda is clearly developing in Europe, but there is no single, simple trend or model of it across European countries and institutions.”

8

Monitoring RRI in Europe: approach and key observations

Niels Mejlgaard, Erich Griessler

8.1 Introduction

In 2009, an expert group, appointed by the European Commission and chaired by Karen Siune, delivered an interesting report on emerging trends and cutting edge issues related to science in society in Europe (Siune et al. 2009). The report identified a number of common features characterizing the evolving discussion about the role and responsibilities of science across European countries. It pointed out, among several other trends, that science increasingly reflects on its own role and impact, on greater communication efforts and the inclusion of citizens in science, and on efforts to contest the appropriate place of science in society. Compared to other parts of the world, the report argued, a combined commitment to strategic research and broad involvement of societal actors, to innovation and democratization, tended to characterize the European model for science in society (see also Horst and Irwin 2010).

The concurring embrace of the innovation agenda and commitment to interactive governance of science has also become an important element of the emerging discussion about responsible research and innovation (RRI). The expert group report can be considered one of many forerunners of the current academic and policy discussion aimed at understanding what it means to be responsible in the context of research and innovation. The report pointed to a lack of empirical information on policies and activities related to science in society at the level of member states. It invoked a systematic monitoring effort during 2010–2011, the “Monitoring Policies and Research Activities on Science in Society in Europe (MASIS)” project, which aimed at providing a more detailed picture of differences and similarities across European member states and countries associated with the European research framework programmes (Mejlgaard et al. 2012).

When the Res-AGorA project was designed, it was decided to extend and refine these earlier monitoring activities as part of the vast empirical programme within the project. The “RRI-Trends” component of Res-AGorA was developed to explore issues related to RRI across organisations and countries based on a uniform approach, thus allowing for comparative analyses. RRI-Trends feed into the overall empirical research programme of Res-AGorA by examining *de facto* governance arrangements around research and innovation across a variety of different organisations and situations.

RRI-Trends has three main objectives. First, it intends to provide comprehensive information about the “state of

RRI" in each of the respective countries covered by the study. It explores the overall policy developments relating to RRI as well as RRI governance arrangements across several organisational sites in each of the countries included and thus provides a fairly robust national profile for each country. Second, it wishes to enable comparative analyses across countries and organisations. In order to achieve this aim, it uses a uniform protocol for research and common design to present results across countries. Third, it aims at presenting the collected data and evidence in a user-friendly and flexible format. A special RRI-Trends platform has been developed for the Res-AGorA website, from which users can access the country reports or self-selected parts of these depending on interests and purposes.[1]

8.2 The monitoring approach and key questions

RRI-Trends covers a total of 16 European countries. These include the seven countries (Austria, Denmark, France, Germany, Italy, the Netherlands, and United Kingdom) represented by the partner organisations in the Res-AGorA project and one country (Finland) selected due to its collaboration with the sister RRI project GREAT.[2] In addition to these eight pre-selected countries, another eight countries were selected with the intention of capturing European heterogeneity. The MASIS monitoring work had already pointed to significant variations across Europe, and the selection of countries for RRI-Trends was designed to ensure that cross-country diversity with regard to RRI would not be neglected.

Hence, an initial scanning exercise collected existing indicators and metrics on issues pertaining to the organisation of science in society, as a background for making an informed choice about which countries should be included in RRI-Trends. These indicators tapped into models and degrees of citizen involvement in science and technology, patterns of science communication and public debate related to science and technology, and the use of science in policy-making, which have been influential dimensions in the European Commission's Science in Society schemes. The scanning exercise also collected data related to innovation capacity, R&D intensity, and the interaction of public and private research, as well as data on gender equality in science. While these existing indicators had not been tailor-made to the notion of RRI, they were, however, conceptually related and were considered adequate as "proxies" for the RRI indicators to be developed by RRI-Trends and therefore adequate for the country selection procedure. Using cluster analyses, European countries were divided into six clusters with limited intra-cluster variation. Interestingly, the eight pre-selected countries were all contained within the same cluster, indicating that these countries were in fact fairly similar in terms of how science is placed in society. This provided a strong argument for selecting the remaining eight countries from across the remaining five clusters, in order to ensure sensitivity to diversity across Europe. Based on this reasoning, the Czech Republic, Greece, Hungary, Iceland, Ireland, Lithuania, Poland, and Spain were selected as the eight complementary countries for further exploration in RRI-Trends.

The backbone of RRI-Trends is a group of national correspondents, one from each of the 16 countries, who have considerable knowledge of the current RRI discussions combined with expert knowledge about policies and actor landscapes in their respective countries. The correspondents performed research in their own country using a common approach and addressing shared research questions. The empirical research included document analyses and a series of qualitative interviews, and was implemented in three consecutive waves.

The first wave of research in RRI-Trends aimed at providing an initial understanding of the *dimensions* of RRI that materialize in national policies, the *actors* who are involved in the governance of RRI, the techno-*scientific domains* that RRI governance addresses, and the *variety in policy mechanisms* that are applied at the national level. Correspondents selected ten important, recent documents exemplifying national policies on RRI in their respective countries. Documents included, e.g., national research or innovation strategies, laws and their supporting documentation, communications / declarations / resolutions and other means for soft regulation, contracts between state and universities, and white papers. For each document, the correspondents provided an abstract in English. Based on this collection, a brief analysis was developed and presented as the first component of the national reports.

While the first wave established a broad panorama of the national RRI landscape, the consecutive waves zoomed in on particularly important and interesting "spots on the map" in terms of specific organisations. The second wave focused on two themes, namely "responsibility in *funding* research and innovation" and "responsibility in *performing* research and innovation" across both the public and the private sector. Correspondents researched four different types of actors in their respective countries: the most prominent national public research funding agency (e.g. the national research council), an important private research foundation, a selection of ten universities, and two selected research-intensive private companies. Based on desk research and qualitative methods, correspondents explored the saliency of the RRI notion and the extent of international learning in relation to RRI, the implicit understandings of responsibility in the practices and strategies of these actors, the actual mechanisms for obtaining responsibility in research and innovation, the organisational opportunities and incentive structures for achieving RRI, and the barriers or obstacles for its implementation.

Finally, the third wave explored the civil society organisations' uptake of the RRI concept and addressed issues similar to the second wave but within the context of actors who are distinctly independent from the state and also distinctly not traditional profit-driven market actors. Correspondents selected one such 3rd sector organisation (e.g. advocacy groups, foundations, NGOs, not-for-profit think tanks, patient organisations, learned societies etc.) and performed interviews to address RRI aspects relating to the organisation. The table below summarizes the contents of the three waves of RRI-Trends.

In total, RRI-Trends has identified and examined several hundred documents relating, directly or indirectly, to the issue of responsibility in research and innovation at the national level and at the level of specific organisations across 16 countries. More than 200 individual organisations have been covered by the collective research effort. An important ambition has been to make the vast empirical information, which was gathered, accessible to interested users. In order to ensure open access and transparency, the material has been uploaded to a tailor-made platform on the Res-AGorA website. The background documents as well as the national reports provided by correspondents can be selectively accessed by visitors.

Table 8–1: Three waves of RRI-Trends

Wave	Focus	Main questions	Methods
Wave 1 January 2014–April 2014	The broad national policy- and actor-landscape for RRI	▸ Which RRI dimensions are manifest? ▸ Who are the main actors? ▸ In which techno-scientific areas are RRI issues pertinent?	Analysis of ten selected core policy papers
Wave 2 November 2015–February 2015	Research and innovation funding and performing organisations in both the public and private sector	▸ How is RRI, explicitly and implicitly, being addressed? ▸ Which mechanisms are applied to enhance responsibility? ▸ Which are the perceived barriers to RRI?	Document analyses in combination with interviews covering one public funding agency, one private research foundation, ten universities, and two companies in each country
Wave 3 July 2015 – October 2015	Civil society organisations	▸ How is RRI, explicitly and implicitly, being addressed? ▸ Which mechanisms are applied to enhance responsibility? ▸ Which are the perceived barriers to RRI?	Document analyses in combination with interviews covering one CSO in each country

1 See https://rritrends.res-agora.eu.
2 For information about GREAT: http://www.great-project.eu/.

8.3 Key observations across countries

In the two succeeding chapters of this book, the "horizontal" and the "vertical" potential of the database will be exemplified. In Chapter 9, Velsing Nielsen et al. provide an analysis of RRI at European universities, based on cross-reading of the university case studies across the 16 countries. In Chapter 10, Daimer et al. offer a rich introduction to one specific country, Germany, and discuss the specific national policy context for RRI. The analytical work in RRI-Trends is intended to continue along paths similar to those presented in the succeeding chapters, also beyond the life-span of the Res-AGorA project, and hopefully the collected data will also be used by academics, policy makers, and representatives from civil society outside of the Res-AGorA consortium. As a conclusion to this chapter, however, a few general observations emerging from RRI-Trends can be noted.

One main result of the RRI-Trends is that while the notion of "RRI" is emerging in some countries and across several organisational sites, it is not a mainstreamed concept across the European research and innovation actor landscape. In many research funding and performing organisations, public and private, as well as in civil society organisations, the RRI terminology is simply not used.

This does not imply, however, that concerns, practices and governance arrangements relating to responsibility in research and innovation are not salient. On the contrary, we find widespread examples of thorough organisational commitment to responsible research and innovation. Even if these are established under different headings, they are clearly apparent in, for example, Corporate Social Responsibility (CSR), sustainability schemes or diversity management in private companies, or in codes of conduct, research integrity training or gender equality plans at universities. A useful example is the organisational landscape for competitive research funding in the United Kingdom. Here, neither the Engineering and Physical Sciences Research Council nor the Welcome Trust, which are two major funding institutions examined by the UK correspondent, have explicitly adopted the RRI terminology. However, both of these have prominently engaged with issues of responsibility in research and innovation in multiple ways. The UK case studies thus underline that organisations can be actively practicing responsibility in research and innovation without applying the specific terminology.[3]

A second main observation of RRI-Trends is the heterogeneity of governance arrangements for responsible research and innovation across countries and types of actors. Inclusive governance, e.g., features prominently in some countries, while citizen and Civil Society Organisations (CSO) engagement plays less of a role in other countries. Likewise, open access and open data are core responsibility concerns within some organisations but not noticeably important within other settings. There are, in other words, a diversity of bottom-up responses to what it means to be responsible in different research and innovation situations, organisation types, and national political, economic, social, and cultural contexts. In France, e.g., concerns around ethics in research and development of codes of ethics can be traced across different institutions, whereas this dimension of RRI features less intensively in other countries.

The diversity of understanding and practices of responsibility in research and innovation is highlighted by RRI-Trends as well as the rest of the empirical research programme of Res-AGorA. This observation has been acknowledged in the development of the governance framework for RRI, specifically reflected and translated into a principle of subsidiarity as a component of the framework. An RRI agenda is clearly developing in Europe, but there is no single, simple trend or model of it across European countries and institutions.

3 The UK report is available at https://rritrends.res-agora.eu/reports/custom/ (accessed 23 November 2015).



The authors in this chapter

"[...U]niversity strategies often refer to the importance of tackling societal challenges, and also refer to the dimensions of RRI. A few even emphasise different concepts of responsibility, some very close to RRI."

9

RRI at European universities

Morten Velsing Nielsen, Loreta Tauginienė, Adolf Filacek, Saulė Mačiukaitė-Žvinienė, Gema Revuelta

9.1 Introduction

Universities are a central actor in the research and innovation system in all European countries, and therefore also important for the uptake of RRI. In the following, we analyse the extent to which RRI is integrated at universities for the 16 European countries represented in the "RRI-Trends" study. After a short introduction, we give an overview of how RRI is applied across European universities. This is followed by an explanation of the key mechanisms universities apply to enhance specific dimensions of RRI. The chapter finishes by discussing the key incentives for and barriers to the uptake of mechanisms promoting RRI.

9.2 Methodology

The RRI-Trends study covers ten universities in each country under review, although some smaller countries have fewer than ten. The ten universities chosen aimed to cover all the varieties in each country, including variations in size, geography and scientific specialisation. This chapter sums up the study for the 16 European countries in RRI-Trends.[1]

The study of the universities was carried out using a common input structure, which was decided in consultation with the correspondents representing each country. The aim of this preparatory work was to create a common understanding of the questions of analysis, and to make sure that the common structure was still able to integrate the specifics of the respective national research system. Strategic documents were analysed to gauge the general spread of RRI and importance attached to the dimensions. The more detailed analysis of the dimensions and mechanisms to implement them drew on a broad variety of publicly available data, primarily obtained through the websites of universities and national research authorities.

The analysis is limited to publicly available documents, which emphasise what universities communicate about their activities, and is an important measure of how RRI is slowly being taken up by European universities. However, these documents do not cover every single activity at universities, nor do they always give details on how the activities mentioned are being implemented. For some universities, the strategic documents are not updated regularly, making it difficult to obtain an up-to-date assessment of their inclusion of RRI dimensions. In addition, primarily short-term strategic documents were analysed.

1 For the full reports for each country see https://rritrends.res-agora.eu/reports/custom/.

According to Abrahamson (1983), it is generally recommended that comparative analysis uses data covering several points in time.

9.3 RRI across European universities

To understand how RRI is integrated at European universities, we examined university strategies to determine the extent to which RRI, and the dimensions considered part of it, are included. Not a single university explicitly mentions the concept of RRI in their strategy. A few mention responsibility as a core value, while others use terms such as ethical responsibility, social responsibility, global responsibility, corporate social responsibility and the civil responsibility of science. Discussions of responsibility are therefore part of university strategy, but there is no common definition or understanding of this concept. While the language of RRI may not yet be an integrated part of strategic discussions in management at any European universities, RRI dimensions do feature in strategic documents.

At an overarching level, RRI is most visible in values' and mission statements through a focus on tackling societal challenges, common to the strategies at many universities. Universities emphasise their responsibility to contribute to society, locally, nationally and globally. Related to this point, most of them mentioned the need to incorporate public participation and / or communication activities in order to get feedback from different publics and also share with them any new knowledge derived from research. Sustainability is often mentioned in this regard as an important measure of universities' contribution, and some strategies also mention more practically applicable dimensions of RRI in their strategic focus. However, with no common structure for university strategies, the details and dimensions included vary from university to university, and some remain very abstract and intangible.

When examining university documents, beyond the overall strategies, it is evident that the concept of RRI is slowly beginning to be applied at universities across Europe, especially related to EU projects. The country reports show that the concept is used in research groups, individual projects, and at conferences and smaller events. While these examples are widespread, their narrow scope also confirms that RRI has yet to become part of more strategic discussions in the governance of research and innovation. Three country examples describe how the concept of RRI is currently applied at European universities. Greece is an example of the countries where RRI has so far received very limited attention. The only visible signs of the concept being used are in projects funded by the European Commission. Denmark is an example of RRI receiving slightly more attention. Here, aside from EU projects, RRI has also been discussed at two conferences and in relation to a public debate on funding decisions. However, there are no significant university-led initiatives to enhance the knowledge and debate about RRI. The UK is one of the countries where RRI is being actively discussed at university level. While RRI is still not part of strategic documents, universities in the UK are playing an active role in creating research communities focused around the concept of RRI. Table 9–1 summarises the attention paid to the concept of RRI at universities in European countries.

9.4 Mechanisms that aim at enhancing RRI

While the previous section looked at how widespread RRI is across Europe, this section addresses some of the key mechanisms aimed at enhancing RRI at universities. We identified five mechanisms across countries that are commonly used to implement specific dimensions of RRI. While these are present in almost all European countries, the extent to which they are implemented at each university varies greatly. The few universities who are pioneering the work with RRI are characterised by strong implementation of all five types of mechanism.

Table 9–1: RRI at European universities

RRI is fairly unknown
Greece, Hungary, Iceland, Poland
RRI is getting limited attention
Austria, Czech Republic, Denmark, Finland, Germany, Lithuania, Ireland, Italy, Spain
RRI is actively discussed
France, Netherlands, UK

- **Engagement and public dialogue**: A number of mechanisms are used to enhance how researchers and universities develop partnerships and engage with society in general. Some of these mechanisms are solely based on communicating the work of the university, with the aim to increase the uptake of students and external funding. Others promote actual engagement between the university and its surroundings. One example of this is how Science Shops in, e.g. the Netherlands and Ireland, are used in a number of universities to get input from external actors onto research agendas, while also introducing collaboration to the research process.

- **Equality and diversity**: Equality is another dimension where mechanisms are common. These range from legal requirements, over special committees and rewards, to more informal targets and guidelines. It also varies whether these targets relate only to gender equality or to diversity in a broader sense. Austria and Finland are examples of countries where equality is regulated by law, stipulating that all universities must have plans as well as set targets for the promotion of equality.

- **Research ethics**: Mechanisms for research ethics, sometimes referred to as research integrity or code of conduct, are also common. These mechanisms relate to the responsibility of individual researchers and research groups and consist of either rules or guidelines, sometimes supplemented by committees that oversee their application. It is noticeable that these guidelines are either quite generic, or tend to be focused on natural and biomedical science research, often with a special emphasis on human and animal experimentation.

- **Open access**: Open access is also a topic increasingly taken up by universities. While many universities emphasise how important open access is, as demonstrated by the increasing number of signatures to the Berlin Declaration on Open Access[2] and data of the Registry of Open Access Repository Mandates and Policies[3], only a few have actual mechanisms in place to promote it. As a consequence, at many universities, only a very small amount of the research is publicly available without charge.

- **Sustainability**: The final mechanisms concern the universities' responsibility to the surrounding society in terms of its social and environmental impacts. Again, different phrasing is applied by universities ranging from sustainability to responsible conduct, social responsibility and corporate social responsibility. Examples include making a greener campus, integrating sustainability and broad responsibility into education across disciplines, and developing social responsibility towards the local community in which the university is located.

9.5 Incentives and barriers

The very sporadic implementation of RRI dimensions shows that general incentives are often lacking, although general barriers were not found either. This section looks at some of the incentives used to enhance RRI practices, and some of the potential barriers to RRI. While the types of mechanism described above are often mentioned, the incentives and barriers related to enhancing RRI are often limited to only a few countries or universities.

Some countries have laws, common standards or joint targets across all universities promoting mechanisms within specific RRI dimensions. In particular, those concerning gender equality, research integrity and open access tend to be part of such overarching national frameworks. This encourages stronger and more widespread implementation of RRI dimensions. As the implementation of RRI dimensions is limited so far, this seems to be the most efficient strategy to spread RRI across universities. Still, challenges persist when it comes to agreeing on appropriate standards and ways to encourage universities to implement common frameworks. Grant requirements are another external mechanism that can provide incentives for enhancing RRI at universities. Research councils, both public and private, are increasingly including RRI dimensions as part of the proposal requirements. This encourages universities to acquire and develop the knowledge and practices needed to be able to meet the requirements related to RRI. In stark contrast to the promotion of these incentives are countries where the research and development sector as a whole is weak, and where such strategic decisions and collaboration are limited. Examples include Greece, Hungary and Lithuania. In these countries, a lack

2 http://openaccess.mpg.de/319790/Signatories (accessed 12 November 2015).
3 http://roarmap.eprints.org/ (accessed 12 November 2015).

of resources and experience represent a barrier for universities to developing a more active approach to RRI.

Other incentives are focused on motivating individual researchers to pursue RRI. A few countries and individual universities have awards relating to specific dimensions of RRI. In Finland, two universities award work done to promote equality, while Manchester University in the UK has awards for Social Responsibility, and the University of Delft in the Netherlands awards the Mekel Prize for responsible innovation. The possibility of future job opportunities is another incentive highlighted in the country reports. At some universities, positions connected to RRI have been created, for example at Aberystwyth University in the UK, where the position as Director of Ethics has been created. In the Czech Republic, some universities have career requirements that value work carried out in connection to RRI dimensions, and, in addition to this, some Lithuanian universities have requirements that are related to responsible research as an integral part of the annual assessment of researchers. Furthermore, the establishment of academic communities can create networks for people working on RRI issues. At University College London, an RRI Hub has been established to create a space for researchers, policy-makers and representatives from civil society and industry to debate RRI.

At a very general level, the lack of awareness of RRI is a barrier to its implementation. RRI is a concept simply not known to university management at the current time. This means that no university implements RRI dimensions as part of a larger framework of responsibility. The commitment of politicians and university management is important for the implementation of RRI. While RRI dimensions are not officially assigned low priority by any university, there is a tendency for them to focus on areas regulated by law or that impact their economic interests. Universities therefore seem to need some kind of external impetus if they are to integrate RRI dimensions. However, even when national frameworks are in place, including specific dimensions of RRI, the extent to which the frameworks are implemented vary at individual universities. It is therefore essential that frameworks are followed by commitment to implementing RRI at all levels at universities. An example of the importance of economic incentives is a country like Greece, where RRI is not prioritised in the tight funding to universities, and mechanisms related to RRI have therefore been cut at universities. However, because of the need to bring in external funding, several Greek universities are part of EU projects integrating RRI. While economics is seldom mentioned directly as a barrier to enhancing RRI, there are a few cases where economic effects are obvious. One example is the issue of open access. In Hungary, the lack of funding for open access is a clear barrier to advancing this dimension of RRI, while in other countries, e.g. Germany, steps have been taken to provide special funding to ensure that research is increasingly published as open access.

9.6 Conclusion

RRI is still a new concept for European universities and therefore has yet to be adopted as a strategic concept at university level. Nevertheless, university strategies often refer to the importance of tackling societal challenges, and also refer to the dimensions of RRI. A few even emphasise different concepts of responsibility, some very close to RRI. Mechanisms aiming to enhance specific dimensions of RRI are widespread, but the extent to which these are implemented vary greatly from country to country, and from university to university. We highlighted five dimensions that are applied at universities: engagement and public dialogue, equality and diversity, research ethics, open access and sustainability. Finally, we drew attention to the key incentives used to promote further integration of the five dimensions and the barriers to their implementation.



The authors in this chapter

“[…A]lthough recent contributions to the debate can be regarded as bridge-building initiatives, there are still fundamental differences concerning beliefs about the compatibility between excellence-driven research and societal relevance.”

10

RRI in European member states: the case of Germany

Stephanie Daimer, Cheng Fan, Sarah Seus

The term “Responsible Research and Innovation (RRI)” as such is not widespread in Germany. Three years of monitoring “RRI-Trends”[1] show that only very few actors in Germany have taken ownership of this term, originally coined by the European Commission (see Chapter 4), and explicitly used it as is the case in the UK and the Netherlands. However, many aspects of the RRI discussion do exist in Germany. Some are reflected in established values, norms and activities or procedures whose origins date back to 30 years ago, while others are emerging issues triggered by similar considerations and problem perceptions that have already triggered the RRI debate at European level.

In essence, RRI means to strive for research and innovation activities and impacts being aligned with societal values and demands (cf. von Schomberg 2011, Stilgoe et al. 2013: 1570, Walhout et al. 2013). Thus, RRI is an explicitly normative concept. Some proponents specify normative directions such as sustainability and ethical acceptability quasi exogenously, while others explicitly or implicitly assume that normative directions of research and innovation (R&I) are a result of the dialogues and negotiations taking place within research and innovation systems. While there is some agreement that collaboration between research and innovation actors requires a basic consensus about normative directions, in principle, the RRI concept is pluralistic and not meant to exclude innovation paths from the outset. The argument in favour of multiple-solution pathways to a societal problem is based upon the uncertainty associated with the chances, risks and impacts of emerging technologies – and it is this uncertainty which constitutes the collective responsibility of all stakeholders in research and innovation according to the RRI proponents’ point of view.

Although the European-level academic and political debate about RRI is not a reference point for the large majority of actors in Germany, it has served to define our research strategy. The research on RRI-Trends is aimed at understanding how the institutions and actors perceive their roles in the national R&I systems, how they derive and define their responsibilities, and how they translate this responsibility into action. The potential fields of action considered in this study include the dimensions specified in the European Commission’s RRI agenda: public engagement (PE), gender equality (GE), science education (SE), ethics, open access (OA), as well as governance as a meta-category. RRI governance models at national or organisational level are yet to be defined. As a practical

1 http://www.rritrends.res-agora.eu/.

approach to our empirical work, we searched for systematic routines in organisations or R&I processes designed to serve responsibility and normative goals.

This chapter aims to give an overview of the state of affairs regarding RRI in Germany. We summarise the results of our study in the light of substantial aspects (Section 10.1: understanding of RRI) and procedural aspects (Section 10.2: RRI activities), for selected key actors in Germany's R&I landscape in the following sectors: research councils, private funding agencies, research performing organisations (RPO) including higher education institutions (HEI), the business sector and Civil Society Organisations (CSO). We used document analysis and interviews to address these actors and complemented this by systematic reviews of relevant policy documents.

10.1 Understanding of RRI in Germany

We only find rare examples of the explicit use of the term RRI in the R&I policy discourse in Germany as well as in the R&I landscape here. CSOs such as the German civil platform "Forschungswende"[2] that advocate RRI thinking in R&I policy, or the "Wissenschaftsladen Bonn (WILA Bonn)"[3] (Bonn Science Shop), which has more than 30 years practical experience of public engagement in research, refer explicitly to RRI on their websites and in documents, and engage in RRI projects at European level. And the Fraunhofer-Gesellschaft, one of the four major public research organisations in Germany,[4] has recently established a small "RRI" unit to perform participatory R&D processes (Goos and Lindner 2015).

However, the discourse about "responsibility to society" exists in Germany without explicit references to RRI, and has a long tradition. Different actors have their own interpretations and have already made a commitment to it. Some actors are not only reluctant to use the term RRI, but also to share the conceptual ideas behind it. They regard the primacy of normative directions as a critical restriction on the freedom of research. This debate has recently received new impetus from two contributions from the German Research Foundation (Deutsche Forschungsgemeinschaft [DFG], Strohschneider 2015) and the German Council of Science and Humanities (Wissenschaftsrat [WR] 2015), which signal the intention to overcome the perceived antagonism between excellence and societal relevance.

Looking at the national R&I policy, there have been recent signs of a shift towards a*ddressing the Grand Societal Challenges (GSC)*. The German government's High-Tech Strategy (HTS) (BMBF 2014), the latest version of which was launched in 2014, is the most important strategic process in this field. It aims at innovative solutions to "find creative answers to the urgent challenges of our time[5] […]" (BMBF 2014: 3). This kind of challenge-oriented R&I policy began in 2010 and can be viewed as a reaction to the Lund declaration in 2009 (Daimer et al. 2012). It is worth noting that the concept of innovation has been expanded in the latest HTS to include not only technological innovation, but also social innovation. On top of that, *public participation processes* have become more important (BMBF 2014: 4, 6–7).

The major stakeholders, i.e. the German Research Foundation, the German Council of Science and Humanities, the German Rectors' Conference, and the German Academies of Science had not made major contributions to this strategic orientation for a long time,[6] but this changed in 2015.

The DFG, which is the most important German research funding organisation, believes its essential task is to fund and support excellent (basic) research. The DFG reinforces this commitment to basic and quality research by "rejecting other possible criteria such as funding quotas for specific regions or fields, societal relevance or economic expediency".[7] The criterion of "scientific merit" is assigned the highest priority in its funding practice. Although there have been some changes in its funding strategies over the years in response to social and political circumstances,[8] the research governance mode applied by the DFG has remained competition-based, and observers now describe a strongly "orchestrated competition" (Zürn and Schreiterer 2011). However, there are some recent indications that this kind of governance mode is being re-examined. In his 2015 New Year's Address, the President of the DFG explicitly mentioned the tension and balance between *research autonomy* and *research utility* for society. The DFG views the link between science and society as: "Freedom for the intrinsic dynamics of scientific knowledge processes is essential to the ability of research to provide new answers to social questions" (Strohschneider 2015). DFG believes that its "Excellence Initiative" will continue the transformational dynamics that have shaped and enhanced the research system and that a balance between these two poles can be achieved.

The *Council of Science and Humanities*, one of the leading science policy advisory bodies, published its position paper "Grand Societal Challenges as a Topic for Science Policy" in early 2015. From the viewpoint of WR, the GSC are compatible with other objectives of science policy such as basic research and innovation funding. "The importance of other objectives […] will not be reduced by adding the tackling of Grand Societal Challenges as a new goal" (WR 2015: 30).

In comparison, *private funding organisations* such as the Volkswagen Foundation, the Robert Bosch Foundation, or the Stifterverband have always been close to the basic ideas of RRI because their self-conceptualisation builds on strong links between science and society (e.g. Stifterverband 2010). For example, the Volkswagen Foundation not only supports research for its own sake, even though funding focuses very much on basic research and natural sciences, but also considers:

1. which social implications could induce relevant research topics,
2. which mutual influences evolve between society and the sciences and
3. *the responsibility science has towards society.*

In practice, the Foundation has been consistently applying a forward-looking approach to support future-oriented, challenge-oriented and path-breaking research projects.

There is a broad spectrum of interpretations concerning "social responsibility" among different *research performing organisations*. Among the four major public research organisations and several hundreds of higher education institutions, it seems that public assertions about conducting research oriented towards societal challenges are more frequently made by applied research-oriented RPOs (e.g. the Fraunhofer-Gesellschaft, the Universities for Applied Sciences and technical universities) than in universities which have their main focus on basic research. Some RPOs embed their claim to conduct research directed towards societal needs in the broader concept of *sustainable development*.[9] In fact, there have been essential changes made to the framework conditions of German universities since the end of the 1990s which have assigned more weight to societal aspects in their strategic actions. The Framework Act for Higher Education defined "knowledge and technology transfer" as a third task for universities in 1999. In addition, national policies aiming to trigger either scientific excellence or technology transfer, cooperation with business, and integration into local innovation environments together with an increasing autonomy of universities have influenced their targets and behaviour. Today, there is a growing focus on the economic, regional and societal contributions of HEIs (Schubert and Kroll 2014, Kroll et al. 2015).

Corporate Social Responsibility (CSR) is a mainstream trend, and sustainability reporting, which has its roots in the environmental reporting made since the 1980s, is standard for German *DAX companies* (Blanke et al. 2007). In parallel, an increasing number of *SMEs* publishes annual sustainability reports and engages in CSR as well. CSR can

2 http://www.forschungswende.de/.
3 http://www.wilabonn.de/en/.
4 Max Planck Society, Helmholtz Association of German Research Centres, Fraunhofer-Gesellschaft, Leibniz Association.
5 Examples mentioned in the document are "sustainable urban development, environmentally-friendly energy, individualised medicine and the digital society".
6 The German Rectors' Conference has contributed to the role of HEIs (higher education institutions) in sustainable development with a focus on education (HRK-DUK 2009). Several academies of science have published position papers in the context of technology acceptance and science communication and highlighted the role of dialogue with society (Acatech 2011 and 2013, Leopoldina et al. 2014).
7 The DFG's Funding Strategy. From DFG website: http://www.dfg.de/en/dfg_profile/history/funding_past_and_present/actually_strategy/index.html (accessed 02 March 2015).
8 DFG has modified its funding strategies from the "response mode", i.e. reacting to research proposals on any topic, to actively promoting national and international research infrastructure (e.g. networking), as well as discipline-specific funding initiatives under the principle of "competition". With the adoption of the "Excellence Initiative" in 2005, the DFG has become a system-defining institution and has a growing influence on developments at German universities.
9 For example, the University of Luneburg and the Fraunhofer-Gesellschaft publish an annual sustainability report which features many elements related to RRI.

encompass RRI, and sustainability reports document the commitment of firms to applying the highest ethical standards when developing new products which shall serve the "current and future needs of society" e.g. "resources, environment and climate, food and nutrition, and quality of life" (BASF 2015: 22), or "digital transformation, globalization, urbanization, demographic change and climate change" (Siemens 2015: 215). Companies are positive about societal challenges, because they view them as chances that can provide future business opportunities. However, at the same time, environmental product regulations and sustainability documentation obligations represent limitations to entrepreneurial freedom, which increases the risk of "greenwashing", as the recent scandals in the automotive industry have reminded us.

Science shops are highly relevant CSOs *supporting RRI*. Like many other science shops, WILA Bonn was founded long before the emergence of today's RRI discussion back in the 1980s, a period characterised by social movements. WILA Bonn defines its "social responsibility" as contributing to social benefits by means of mediation, communication and networking between research, society and policy. Above all, WILA believes that basic research topics can also be derived from societal needs. The Science Shop is concerned with examining where the two systems complement each other, i.e. freedom of research on the one hand, and research with citizen participation on the other. According to WILA, the element of "*public engagement*" should be further advanced as an important instrument to realise RRI.

10.2 RRI activities in Germany

As the term RRI has not (yet) been enforced in Germany, explicit RRI activities are scarce as well. However, there are many activities which are *de facto* RRI activities in the sense of the above discussed understanding of RRI. Many have a long tradition in Germany and serve to secure the quality of research such as (institutionalised) technology assessment, ethics commissions, codes of conduct and (legal) measures to support gender equality (GE). Others such as foresight processes or advisory boards serve to improve the capacities to anticipate social and political change. Many recent activities have been introduced to address the GSC like specific funding or collaboration programmes.

In RRI-Trends, we looked at the activities of a few key actors in Germany in order to give an illustrative account of the current situation.[10] If the RRI activity fields proposed by the European Commission are used as a structuring device, we find a well developed set of activities in Germany with the exception of public engagement (PE). GE and ethical standards are firmly established in standards, codes of conduct and procedures (e.g. ethics commissions' reviews). However, in GE the focus is on promoting female participation and female leadership in R&I organisations. The issue of "gendered innovation", i.e. integrating gender sensitivity in the content of R&I, is rarely emphasised in the strategic documents of organisations. Open Access as a relatively new topic is supported by many actors who signed the "Berlin declaration", as well as some concrete programmes. Science education, in particular, the aspect of the transfer of knowledge to non-academics is being followed up by various activities of a broad set of actors. It is remarkable that PE is still a relatively "new" issue for most of the investigated actors. And most of the current activities do not make use of the full potential of PE. When applied in a systematic manner, PE can help to increase mutual understanding between academics and non-academics and integrate non-academic knowledge into research and development processes. The Science Shop's activities stand out in this regard among the activities investigated in Germany.

At the same time this approach clearly demonstrates that many activities identified in the course of the RRI monitoring cannot be captured by the five dimensions specified by the European Commission. Instead, they fit into the meta-category of governance, introduced in this chapter as "systematic routines in organisations or R&I processes designed to serve responsibility and normative goals". We found the national innovation strategy and its implementation projects, or the challenge-oriented funding programmes of the Volkswagen Foundation reflect important elements of what could develop into RRI governance in the future. Likewise, many strategic processes in universities triggered by the need to perform their "third role", or by the excellence initiative, are important preconditions to raising awareness for RRI within the organisations. The Fraunhofer RRI unit or CSR instruments in companies are examples of starting points for RRI governance within organisations.

10 The reports including the range of activities can be found on the RRI-Trends website at http://www.rritrends.res-agora.eu/reports/.

10.3 Conclusion

Although the term RRI is rarely used in current R&I policy debates and activities in Germany, we find that many aspects of the *RRI concept* are indeed present. Most of them have not been triggered by RRI as such, but rather by the (long-standing) discourse on the quality of research, the 30-year old environmental and social movements in Germany, or the debate about Grand Societal Challenges. The national innovation strategy is mission-oriented, and major stakeholders have started to contribute to discourses about the responsibility and societal relevance of research. Moreover, there are grassroots initiatives, for example by CSOs. At the *level of activities*, we find many that account for individual aspects of RRI like gender equality, ethics and science education. Beyond that, there are other types of activities, e.g. strategy-building and organisational routines that seem to be highly relevant for realising RRI. As they are structured and systematic approaches, they appear to be forerunners of a future RRI governance.

Given that all the German stakeholders investigated in the RRI-Trends have RRI-related discourses and activities, there is good reason to believe that the essential ideas of RRI will become more important and there will be growth in the relevant activities in the future. At the same time, we find that the majority of these discourses and activities are uncoordinated. Up to now, R&I stakeholders have not launched any major initiatives to coordinate their understanding of responsibility in R&I, or their activities. And although recent contributions to the debate can be regarded as bridge-building initiatives, there are still fundamental differences concerning beliefs about the compatibility between excellence-driven research and societal relevance. This heterogeneity and the large size of the German R&I system indicate that developments in RRI will continue to take place in a decentralised way.

PART 4

GOVERNING TOWARDS RESPONSIBILISATION

GOVERNING TOWARDS RESPONSIBILISATION

Kuhlmann
et al.
2015
Page 2

“The nature and direction of RRI is shaped by varieties of governance instruments and arrangements, and the design and operation of all instruments […] are in fact not a given, but actively constructed through processes of problem framing […], coordination and negotiation.”

11

Responsibility Navigator©

Stefan Kuhlmann, Jakob Edler, Gonzalo Ordóñez-Matamoros, Sally Randles, Bart Walhout, Clair Gough, Ralf Lindner

11.1 Responsibility Navigator[1] – Why, what, how?

Research and innovation activities need to become more responsive to societal challenges and concerns. The *Responsibility Navigator*, developed in the Res-AGorA project, supports decision-makers to govern such activities towards more conscious responsibility. What is considered “responsible” will always be defined differently by different actor groups in research, innovation, and society – the *Responsibility Navigator* is designed to facilitate related debate, negotiation and learning in a constructive and productive way. The *Responsibility Navigator* supports the identification, development and implementation of measures and procedures that can transform research and innovation in such a way that responsibility becomes an institutionalised ambition.

1 The Responsibility Navigator is also available as a stand-alone document at http://responsibility-navigator.eu/wp-content/uploads/2016/01/Res-AGorA_Responsibility_Navigator.pdf

Preamble

Research and innovation (R&I) activities and outputs are subject to increasing public and political scrutiny. In response, R&I organisations and actors are making efforts, or are being asked to make efforts to shape their activities and performance in ways that are socially desirable and ethically acceptable. Major actors such as the European Commission have characterised this ambition as "Responsible Research and Innovation (RRI)". The demand for responsible action in R&I has evolved since the 19th century. Originally, the main aim was to prevent fault and to minimize risk. More recently, requests for responsibility have also included precaution and responsive attitudes of researchers and innovators. In 2015, the European Commission stated that:

"Responsible research and innovation is an approach that anticipates and assesses potential implications and societal expectations with regard to research and innovation, with the aim to foster the design of inclusive and sustainable research and innovation."

Negotiations and re-definitions of responsibility in R&I will continue in the future and further evolve. The *Responsibility Navigator* is designed to facilitate the related debate, negotiation and learning in a constructive and productive way.

What is desirable and acceptable is in fact highly subjective. At the same time, stakeholders expect researchers and innovators to perform in ways (and / or obtain results) that are based on commonly agreed definitions and criteria of what responsible research and innovation is, and what it is not. We propose to achieve this by following a set of principles and requirements, in other words, by applying an orientating framework to enable "navigation" towards learning and institutional transformation. We call this the Res-AGorA *Responsibility Navigator*, and expect that, by adopting and adapting it, R&I performed in Europe will become more effectively aligned with societal needs and concerns.

The Res-AGorA *Responsibility Navigator* is directed at several target groups who may play one or several of the following roles:

- **A** those who lead R&I organisations and procedures towards more responsiveness and accountability,
- **B** those setting priorities, defining policies, and developing evaluation and assessment tools, and
- **C** those who mediate between different levels of the innovation system by bringing together different actors and different interests as well as defining the practical implementation of governance instruments.

These "change agents" are motivated and able to work as "institutional entrepreneurs", seeking to lead the R&I performed in Europe in the direction of more responsiveness. They typically work at research funding organisations, are on the boards of universities or companies, or in professional organisations.

The *Responsibility Navigator* offers all of those actors support and guidance for reflecting on and intervening in decision making and negotiation processes to fund and orientate R&I activities, whereby these processes can be located within or between organisations. The Navigator supports all those actors in organisations who seek to take and influence those decisions in a broadly informed and reflexive manner, taking into account the views and preferences of actors affected by their decision and with a view towards the societal desirability and acceptability. Thus, it shall facilitate exchange about the nature of responsibility in any given situation, and for the implementation of appropriate instruments and governance arrangements.

Moreover, building on the collective nature of responsibility-oriented governance and the challenges therein, the *Responsibility Navigator* will also inspire institutional actors such as intergovernmental organisations, research performers, expert bodies and advocacy groups, particularly those operating at the analytical, strategic or procedural levels, and responsible for guidance, programming or performance of activities related to R&I.

The framework can be used by actors facing dilemmas and complex situations impeding the governance of responsible research and innovation, and by actors wanting to reflect strategically on their own position as well as that of others in navigating R&I towards higher levels of responsible action. Since these actors have different roles and different needs, they will have to make choices about whether and how to tailor the Res-AGorA *Responsibility Navigator* to specific contexts.

The *Responsibility Navigator* is a result of the collective work of the Res-AGorA project team (2013–2016). The project built on existing ideas and models associated with R&I governance in different contexts. It analysed existing *de facto* responsibility-related governance arrangements, including activities such as Corporate Social Responsibility (CSR) schemes, societal mission-oriented research funding practices, citizen science initiatives, ethical reviews and safety regulations, technology assessments, etc., and conducted a range of structured conversations and workshops with relevant stakeholders.

The *Responsibility Navigator* is conceived as a "thinking tool", not only intended to make individuals, organisations and institutional systems more responsive towards societal needs and preferences, but also to make existing and new governance instruments and arrangements robust, and to allow, encourage and process contestation, learning, and experimentation. Ultimately, this will facilitate institutional transformation at a systemic level, allowing RRI to emerge in a constructive, bottom-up process. The key to the *Responsibility Navigator* lies in the reflexive, self-organised and collective nature of responsible research and innovation, where governance dynamics are shaped by specific instruments and arrangements, and where the design and operation of all instruments (even the formulation and operation of hard law) are not a given, but are actively constructed through processes of problem framing (appraisal), coordination and negotiation. In this context, what is judged responsible is part of these interactions, where the responsibility-related governance takes place in sense- and decision-making processes in a collective way.

However, it is important to keep in mind that, if the proposed framework is to make a difference, the resulting actor strategies must aim for effectively transforming present day practices of R&I towards "responsibilisation", i.e. a process by which the involved actors internalise the issues of concern, enabled by appropriate organisational conditions and governance mechanisms. Given that there will always be multiple responsibility-related goals (from safety and sustainability to inclusiveness and responsiveness), as well as different instruments to promote them (from professional training and education, design principles, stakeholder and public dialogue to regulation by voluntary codes as well as hard law), the *Responsibility Navigator* aims to facilitate strategic reflection and continuous formative evaluations, to understand how instruments interact and play out at different levels and contexts, and to what extent goals are ultimately achieved.

We claim that these processes involve effective transformation towards a set of articulated normative goals embedding values into practices and processes, and orienting action towards those goals. We call this the "deep institutionalisation" of responsible research and innovation, which, in practice, represents a process of cultural change.

11.2 Ten governance principles and requirements for responsibilisation

The following is a brief description of the Res-AGorA *principles* and requirements for responsibility-related governance. It includes a set of *questions* which those interested in "navigating" towards responsibilisation in Europe and beyond would have to ask themselves in order to arrive at practices and directions that are widely accepted. The ten principles are organised into the three dimensions of (1) Ensuring Quality of Interaction, (2) Positioning and Orchestration, and (3) Developing Supportive Environments. Principles 1–9 are *illustrated by short fictive cases*.

Responsibility Navigator Overview

Ten governance principles and requirements for responsibilisation

Ensuring quality of interaction

1 **Inclusion**

2 **Moderation**

3 **Deliberation**

Positioning and orchestration

4 **Modularity and flexibility**

5 **Subsidiarity**

6 **Adaptability**

Developing supportive environments

7 **Capabilities**

8 **Capacities**

9 **Institutional entrepreneurship**

10 **Culture of transparency, tolerance and rule of law**

Examples in this publication

Example 1, p. 140
Research council
European country, synthetic biology

Example 2, p. 142
Government
European country, research funding

Example 3, p. 144
Research consortium
Co-construction method

Example 4, p. 146
Semi-public lab, nano-toxicology
Professional code-of-conduct

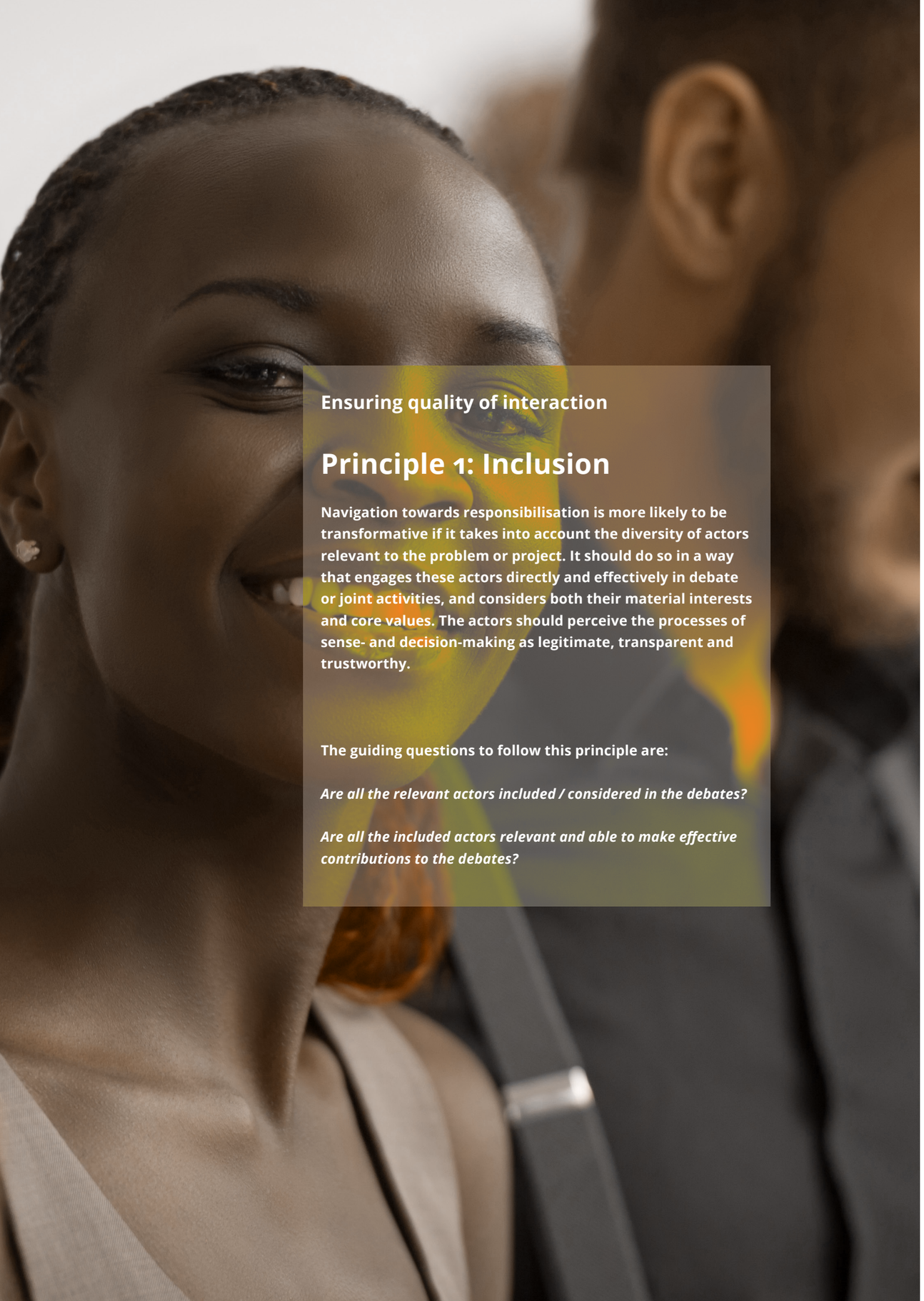
Example 5, p. 148
Supra-national European organisation
Standardising and up-scaling responsibility

Example 6, p. 150
Medium-sized firm, personalised health
Institutionalising ethical business practice

Example 7, p. 152
Research funding organisation
RRI-conscious researchers

Example 8, p. 154
Civic society organisation
Institutional change and capacity-building

Example 9, p. 156
Large US-American university
Organisational transformation



Ensuring quality of interaction

Principle 1: Inclusion

Navigation towards responsibilisation is more likely to be transformative if it takes into account the diversity of actors relevant to the problem or project. It should do so in a way that engages these actors directly and effectively in debate or joint activities, and considers both their material interests and core values. The actors should perceive the processes of sense- and decision-making as legitimate, transparent and trustworthy.

The guiding questions to follow this principle are:

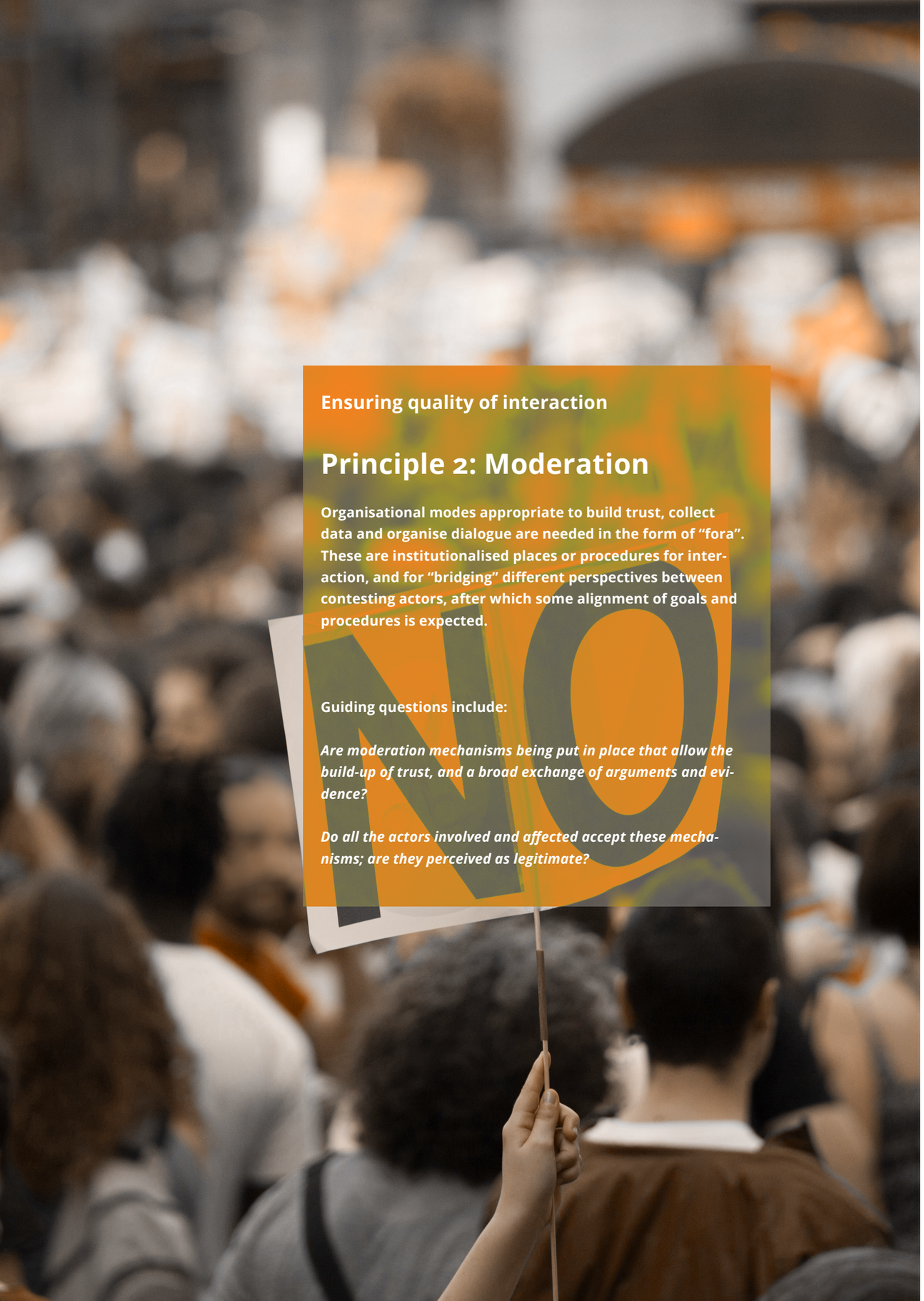
Are all the relevant actors included / considered in the debates?

Are all the included actors relevant and able to make effective contributions to the debates?

Developing a roadmap for an emerging technology based on a broadly accepted process

Example 1

The research councils of a medium-sized European country are exploring the future potential of an emerging technology, synthetic biology (synbio). The pressure from a number of government departments (a coalition of economics, business and technology / innovation) is to focus funding on advancing technological development as an expected route to accelerating economic and technological growth, but their proposed process is a hurried one and does not allow time to organise a dialogue involving broader participation of societal actors and stakeholders. However, the research councils responsible for biology and chemistry, supported by funding available from the supra-national governmental body, organise a national discourse on the future of synthetic biology and its contribution to a range of societal objectives across health, well-being, environment, sustainability, and economic growth. Inclusion is managed by a combination of online consultations (*principle 1: broad openness, bottom-up*) and physical meetings (*principle 1: targeted inclusion, sufficient level of representation*). They ensure that the invitation list for the physical meetings is coordinated with the ministry of science and education, the ministry for economics and the research council responsible for social sciences to include a broad variety of stakeholders (*principle 1: heterogeneity of actors to be included, broad ownership of debate*). Invitees include firms and research organisations seeking early commercialisation, actors and organisations that have been openly sceptical about an accelerated development of applied synbio research, as well as observers from social science (including philosophy and ethics). Care is taken to ensure that diversity of opinion is represented from the outset, including how the topic is framed (*principle 1: initial openness of the framing of an issue*). The roadmap is drafted in an iterative and dynamic process by a group of authors reflecting diverse perspectives. Minority views are clearly expressed in the final roadmap and its operationalisation provides for resources to enable on-going adaptive and inclusive dialogue and action including the full range of stakeholders (*principle 1: demonstrating inclusion, accepting dissent*).



Ensuring quality of interaction

Principle 2: Moderation

Organisational modes appropriate to build trust, collect data and organise dialogue are needed in the form of "fora". These are institutionalised places or procedures for interaction, and for "bridging" different perspectives between contesting actors, after which some alignment of goals and procedures is expected.

Guiding questions include:

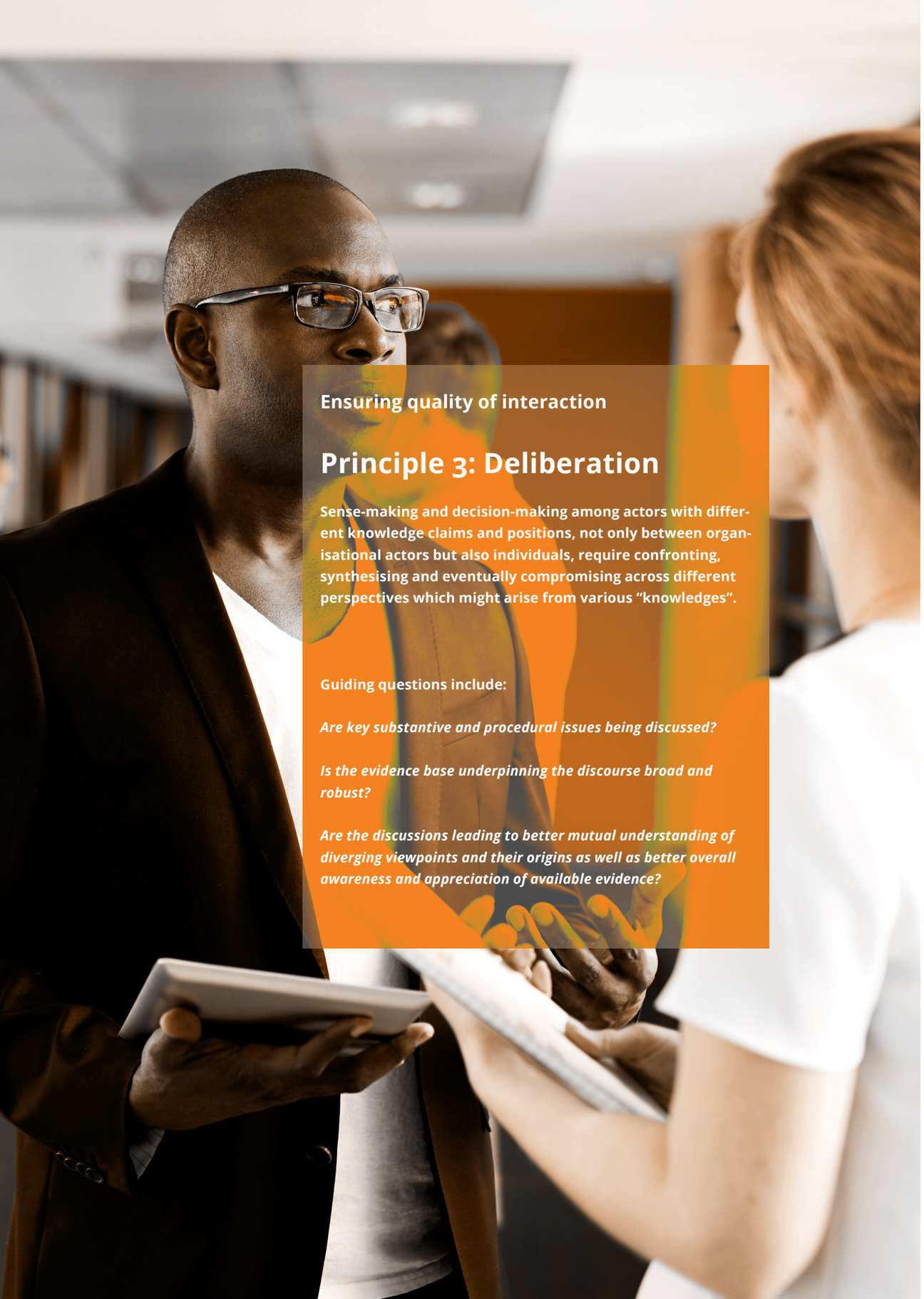
Are moderation mechanisms being put in place that allow the build-up of trust, and a broad exchange of arguments and evidence?

Do all the actors involved and affected accept these mechanisms; are they perceived as legitimate?

Moderated discourse to rebalance national research funding profiles

Example 2

As a matter of high political priority, the government of a small European country is reconsidering the balance of research funding between calls for research activities directed through thematic programmes / grand challenges, and those without thematic prioritisation. The Science and Technology Advisory Council (STAC) is tasked with implementing a forward-looking process to realise this. STAC is composed of representatives of all major political parties, employers' and employees' organisations, civil society organisations and consumer groups, and scientists representing different disciplines (including social scientists), aiming for a balanced representation of organisation type, level of seniority, and gender (*principle 2: initial moderation through neutral actors without operational budgets and a representation of major vested interest*). A Task Force (TF) is established, representing a wide diversity of societal groups and perspectives, giving each member time to design and implement a systematic and open process of evidence gathering (background reports, international hearings etc.). The TF appoints an independent figure to draft a report which outlines different models of, and the pros and cons for, thematic prioritising in research funding based on evidence from a number of comparable innovation systems. The process separates the decision about the share of thematic prioritising in research funding from the choice of themes (*principle 2: building trust in the process as the basic decision is taken without focusing on specific areas, providing robust data*). In response to the report, STAC asks for Parliament (through two committee meetings with open inclusive hearings) for an online consultation, the results of which are detailed in an Annex to the TF report (*principle 2: moderation iterates between advisory context and political context, combining different sources of legitimacy*). On STAC's recommendation, core funding is reduced and funding in competitive and thematically-defined areas is increased, followed up by a well-received, challenge-oriented foresight process to support a further transparent dialogue to frame, define, and prioritise the definition of "challenge" areas, based on a similar model of neutral moderation.



Ensuring quality of interaction

Principle 3: Deliberation

Sense-making and decision-making among actors with different knowledge claims and positions, not only between organisational actors but also individuals, require confronting, synthesising and eventually compromising across different perspectives which might arise from various "knowledges".

Guiding questions include:

Are key substantive and procedural issues being discussed?

Is the evidence base underpinning the discourse broad and robust?

Are the discussions leading to better mutual understanding of diverging viewpoints and their origins as well as better overall awareness and appreciation of available evidence?

Organising a co-constructive deliberation process on responsible innovation

Example 3

A team from nine universities and research institutes wins a competitive European research grant to develop a framework for fostering RRI. A co-construction deliberative methodology is adopted, involving representatives of relevant organisations (academics, research funding councils, research performing organisations, small businesses and multi-national corporations, utilities, local and national governments, Civil Society Organisations (CSO), and known individuals with a commitment to and expertise in Science and Society dialogues) (*principle 2: sense-making and decision-making among actors with different knowledge claims and positions*). Five two-day stakeholder workshops are held in different European cities with approximately 80 participants in total. The workshops are themed to test the prototype framework in different contexts. The first two focus on technology controversies – energy, climate change and shale gas fracking; and the genetic modification of food. The third and fourth look at problems of responsibility in R&I from the perspective of research-funding and -providing organisations, respectively; the final workshop of participants with a spread of backgrounds and functions focuses on strategic actors. The workshops use techniques to maximise opportunities for participants to actively engage in the process (*principle 3: opening up for mutual understanding*); although team members are present at the workshops, they influence the deliberation as little as possible, with the primary aim of listening in order to understand the real-life working contexts of participants and their perceptions of the prototype framework. The deliberation process is supported by a fully transparent empirical knowledge base, generated by the research team over two years. The process of co-constructive deliberation is realised through a comprehensive multi-disciplinary and multiple-stakeholder process of critical reflection. The result is a stabilised framework of ten key governance principles, communicated in a style sensitised to practitioner audiences (*principle 3: discussions lead to some level of consensus*). The principles are supported by fictive case vignettes based on the team's empirical research. The final framework becomes a tool to support self-reflection and the strategic action of practitioners – user-friendly and integrating participants' recommendations.



Positioning and orchestration

Principle 4: Modularity and flexibility

Legitimate and effective governance is founded on a careful combination of "hard" and "soft" regulatory mechanisms. It allows for self-regulation and organisation, as well as external control and accountability structures (e.g. supervision), where the flexibility of governance arrangements should not lead to arbitrariness.

Guiding questions include:

What is the existing mix of governance tools that influences the debate and decisions concerning the issue at stake?

Do affected stakeholders regard this mix as appropriate?

How difficult are they to implement and what could be done to support implementation?

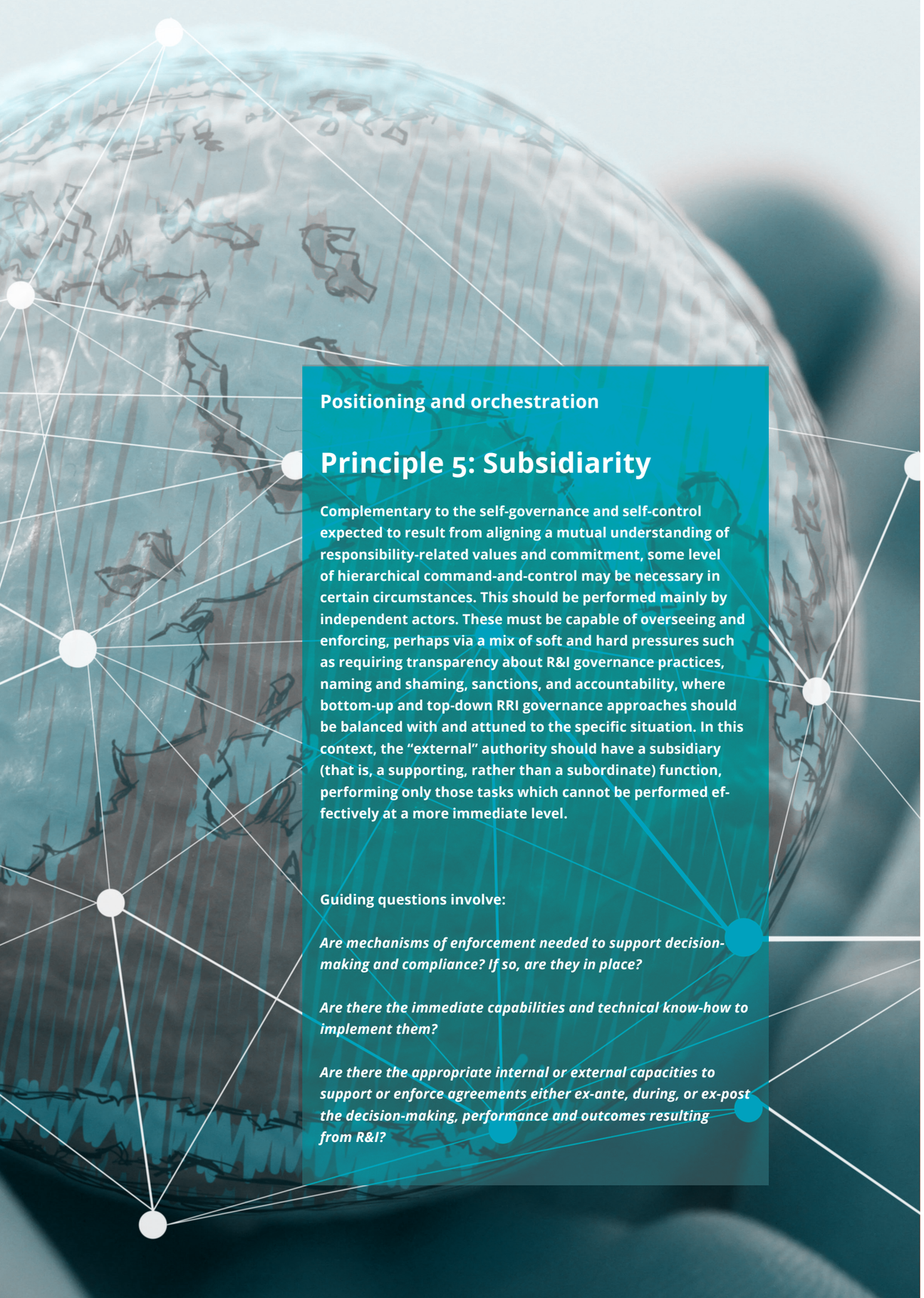
Are there enough financial resources, managerial capacity and appropriate organisational conditions in place to support their implementation jointly or independently?

Are they easily understood by the stakeholders involved?

A flexible code of conduct for responsibility across institutions and research practices

Example 4

A large semi-public lab in the field of nano-toxicology is committed to the highest ethical standards and the accommodation of societal concerns and needs, with recruitment procedures and training aimed at establishing and promoting a diverse workforce. The institute has established a number of internal principles and processes to achieve this mission, which are reviewed periodically (*principle 4: modularity*). One core instrument is a professional code of conduct for engineers and scientists in the field of nanosciences and technologies, which takes account of national differences in professional traditions (*principle 4: flexibility*). Its contents are integrated into the institute's internal guidelines and employment contracts, and promoted throughout the organisation from recruitment up to all major activities (*principle 4: communication, mechanisms to be easy to understand*). Further, the institute conducts periodic internal and external seminars and meetings to deliberate and anticipate the ethical, health, natural environment, regulatory and socio-economic implications of the laboratory's research lines and how their research relates to societal challenges. In addition to these soft instruments, there is a formal sign-off process for all research activities (including, but not limited to, external research proposals), which again links to the code and the internal guidelines (*principle 4: combining "hard" and "soft" regulatory mechanisms*). Working with the code gives staff a "responsibility literacy" and creates awareness internally (see also *principle 7: capabilities*); it also positions the institute as a credible actor within the broader professional and societal discourse on responsibility, able to influence debates both specifically and generally towards a more systemic adoption of and commitment to responsibility by organisations (see also *principle 5: subsidiarity, influencing and taking advantage of higher levels of governance*).



Positioning and orchestration

Principle 5: Subsidiarity

Complementary to the self-governance and self-control expected to result from aligning a mutual understanding of responsibility-related values and commitment, some level of hierarchical command-and-control may be necessary in certain circumstances. This should be performed mainly by independent actors. These must be capable of overseeing and enforcing, perhaps via a mix of soft and hard pressures such as requiring transparency about R&I governance practices, naming and shaming, sanctions, and accountability, where bottom-up and top-down RRI governance approaches should be balanced with and attuned to the specific situation. In this context, the "external" authority should have a subsidiary (that is, a supporting, rather than a subordinate) function, performing only those tasks which cannot be performed effectively at a more immediate level.

Guiding questions involve:

Are mechanisms of enforcement needed to support decision-making and compliance? If so, are they in place?

Are there the immediate capabilities and technical know-how to implement them?

Are there the appropriate internal or external capacities to support or enforce agreements either ex-ante, during, or ex-post the decision-making, performance and outcomes resulting from R&I?

A dialogue between European supra-national and global governance organisations on RRI

Example 5

A supra-national European organisation has spent years developing an understanding of RRI and mainstreaming it within its own science and innovation programmes. It approaches a global governance body, initiating a conversation on how to standardise and up-scale this concept to the global level, upholding three core tenets of RRI: participative governance, orientation to societal challenges, and futures-oriented anticipation of technological development and the global political economy. This is welcomed, but in order to canvass a wider range of perspectives, the global organisation initiates a consultation, seeking evidence from other countries around the world, supra-national regional governance bodies, multi-national companies, and Civil Society Organisations (CSO) with cross-border and North-South remits. Evidence shows that RRI, as interpreted by the European supra-national body, has in fact originated from quite a concentrated cluster of nations and from its own "science in society" legacy programmes. The leadership of these nations is acknowledged but, beyond this limited cluster, other countries have a much lower awareness and still less experience of implementing RRI. These other countries vary considerably in economic, political, social and cultural terms, putting them at a disadvantage should the supra-national body seek to impose a common understanding of RRI. Multi-nationals and global CSOs give a mixed response. The standardisation of concepts is welcomed by some, but is resisted by others as a new form of imposition by strong nations. Rather than simply up-scaling a particular interpretation of RRI, the global organisation proposes a 3-year initiative in which countries and regions from across the globe (supra- and sub-national) exchange perspectives and knowledge of what it means to undertake research and innovation in a responsible way (*principle 3: balancing bottom-up and top-down RRI governance approaches*). This knowledge will be shared through the intermediation of the global body, enabling nations and CSOs and business fora to learn from, adapt and translate the concept within their own contexts (*principle 3: self-governance and self-control overseen by independent actors*), whilst still acknowledging the three core tenets of RRI.



Positioning and orchestration

Principle 6: Adaptability

Governance towards responsibilisation should be able to reflect different historical developments of R&I systems and changing conditions. Therefore, such calibration requires an assessment of whether governance arrangements still effectively and legitimately serve responsibility goals. This must consider that the goals, costs and consequences of governance instruments and arrangements may also change over time.

Guiding questions include:

Is the current understanding of the governance challenges still valid despite changes in the context and conditions?

If the supporting assumptions and mechanisms fail, can we replace them without major problems and how?

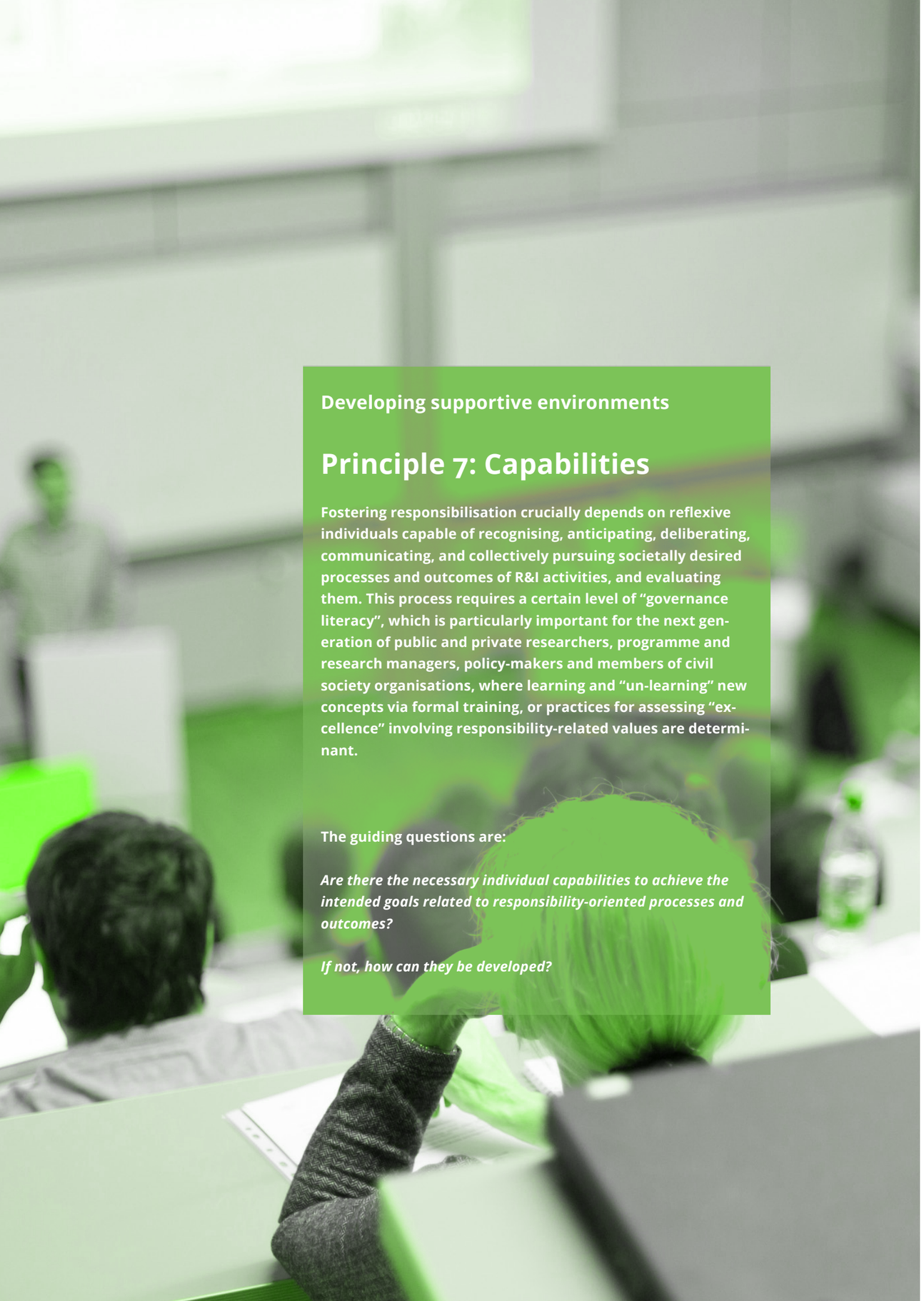
What (positive and negative) non-intended effects may result from their implementation?

How could they affect the current distribution of burdens and benefits among the stakeholders involved?

Institutionalising ethical business practice in a highly contested technological area

Example 6

A medium-sized firm leads research on the digital genome and its application to medical innovation. With the advent of rapid sequencing and digital synthesis of DNA / genomes, it capitalises on the many commercial opportunities in the fast growing area of personalised health. Fully aware of the threats posed by the "transparent individual", including pressure from employers and insurers to disclose personal health information, the firm uses various responsible governance mechanisms. Its own ethics committee meets quarterly to advise researchers, product and marketing managers on the ethical and societal implications of new products and processes. The ethics committee comprises different research and business representatives within the organisation (senior / junior individuals), external stakeholders, and experts, including social scientists (*principle 1: targeted inclusion, sufficient level of representation*). Recommendations by the committee require a formal response by the responsible researcher, product manager and the firm's leadership before implementation. A "roving" social scientist is embedded in the company to advise on socio-technical integration, building reflexive capabilities to question the status quo, facilitating bottom-up participation, guided by top-down protocols. This approach supports the development and adaptive translation of RRI principles into practice across the business. In addition, an external advisory board representing divergent views meets every two years to reflect on the field's development, its application context and the broader societal and political trends as novel business models associated with the digital genome emerge (*principle 6: adaptability, in-built mechanisms to reflect on the appropriateness of the existing internal governance mechanism*). The board reviews the work of the ethics committee, its guiding mission, principles, operationalisation, and proposes new or revised working practices, and how the organisation can institutionalise responsibility to increase employees' awareness of societal concerns (*principle 7: capability building; principle 8: capacity*). The firm's CEO participates, and encourages employees to shape the broader societal multi-actor discourse on genomics and personalised health. The firm receives an award for its effective implementation and leadership in RRI; its share price, turnover and profits continue to grow.



Developing supportive environments

Principle 7: Capabilities

Fostering responsibilisation crucially depends on reflexive individuals capable of recognising, anticipating, deliberating, communicating, and collectively pursuing societally desired processes and outcomes of R&I activities, and evaluating them. This process requires a certain level of "governance literacy", which is particularly important for the next generation of public and private researchers, programme and research managers, policy-makers and members of civil society organisations, where learning and "un-learning" new concepts via formal training, or practices for assessing "excellence" involving responsibility-related values are determinant.

The guiding questions are:

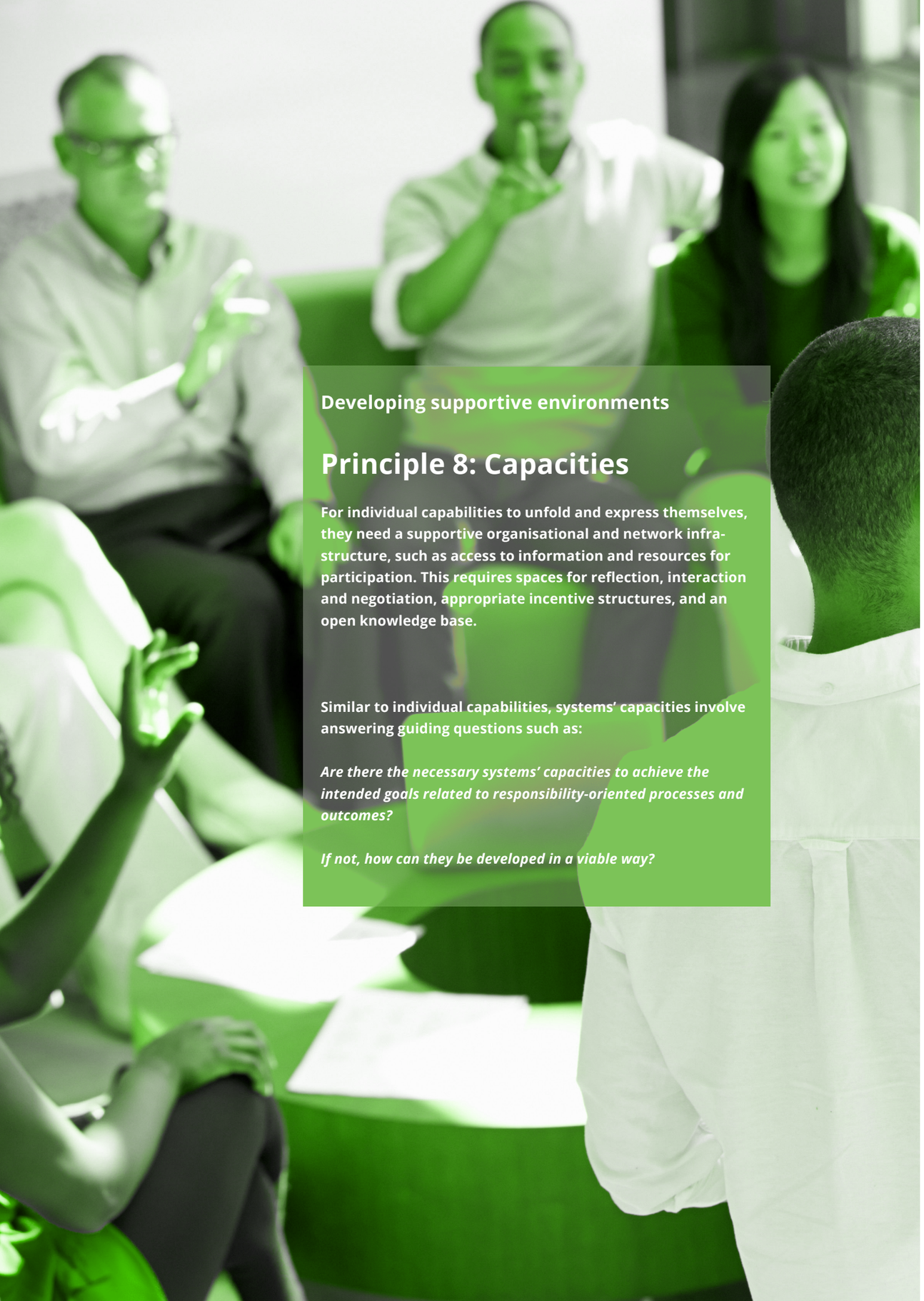
Are there the necessary individual capabilities to achieve the intended goals related to responsibility-oriented processes and outcomes?

If not, how can they be developed?

Conditions and processes to create a new generation of RRI-conscious researchers

Example 7

A research funding organisation seeks to enable greater reflexivity and anticipatory awareness of issues of societal concern in the community it funds. It has long adopted a formal framework that guides its programme design as well as its funding application and approval processes. Relying on formal principles in project proposals has resulted in RRI becoming yet another tick box exercise. The organisation thus starts to focus on building the capabilities and awareness of its researchers, starting with the young generation of researchers and their employing organisations. Now, all funding applications have to show how they propose to accommodate specific challenges such as risks, ethical concerns, and further societal challenges (by incorporating participation / engagement, for example). All proposals are required to allocate part of the budget and research time to issues of interaction and awareness-building beyond traditional "impact" considerations. In addition, to be eligible, proposals must demonstrate how the supporting organisation will enable researchers to identify, plan and implement an action plan to deliver an RRI portfolio (see *principle 8: capacity* and *principle 5: modularity, soft and hard instruments*). Importantly, the funding organisation also conducts a series of three-day workshops for the young leaders of funded projects across the country. Principal Investigators (PI), responsible for line managing the early career researcher, are expected to participate in such a workshop early in the project. This not only involves teaching general principles and guidelines, but also a collective critical reflection of responsibility challenges and ways to deal with them. Each PI is required to draft a responsibility report two months after the workshop, signed off by their own line manager, committing the host organisation to supporting the early career researchers, recognising the additional work and resources necessary to implement personalised RRI plans. The early career researchers receive progressive certificates of competency in RRI, and build credits towards a new vocational qualification in Responsible Innovation, which is becoming increasingly recognised by employers. As a result, the system builds a more reflexively aware, questioning, and therefore benchmark-effective, RRI-literate workforce.



Developing supportive environments

Principle 8: Capacities

For individual capabilities to unfold and express themselves, they need a supportive organisational and network infra-structure, such as access to information and resources for participation. This requires spaces for reflection, interaction and negotiation, appropriate incentive structures, and an open knowledge base.

Similar to individual capabilities, systems' capacities involve answering guiding questions such as:

Are there the necessary systems' capacities to achieve the intended goals related to responsibility-oriented processes and outcomes?

If not, how can they be developed in a viable way?

A Civic Society Organisation lobbies for institutional change and system capacity-building

Example 8

A large Civic Society Organisation (CSO) is aware of efforts to improve the capabilities and sensitisation of researchers towards responsible innovation criteria via training for individuals, especially early career researchers (in participative and co-construction methods, the development of researchers' own reflexivity and sensitisation to societal problems, risks and impacts, inter-disciplinary working and futures-oriented methods). Research councils have begun to include these training requirements and institutional responses in new research calls (*Principle 7: Capabilities*). However, the CSO believes there is a need to go further to achieve systemic institutional change in order to redress the current dominance of scientific, business and government elites. It acknowledges that current institutional disincentives such as long lead times to publication and publication league tables together with competitive pressures within the new product development pipeline of large businesses run counter to the aspirations of responsible innovation. The CSO argues for a more fundamental role of civil society in constructing R&I pathways, with earlier participation in technology assessment dialogues, and involving values-centred small and medium and social enterprises. The CSO leads the creation of a network of CSOs covering a range of interests and remits from health and well-being to the natural environment and human rights (*principle 8: a supportive organisational and network infrastructure*). The network seeks to develop capacity internally and beyond with external funds from government and other sources (*principle 8: available spaces for reflection, interaction and negotiation and an open knowledge base*). It lobbies for deeper institutional change within the dominant institutions of research and innovation to achieve greater diversity in the workforce, an early and transparent dissemination of results, and the engagement of wider constituencies of users and stakeholders of research and innovation. However, in order to effectively engage and influence systemic change, the network needs to build the capacity of its network members as well, in order to be able to provide a voice that can balance that of other stakeholders within the emerging dialogue on what constitutes responsibility in research and innovation.



Developing supportive environments

Principle 9: Institutional entrepreneurship

Both capability and capacity-building are usually not self-organised activities. They require leadership, top-level and continuous support, vision and strategy, lobbying and rewarding institutional improvement in order to facilitate change towards responsibilisation.

A key guiding question is:

Are there credible leadership capabilities and institutional conditions in place for change agents to help transform the status quo?

Organisational transformation within a large US-American university

Example 9

A decade ago, a new President was appointed at the Abernath University, USA, a very large public university. President Stark had a strong vision of a "Good University", and was critical of the institutionalised model of top-league American universities, which he believed to be exclusive and narrow in their faculty and student base, working in discipline silos, and unconcerned about social problems in regional environments. His vision of "responsibility" was to demonstrate how a public university could perform successfully in financial terms, yet be founded on the inverse normative criteria, i.e. an inclusive student base, excellent science, and inter-disciplinary approaches addressing social problems (*principle 9: leadership, vision and strategy*). Many senior faculty members embraced this vision and joined the management team, whilst others who shared it were recruited. A new organisational structure was developed along inter-disciplinary lines of problem-oriented centres and institutes. Faculty staff took on multiple identities according to their problem-focused centre, their teaching host school, and their "normative home", e.g. sustainability. Networking across these identities was facilitated through meetings and events, and new inter-disciplinary centres were established (with five-year reviews) (*principle 9: capability and capacity-building are not one-off activities*). Middle tiers of Principal Investigators and faculty members were recruited who shared the broad vision, translated to their field, and who were entrepreneurial, forming inter-disciplinary teams to bring in new grants. There were turbulent years of disruption and change and some left who were not comfortable with the new model. Ultimately, the grant income of the university has increased four-fold and the student body has grown dramatically, and now reflects the ethnic demographic of the State with a focus on students whose parents did not attend university. The model has been communicated through books co-authored by Stark, many You-Tube videos and Stark's talks around the world. He entreats others not to simply replicate the model, but to adapt it to prevailing local social contexts and changing global problems.



Developing supportive environments

Principle 10: Culture of transparency, tolerance and rule of law

Only basic democratic principles such as the rule of law and freedom of speech will make responsibility-related governance effective and sustained over time. For this reason, the ability to make claims and to invoke legal or political means is a necessary condition for fostering responsibilisation in different organisational settings and arrangements. Enacting the aforementioned governance principles implies supporting individuals' ability to think and act in a proactive way and under the rule of law. Actors should feel empowered by the appropriate organisational culture.

A basic guiding question in this respect is:

To what extent do the governance mechanisms reflect a commitment to democratic principles and allow actions under the rule of law?

Randles et al.
2015b
Page 7

“[…T]o fix the normative content of RRI risks it becoming a bureaucratic tick-box exercise, an example of responsibility-wash where the ambition of RRI remains on the organisational surface and does not become deeply institutionalized.”

12

Conclusion: making responsibility an institutionalised ambition

Stefan Kuhlmann, Ralf Lindner, Sally Randles

This concluding chapter reflects on the experiences made with the specific Res-AGorA approach and, based on the project’s analyses, offers policy-oriented recommendations for the future of responsibility in research and innovation.

Responsible Research and Innovation (RRI) is part of the broader, long-term evolution of research and innovation as organised professional activities in modern societies. For at least a decade, certainly in Europe, the acronym RRI has become a “boundary object” (Star and Griesemer 1989) for organisations, policy-makers, funders, industries, and civil society organisations performing research and innovation; an object which has been “catapulted from an obscure phrase to the topic of conferences and attempts to specify and realize it” (Rip 2014: 1). The 2014 “Rome Declaration” demanded:

“to make Responsible Research and Innovation a central objective across all relevant policies and activities, including in shaping the European Research Area and the Innovation Union”.[1]

The Res-AGorA project and this resulting book can be viewed as one of the manifestations of RRI and its astonishing career as a boundary object. But the ambition and approach of the Res-AGorA project went beyond the current RRI discourse. Starting from our interest in:

A “*RRI in the making*” and
B the guiding assumption that responsibility claims are inherently normative and will always be *contested* in our pluralistic societies (Chapter 1),

we studied the evolving patchwork of practices aiming to make responsibility an institutionalised ambition in research and innovation, in other words an ongoing “social innovation which creates opening in existing (and evolving) divisions of moral labour” (Rip 2014: 1). Learning from these dynamics in different settings and situations enabled us to design, with the co-constructive assistance of a broad spectrum of stakeholders, a *governance framework* for responsible research and innovation capable of modulating these dynamics and their inherent tensions in a transformative way. We call this a “constructive and socio-normative” approach.

1 Rome Declaration on Responsible Research and Innovation in Europe, available at http://ec.europa.eu/research/swafs/pdf/rome_declaration_RRI_final_21_November.pdf (accessed 15 January 2016).

12.1 Lessons from studying the patchwork of "RRI in the making"

Extensive empirical research informed the Res-AGorA team's understanding of "RRI in the making". The notion of responsibility in research and innovation is a contested phenomenon that is historically and geographically situated and continually evolving. Developing a profound understanding of how the concept of RRI has emerged was critical in enabling the co-construction of a governance framework to assist strategic decision-makers and practitioners. Our study of "RRI in the making" included a number of elements:[2]

Where did RRI come from?

As shown in more detail in Chapter 4, we used scientometric analysis to construct a genealogy of responsibility discourses in research and innovation, analysing the emergence and characterisation of RRI. We employed the CorText[3] tool for content analysis of a corpus of more than 200 documents, selected for their use of the phrases "Responsible Research and Innovation", "RRI" and other related terms. RRI has a very recent history. It originated in the European Commission's "Science with and for Society" programme within the DG Research and Innovation, and experienced a sudden surge in the academic and policy literature as recently as 2011 when emphasizing the inclusion of societal concerns and actors and advocating a shift from retrospective accounts (accountability, liability) to prospective (anticipative) future-oriented accounts. Of course, the discussion of responsibility in science has a much longer history. It was already a topic of interest during the period of enlightenment in the 18th century. Not only is the RRI literature dwarfed by, but it remains institutionally separated from, the larger / classical literature on responsibility in science. RRI authors are almost exclusively from the Social Sciences and Humanities (SSH), whilst the earlier / larger corpus is authored by natural and physical scientists. The larger corpus witnesses the dominance and institutionalisation of earlier themes such as ethics, impact assessment, and Corporate Social Responsibility. The new literature on RRI does not (yet) show connections to these earlier literatures, i.e. it has not emerged from them, and is not yet creating bridges to them, but exists so far as a separate branch.

How is responsibility *de facto* understood, contested, and practised?

As outlined in Chapter 7 and the five ensuing case study examples, we conducted and analysed an extensive programme of in-depth case studies across a range of research and innovation situations and contexts in order to learn about the institutionalisation and governance challenges of responsible research and innovation. Over two dozen in-depth case studies were undertaken in three phases over two years.[4] The cases were selected to reflect the full variety of research and innovation situations, encompassing different entry points and foci, from the role and impact of specific governance instruments and processes, cases of organisational and institutional change, to whole multi-actor innovation systems' responses. These case studies were iteratively and increasingly guided by the Res-AGorA Research Model (Chapter 5).

In understanding the *de facto* governance of responsible research and innovation, we developed the twinned concepts of *Responsibilisation* (Dorbeck-Jung and Shelley Egan 2013), a process by which the involved actors internalise issues of concern, enabled by appropriate organisational conditions and governance mechanisms, and *Deep Institutionalisation* (Randles et al. 2014), embedding the understanding of responsibility into practices, governance processes, organisational structures and incentives. In a number of instances we found examples of converse effects and coined the terms *responsibility-wash, responsibility-overload, and responsibility-relabelling* (Randles et al. 2015a) for the tactical responses evident in some cases. The cases were compared and contrasted to identify similarities and differences and common themes. Through this process we generated *13 transversal lessons on the governance and institutionalisation of responsibility* in research and innovation (Chapter 7).

How does RRI differ across Europe?

We created *RRI-Trends*,[5] a research method and on-line resource for monitoring the awareness, similarities and differences in the understanding and practice of RRI in 16 European countries, giving external practitioners full access to the data collected in a web-based open-access form. A main result of RRI-Trends is that, while the notion of "RRI" is emerging in several organisational sites, it is not yet a mainstream concept throughout the European research and innovation actor landscape. The RRI terminology is simply not used in many of the organisations performing and funding research, both public and private. This does not imply, however, that concerns, practices and governance arrangements relating to responsibility in research and innovation are not salient. On the contrary, we find widespread examples of organisational commitment to responsible research and innovation, even if these are established under different headings, such as Corporate Social Responsibility (CSR), sustainability schemes or diversity management in private companies, or in codes of conduct, research integrity training or gender equality plans at universities.

Another key observation is the heterogeneity of governance arrangements for responsible research and innovation across countries and types of actors. Inclusive governance mechanisms such as citizen and Civic Society Organisation engagement feature prominently in some countries while they are less marked in others. Likewise, open access and open data are core responsibility concerns within some organisations, but are not noticeably important in other settings. This diversity of bottom-up responses to what it means to be responsible in different research and innovation situations, organisation types, and national political, economic, social, and cultural contexts is highlighted by the empirical work in RRI-Trends. In Res-AGorA, this result is reflected and translated into the principle of subsidiarity in the *Responsibility Navigator* (Chapter 11).

How can a co-construction methodology support the development of an RRI governance instrument?

We put inclusive and deliberative methodologies into practice by conducting five co-construction stakeholder workshops with an emphasis on learning. This process supported the development of a stable and robust *Res-AGorA Responsibility Navigator* and a systematic collaborative *Co-construction Method* (Chapter 6). The empirical research conducted up to this point (lessons from the scientometric literature analysis, case studies, and country monitoring) informed the construction of a prototype framework for the governance of responsibility in research and innovation. However, this was only the start. The prototype was then taken into five participative co-construction multi-stakeholder workshops held across Europe. All the workshops focused on open dialogue between the participants in plenary and break-out formats. A number of changes were made to the governance framework as a result of recommendations from the workshops and in response to the research team's reflections on how the prototype framework was being understood (or not) by practitioner audiences. As a result, the team was able to develop an orientating 'thinking tool', the *Res-AGorA Responsibility Navigator* (Chapter 11).

12.2 Navigating towards responsible research and innovation

Research and innovation activities need to become more responsive to societal challenges and concerns. This requires the identification, development and implementation of measures and procedures to transform research and innovation in such a way that responsibility becomes an institutionalised ambition.[6]

The quest for responsible research and innovation has in fact become an increasingly important concern in research and innovation policy and political debates, not only at EU level, but also within Member States' research systems. Arguably, this is the result of two older claims that developed separately and that are now being brought together.

First, there are long-standing concerns around the ethical, legal, environmental and social implications of research and innovation which are based on issues related to scientific practice and developments as well as technological

2 The following text draws on Randles et al. (2015a).
3 Developed by the Institute for Research and Innovation (IFRIS), Paris: http://ifris.org/en/presentation/.
4 Edler et al. (2014): http://res-agora.eu/assets/ResAGORA-case-lessons-report-D-3_5-final.pdf (accessed 15 November 2015).
5 See Chapter 8 and http://www.rritrends.Res-AGorA.eu/reports/custom/.
6 The following text draws on Kuhlmann et al. (2015).

innovations fuelled by claims of reacting to direct or indirect unintended negative effects. Examples include concerns regarding large investments and experiments in brain sciences, space, biotech and many more domains, which all have the potential for good, but eventually also for harm in the short term or in the foreseeable future.

Second, there is an increasing desire among the research and innovation community and policy-makers to improve "responsiveness" to what societies regard as desirable research directions / outcomes. Examples include the efforts to evaluate the societal relevance of research, corporate responsibility, open access instruments, gender policies, innovation for cohesion, etc.

Against this background, the main purpose of the Res-AGorA project was to assist Europe in simultaneously embracing excellent science, competitive industry and responsibility-related goals by developing a governance framework specifically aimed at supporting stakeholders in navigating towards such goals.

The Res-AGorA governance approach

Our case study findings (Chapter 7) and stakeholder workshops showed that it is in fact far from clear and contested how research and innovation activities can be made more responsive to the above mentioned divergent expectations and concerns. Negotiations and re-definitions of what responsible action is are expected to continue and further evolve.

For this reason, the Res-AGorA team approached the aforementioned challenge by following an understanding of responsible research and innovation as reflexive, self-organised and collective. The nature and direction of responsible research and innovation is shaped by varieties of governance instruments and arrangements, and the design and operation of all these instruments (even the formulation and operation of hard law) are not given, but actively constructed through processes of problem framing (appraisal), coordination and negotiation. In this context, what is judged to be "responsible" and the ways to assess it are part of these interactions, where responsibility-related co-ordination and decision-making, i.e. governance, is a collective process of sense-making.

The prime target users of the proposed governance guideline are representatives of key organisations in research and innovation systems, i.e. stakeholders who aim :

- **A** to lead organisations and procedures towards more responsiveness and accountability;
- **B** to set and define policies, design programmes and develop evaluation and assessment tools;
- **C** to mediate between levels of the innovation system by bringing together different actors and interests; and
- **D** to shape the practical implementation of governance instruments at the analytical, strategic or procedural level.

Such decision-makers typically work as "change agents" at ministries and funding organisations, in universities, research institutes, companies, professional associations, or civil society organisations and deal with governance processes towards responsible research and innovation within or between organisations.

If these ambitions are taken seriously, change agents will have to facilitate a transformation of the research and innovation system towards a set of articulated normative goals, embed values into practices and processes, and orient action towards those goals.

This change can be facilitated using a set of guiding governance principles and requirements, in other words by applying an orientating framework to better "navigate" towards institutional transformation. This is done with the help of a "thinking tool" designed to enable related debate, negotiation, experimentation, and learning in a constructive and productive way. We call this the *Responsibility Navigator*. It aims at making existing and new governance instruments and arrangements effective, from bottom-up processes to transformation at a systemic level. It is therefore expected that by adopting and adapting the *Responsibility Navigator*, the research and innovation performed in Europe will become more aligned with societal needs and concerns.

Ten Res-AGorA principles and requirements have been identified that enable responsibility-related governance (Chapter 11). The *Responsibility Navigator* (www.responsibility-navigator.eu) defines each principle and illustrates them with fictive cases depicting possible situations and governance challenges and dilemmas, and complemented by the guiding questions which those actors interested in "navigating" towards the intended cultural change will have to ask themselves in order to arrive at practices and directions that are widely accepted.

The framework is meant to be used by actors facing the complex situations characterising the governance towards responsible research and innovation, actors wanting to reflect strategically on their own position as well as those of others when navigating research and innovation towards higher levels of responsible action. Since these actors have different roles and different needs, they will have to make choices as to whether and how to tailor the Res-AGorA *Responsibility Navigator* according to specific contexts.

12.3 What next?

If the *Responsibility Navigator* is to make a difference, the resulting actor strategies have to aim for effectively transforming present day practices of research and innovation towards "responsibilisation", i.e. a process by which the actors involved internalise issues of concern, supported by appropriate organisational conditions and governance mechanisms. Given that there will always be multiple responsibility-related goals (from safety and sustainability to inclusiveness and responsiveness) as well as different instruments to promote them (from professional training and education, design principles, stakeholder and public dialogue to regulation by voluntary codes as well as hard law), the *Responsibility Navigator* aims to facilitate strategic reflection and continuous formative evaluation in order to understand how instruments interact and play out at different levels and in different contexts, and to what extent goals are ultimately achieved.

The change agents using the *Responsibility Navigator* will be supported in working as "institutional entrepreneurs" seeking to lead the research and innovation performed in Europe to be more responsive. As stated above, this will require tailoring the Navigator to specific contexts; in our stakeholder workshops we already witnessed the first efforts of participating organisations in this direction.

While we are convinced that applying the *Responsibility Navigator* can support organisations in making responsibility an institutionalised ambition, this transformation of research and innovation practices needs to be encouraged and facilitated by the general framework conditions and by a conducive research and innovation policy environment. During the course of the project, we identified a number of important lessons and implications for policy and programme development. Governments and public and private funding agencies aiming to foster institutional change within research and innovation towards increased responsiveness to societal challenges are invited to take the following into consideration:[7]

- Responsibility in research and innovation is shown to be a historically unfolding, context-specific, emergent process. From this observation, now validated by empirical research, we offer the concept of "*RRI in the making*". It is important that policy-makers at the European and Member State levels and within individual organisations work with this reality, and that they adjust and adapt the spirit of responsible research and innovation to their own circumstances, mobilizing bottom-up inclusive processes in the spirit of RRI in the making.

- The interpretation of what it means to be responsible in research and innovation differs from context to context, resulting in a landscape of variety from the bottom up. Furthermore, the actors themselves are best placed to determine this content through intra- and inter-organisational collective negotiations and action. We caution against top-down prescription of what the focal elements of responsibility should be. Gender equality, science education and open access may be important considerations for some actors but not for others who may have other pressing societal and justice concerns they wish to improve and transform. Genuine bottom-up inclusive processes will help actors to uncover and formalise what these priorities are. On the contrary, prescribing the normative content of RRI risks it becoming another bureaucratic tick-box exercise, an example of *responsibility-wash* where the RRI ambition remains on the organisational surface and does not become *deeply institutionalised*.

7 To a large extent, the following text draws on Randles et al. (2015a).

- The previous point is closely related to the issue of to what extent the "six key dimensions of RRI" (public engagement, open access, gender equality, science education, ethics and governance) that are currently being promoted by the European Commission (2012) should remain the conceptual core of RRI. While these key dimensions represent important nuclei of RRI, the ongoing debate shows (cf. Randles et al. 2014; de Saille 2015; Block and Lemmens 2015) that limiting RRI to these six key dimensions would unduly constrain the integrative potential of the RRI concept, and create the risk of a conceptual "lock-in" as other, currently unforeseen building blocks, elements or requirements of making research and innovation more responsible might be overseen. In particular, this would constrain the potential of RRI to contribute to re-opening fundamental questions about the purpose, direction and future societal benefits of research and innovation.

- The awareness and relevance of making research and innovation more responsible is unevenly distributed across Europe and different actor groups. In terms of realising this ambition, the most developed countries are in North and West Europe (UK, the Netherlands and Scandinavia), where national policies are already well advanced in research councils, for example. A blanket top-down policy would not sit well with this reality. However, a useful policy at the European level to address the uneven distribution would be to support networking activities to spread and exchange experiences on the design and implementation of RRI according to different actor groups and research and innovation situations. East and South European countries would need support in terms of additional resources to make decisions and capacity-build their own approaches relevant to their current and anticipated societal, technological, and economic context-dependent needs.

- The small but emerging corpus of social-science authored RRI literature shows remarkable convergence towards three core themes which provide a common and generic RRI heartland. They are: 1) a new form of (participatory / inclusive) governance in the relationship between science and society; 2) an objective focus on pressing societal problems (grand challenges); and 3) an anticipative futures-oriented perspective. These three themes provide a common generic core, from which adapted normative content can emerge, case by case and context by context.

- The empirical research confirmed again and again that actors operate within the structural and incentive constraints of the political economy or wider organisational culture which condition their scope for realising transformative change, both emphasizing speed and quantity over careful and inclusive deliberation. European and national policy-makers have a significant role to play in influencing these conditions if the ambition of RRI is to become a practical reality.

Given the impressive conceptual and empirical knowledge in the field of responsible research and innovation which has been generated by the growing community of academics, strategic decision-makers and research and innovation practitioners, it is now time for governments and funding institutions to vigorously encourage, enable and fund experimentation with different approaches and instruments in a diversity of settings.

Beyond Europe, amazingly, there are encouraging signals from stakeholders in research and innovation systems in developing countries, who are seeking to make their research and innovation activities and outcomes more responsible in general, and more specifically, who want to work with the *Responsibility Navigator*, even though – or rather because! – up until now the 10th requirement of the Navigator (*Culture of transparency, tolerance and rule of law*) cannot be taken for granted in their respective contexts (Macnaghten et al. 2014). Even within Europe, this requirement needs to be protected and, on occasion, reinforced.



References

Aagaard, K.; Mejlgaard, N. (2012): Dansk forskningspolitik efter årtusindskiftet, Aarhus.

Abrahamson, M (1983): Social Research Methods, Englewood Cliffs.

Acatech (National Academy of Science and Engineering) (2011): Acceptance of Technology and Infrastructure. Position Paper (in German; English summary available).

Acatech (National Academy of Science and Engineering) (2013): Technological Sciences. Discovery – Design – Responsibility. Acatech Impulse paper.

Argyris, C. (1991): Teaching Smart People How to Learn. In: Harvard Business Review, May–June, pp. 1–27, https://hbr.org/1991/05/teaching-smart-people-how-to-learn [01.12.2015].

Arnaldi, S. (2014): ¿Qué tan suave debería ser la regulación nano? Identidades sociales y opiniones de los stakeholders italianos. In: Mundo Nano. Revista Interdisciplinaria en Nanociencias y Nanotecnología 7 (13), pp. 6–27.

Arnaldi, S.; Ferrari, A.; Magaudda, P.; Marin, F. (2014): Nanotechnologies and the quest for responsibility. In: Arnaldi, S.; Ferrari, A.; Magaudda, P.; Marin, F. (eds.): Responsibility in nanotechnology development, Dordrecht, pp. 1–18.

Arnaldi, S.; Bianchi, L. (2016): Responsibility in Science and Technology. Elements of a Social Theory, Berlin.

BASF (2015): BASF Online Report 2014, http://bericht.basf.com/2014/en/managements-report.html [02.03.2015].

Beck, U. (1992): Risk Society Towards a New Modernity, London.

Beitz Ch. (2009): The Idea of Human Rights, Oxford.

Benz, A. (2006): 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, Heidelberg / New York, p. 3–22.

Bhattachary, D.; Calitz, J. P.; Hunter, A. (2010): Synthetic Biology Dialogue. Biological Sciences Research Council (BBSRC); The Engineering and Physical Sciences Research Council (EPSRC); Sciencewise (ERC), London.

Blank, D. (2011): Ledere onderzoeker in dit veld moet de gevolgen overdenken. In: De Volkskrant, 22.01.2011.

Blanke, M.; Godemann, J.; Herzig, C. (2007): Internetgestützte Nachhaltigkeitsberichterstattung. Eine empirische Untersuchung der Unternehmen des DAX30, Lüneburg.

Blok, V.; Lemmens, P. (2015): The Emerging Concept of Responsible Innovation. Three Reasons Why It Is Questionable and Calls for a Radical Transformation of the Concept of Innovation. In: Koops, B.-J.; Oosterlaken, I.; Romijn, H.; Swierstra, T.; van den Hoven, J. (eds.): Responsible Innovation 2. Concepts, Approaches, and Applications, Cham, pp. 19–35.

BMBF (Federal Ministry of Education and Research) (2014): The new High-Tech Strategy – Innovations for Germany, Berlin.

Bos, C.; Walhout, B.; Peine, A.; Van Lente, H. (2014): Steering with big words: articulating ideographs in research programs. In: Journal of Responsible Innovation 1 (2), pp. 151–170, http://www.tandfonline.com/doi/full/10.1080/23299460.2014.922732 [09.11.2015].

Bovens, M. (1998): The Quest for Responsibility. Accountability and Citizenship in Complex Organisations, Cambridge.

Bowman, D.M.; Hodge, G.A. (2007): "Governing" nanotechnology without government? In: Science and Public Policy, 35 (7), pp. 475–487.

Braithwaite, J.; Coglianese, C.; Levi-Faur, D. (2007): Can Regulation and Governance Make a Difference. In: Regulation and Governance 1 (1), pp. 1–7.

Braun, D. (2006): Delegation in the distributive policy arena: the case of research policy. In: Braun, D.; Gilardi, F. (eds.): Delegation in Contemporary Democracies, London, pp. 146–170.

Cabinet (2006): From small to great – Cabinet view on nanotechnologies, Den Haag.

Callon, M.; Lascoumes, P.; Barthe, Y. (2001): Agir dans un monde incertain. Essai sur la démocratie technique, Paris; English translation: The MIT Press Cambridge (2009): Acting in an Uncertain World. An Essay on Technical Democracy, London.

Callon, M.; Yuval, M.; Muniesa, F. (2007): Market Devices. Sociological review monographs, Malden.

Calof, J.; Smith, J.E. (2010): Critical success factors for government-led foresight. In: Science and Public Policy, 37 (1), pp. 31–40, http://doi.org/10.3152/030234210X484784 [09.11.2015].

Cane, P. (2002): Responsibility in Law and Morality, Oregon.

Caroll, A. (1999): Corporate Social Responsibility: Evolution of a Definitional Construct. In: Business & Society 38 (3), pp. 268–295.

Carroll, A.B.; Shabana, K.M. (2010): The Business Case for Corporate Social Responsibility: A Review of Concepts, Research and Practice. In: International Journal of Management Reviews 12 (1), pp. 85–105.

Chowdhury, N.; Wessel R.A. (2012): Conceptualising Multilevel Regulation on the EU: A Legal Translation of Multilevel Governance? In: European Law Journal 18 (3), pp. 335–357.

Coeckelbergh, M. (2012): Moral Responsibility, Technology, and Experiences of the Tragic: From Kierkegaard to Offshore Engineering. In: Science and Engineering Ethics 18 (1), pp. 35–48.

Crow, M.; Dabars, W. (2015): Designing the New American University, Baltimore.

Daimer, S.; Hufnagl, M.; Warnke, P. (2012): Challenge-oriented policy-making and innovation systems theory. Reconsidering systemic instruments. In: Fraunhofer ISI (ed.): Innovation system revisited. Experiences from 40 years of Fraunhofer ISI research, Stuttgart, pp. 217–234.

The Danish Government (2006): Progress, Innovation and Cohesion – strategy for Denmark in the Global Economy – Summary, Copenhagen.

Davey, E. (2012): Written Ministerial Statement by Edward Davey: Exploration for shale gas, https://www.gov.uk/government/speeches/written-ministerial-statement-by-edward-davey-exploration-for-shale-gas [01.03.2013].

Davidson, L. (2014): You fracking hypocrite. The Sun, 26.03.2014, http://www.thesun.co.uk/sol/homepage/news/5531421/oil-heir-lord-cowdray-campaigning-against-fracking-in-sussex.html [30.10.2015].

Davis, M. (2012): Ain't No One Here But Us Social Forces: Constructing the Professional Responsibility of Engineers. In: Science and Engineering Ethics 18 (1), pp. 13–34.

DECC (Department of Energy & Climate Change) (2012): Gas Generation Strategy. Presented to Parliament by the Secretary of State for Energy and Climate Change by Command of Her Majesty, December 2012, http://www.decc.gov.uk/en/content/cms/meeting_energy/oil_gas/gasgenstrat/gasgenstrat.aspx [01.04.2014].

DECC (Department of Energy & Climate Change) (2013): Onshore oil and gas exploration in the UK: regulation and best practice, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/265988/Onshore_UK_oil_and_gas_exploration_England_Dec13_contents.pdf [01.03.2014].

DEFRA (Department of Environment, Food and Rural Affairs) (2008a): The Voluntary Reporting Scheme, http://webarchive.nationalarchives.gov.uk/20130822084033/http://www.defra.gov.uk/environment/nanotech/policy/pdf/vrs-nanoscale.pdf [11.01.2016].

DEFRA (Department of Environment, Food and Rural Affairs) (2008b): A supplementary guide for the UK Voluntary Reporting Scheme, http://webarchive.nationalarchives.gov.uk/20130123162956/http:/www.defra.gov.uk/environment/nanotech/policy/pdf/nano-hazards.pdf [11.01.2016].

de Saille, S. (2015): Innovating innovation policy: the emergence of "Responsible Research and Innovation". In: Journal of Responsible Innovation 2 (2), pp. 152–168.

DFG (Deutsche Forschungsgemeinschaft) (2012): The DFG´s Funding Strategy, http://www.dfg.de/en/dfg_profile/history/funding_past_and_present/actually_strategy/index.html [13.01.2016].

Donham, W. (1927): The Social Significance of Business. In: Harvard Business Review 27, pp. 406–419.

Dorbeck-Jung, B.; Shelley-Egan, C. (2013): Meta-Regulation and Nanotechnologies: The Challenge of Responsibilisation Within the European Commission's Code of Conduct for Responsible Nanosciences and Nanotechnologies Research. In: NanoEthics 7 (1), pp. 55–68.

Douglas, M.; Wildavsky, A.B. (1982): Risk and Culture: An essay on the selection of technical and environmental dangers, Berkeley.

DuPont (2012): DuPont Position Statement on Nanotechnology, http://www.dupont.com/corporate-functions/our-company/insights/articles/position-statements/articles/nanotechnology.html [13.01.2016].

Edler, J.; Randles, S.; Gee, S. (2014): Preliminary Lessons from the Case Study Programme Deliverable Report D3.5, http://res-agora.eu/assets/ResAGORA-case-lessons-report-D-3_5-final.pdf.

Edler, J.; Randles, S.; Gough, C. (2015): Final Synthesis and Lessons Report. Res-AGorA empirical programme of case studies, transversal lessons and illustrations to the Responsibility Navigator, Deliverable Report D3.7, http://res-agora.eu/assets/Res-AgorA_321427_Del_3-7_final.pdf [09.11.2015].

EPA (Environmental Protection Agency) (n.d.): Nanoscale Materials Stewardship Program, http://epa.gov/oppt/nano/stewardship.html [30.12.2013].

European Commission (2008): Recommendation on a Code of Conduct for Responsible Nanosciences and Nanotechnologies Research, 1st Revision: Analysis of results from the Public Consultation of the Public Consultation, Brussels, http://ec.europa.eu/research/consultations/nano-code/consultation_en.htm [30.12. 2013].

European Commission (2009): Commission Recommendation on a Code of Conduct for Responsible Nanosciences and Nanotechnologies, European Commission DG for Research, Science, Economy and Society, Brussels, http://ec.europa.eu/research/science-society/document_library/pdf_06/nanocode-apr09_en.pdf [15.12.2015].

European Commission (2011a): Horizon 2020 – The Framework Programme for Research and Innovation, Brussels.

European Commission (2011b): Work Programme 2012. Capacities Part 5: Science in Society, Brussels.

European Commission (2012): Responsible Research and Innovation. Europe's ability to respond to societal challenges, Brussels, http://ec.europa.eu/research/swafs/pdf/pub_public_engagement/responsible-research-and-innovation-leaflet_en.pdf#view=fit&pagemode=none [04.01.2016].

Everaarts, M. (no date): Dopper: the bottle is the message, https://dopper.com/ [14.12.2015].

Ewald, F. (2001): Philosophie politique du principe de precaution. In: Ewald, F.; Gollier, C.; de Sadeleer, N.(eds.): Le principe de précaution, Paris, pp. 29–44.

Falkner, R.; Jaspers, N. (2012): Regulating nanotechnologies: Risk, uncertainty and the global governance gap. In: Global Environmental Politics 12 (1), pp. 30–55.

Felt, U.; 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, Brussels.

Ferrarese, M.R. (2000): Le istituzioni della globalizzazione, Bologna.

Fischer,F. (2003): Reframing Public Policy, Oxford.

Fisher, E. (2015): Research thrives on the integration of natural and social sciences. In: Nature 463 (7284), p. 1018.

Flick, U.; von Kardoff, E.; Steinke, I. (2004): What is Qualitative Research? An Introduction to the Field. In: Flick, U.; von Kardoff, E.; Steinke, I. (2004): A Companion to Qualitative Research. Translated by Bryan Jenner, London, pp. 3–11.

Forsberg, E.M.; Quaglio, G.L.; O'Kane, H.; Karapiperis, T.; Van Woensel, L. ; Arnaldi, S. (2015): Assessment of science and technologies: Advising for and with responsibility. In: Technology in Society 42, pp. 21–27.

Fredriksson, M.; Blomqvist, P.; Winblad, U. (2012): Conflict and Compliance in Swedish Health Care Governance: Soft Law in the "Shadow of Hierarchy". In: Scandinavian Political Studies 35 (1), pp. 48–70.

Fuller, L.L. (1969): The Morality of Law, New Haven / London.

Garsten ,C.; Jacobsson, K. (2012): Post-Political Regulation: Soft Power and Post-Political Visions in Global Governance. In: Critical Sociology 39 (3), pp. 421–438.

Gielgens, L. (2011): The nanocode in action in NanoNextNL. Presentation at NL NanoCode conference, Delft.

Goddard, J. (2009): Re-inventing the Civic University, NESTA Report, London. Available online at http://www.nesta.org.uk/publications/re-inventing-civic-university [14.12.2015].

Goos, K.; Lindner, R. (2015): Institutionalising RRI – The case of a large research organisation. A case study conducted for the Res-AGorA project, http://www.res-agora.eu/assets/Institutionalising-RRI_FhG_20150325-formatiert.pdf [09.11.2015].

Gorgoni, G. (2011): Modelli di responsabilità e regolazione delle nanotecnologie nel diritto comunitario. Dal principio di precauzione ai codici di condotta In: Guerra, G.; Muratorio, A.; Pariotti, E.; Piccinni, M.; Ruggiu, D. (eds.): Forme di responsabilità, regolazione e nanotecnologie, Bologna, pp. 371–395.

Gosden, E. (2015): Fracking: 6,000 square miles of England earmarked for shale exploration. The Telegraph, 14.08.2015, http://www.telegraph.co.uk/news/earth/energy/fracking/11804461/Fracking-6000-square-miles-of-England-earmarked-for-shale-exploration.html [02.03.2015].

Green, C.A.; Styles, P.; Baptie, B.J. (2012): Preese Hall Shale Gas Fracturing. Review & Recommendations for Induced Seismic Mitigation, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/15745/5075-preese-hall-shale-gas-fracturing-review.pdf [01.03.2014].

Hart, H.L.A. (1968): Punishment and responsibility, Oxford.

Harvey, F. (2015): Shale gas fracking should go ahead in UK, says taskforce. The Guardian, 16.09.2015, http://www.theguardian.com/environment/2015/sep/16/shale-gas-fracking-go-ahead-in-uk-says-taskforce [30.10.2015].

Haydon, G. (1978): On being responsible. In: The Philosophical Quarterly XXVIII (110), pp. 46–57.

Heinemann, M.; Schäfer, H. (2009): Guidance for handling and use of nanomaterials at the workplace. In: Human and Experimental Toxicology 28 (6–7), pp. 407–411.

Hellström, T. (2003): Systemic innovation and risk: technology assessment and the challenge of responsible innovation. In: Technology in Society 25 (3), pp. 369–384.

Henkel, J.; Maurer, S. M. (2009): Parts, property and sharing. In: Nature Biotechnology 27 (12), pp. 1095–1098.

Heyvaert, V. (2009): Levelling Down, Levelling Up, and Governing Across: Three Responses to Hybridization in International Law. In: The European Journal of International Law 20 (3), pp. 647–674.

Hickey, G.M.; Innes, J.L.; Kozak, R.A.; Bull, G.Q.; Vertinsky, I. (2006): Monitoring and information reporting for sustainable forest management: An inter-jurisdictional comparison of soft law standards. In: Forest Policy and Economics 9 (4) , pp. 297–315.

Horst, M.; Irwin, A. (2010): Nations at Ease with Radical Knowledge: On Consensus, Consensusing and False Consensusness. In: Social Studies of Science 40 (1), pp. 105–126.

House of Commons Science and Technology Committee (2010): Bioengineering: seventh report of session 2009–2010, Report, together with formal minutes, oral and written evidence, London.

van den Hoven, J.; Jacob, K.; Nielsen, L.; Roure, F.; Rudze, L.; Stilgoe, J.; Blind, K.; Guske, A.-L.; Riera, C.M. (2013): Options for strengthening responsible research and innovation: report of the Expert Group on the State of Art in Europe on Responsible Research and Innovation, Brussels, https://ec.europa.eu/research/science-society/document_library/pdf_06/options-for-strengthening_en.pdf [02.02.15].

HRK-DUK (2009): Hochschulen für nachhaltige Entwicklung. Erklärung der Hochschulrektorenkonferenz (HRK) und der Deutschen UNESCO-Kommission (DUK) zur Hochschulbildung für nachhaltige Entwicklung, Bonn.

ICCA (International Council of Chemical Associations) (2006): Responsible Care® Global Charter in English, Brussels, http://www.icca-chem.org/ICCADocs/09_RCGC_EN_Feb2006.pdf [30.12.2013].

IEA (International Energy Agency) (2012): Golden Rules for a Golden Age of Gas. World Energy Outlook. Special Report on Unconventional Gas, Paris: IEA/OECD, http://www.worldenergyoutlook.org/media/weowebsite/2012/goldenrules/WEO2012_GoldenRulesReport.pdf [29.07.2013].

ISO (International Organization for Standardization) (n.d.): ISO/TC 229 Nanotechnologies, http://www.iso.org/iso/iso_technical_committee?commid=381983 [30.12.2013].

ISO (International Organization for Standardization) (2010): Reviewed in 2014. Guidance on Social Responsibility, http://www.iso.org/iso/catalogue_detail?csnumber=42546 [14.12.2015].

Jachtenfuchs, M. (1995): Theoretical Perspectives on European Governance. In: European Law Journal 1 (2), pp. 115–133.

Jaspal, R.; Nerlich, B. (2014): Fracking in the UK press: Threat dynamics in an unfolding debate. In: Public Understanding of Science 23(3), pp. 348–363.

Jessop, B. (2002): The Future of the Capitalist State, Oxford.

Kibble, A.; Cabianca, T.; Daraktchieva, Z.; Gooding, T.; Smithard, J.; Kowalczyk, G.; McColl, N.P.; Singh, M.; Mitchem, L.; Lamb, P.; Vardoulakis, S.; Kamanyire, R. (2014): Review of the Potential Public Health Impacts of Exposures to Chemical and Radioactive Pollutants as a Result of the Shale Gas Extraction Process. London: Public Health England.

Kica, E.; Bowman, D.M. (2012): Regulation by means of standardization: key legitimacy issues of health and safety nanotechnology standards. In: Jurimetrics 53, pp. 11–56.

Kohler-Koch, B.; Rittberger, B. (2006): The "Governance Turn" in EU Studies. In: Journal of Common Market Studies, Annual Review, pp. 27–49.

Koutalakis, C.; Buzogany, A.; Börzel, T.A. (2010): When soft regulation is not enough: The integrated pollution prevention and control directive of the European Union. In: Regulation & Governance 4 (3), pp. 329–344.

Kroll, H.; Dornbusch, F.; Schnabl, E. (2015): Universities' Regional Involvement in Germany: How Academics' Objectives and Opportunity Shape Choices of Activity. In: Regional Studies. Journal of the Regional Studies Association.

Kuhlmann, S.; Boekholt, P.; Georghiou, L.; Guy, K.; Héraud, J.-A.; Laredo, P.; 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), Karlsruhe.

Kuhlmann, S. (2001): Governance of Innovation Policy in Europe – Three Scenarios. In: Klein, H.; Kuhlmann, S.; Shapira, P. (eds.): Research Policy, Special Issue Innovation Policy in Europe and the US: New Policies in New Institutions 30 (6), pp. 953–976.

Kuhlmann, S.; Ordonez-Matamoros, G.; Edler, J.; Lindner, R. (2015): Navigating towards responsible research and innovation, Res-AGorA Policy Note #2, http://res-agora.eu/assets/Res-AGorA-Policy-Note-2-Navigating-towards-RRI.pdf [04.01.2016].

Kwok, R. (2010): Five hard truths for synthetic biology. In: Nature 463 (21), pp. 288–290.

Lang, A. (2014a): Fracking in Austria. Case Study, http://res-agora.eu/case-studies/ [09.11.2015].

Lang, A. (2014b): Fracking in Austria and the UK: a comparative study, http://res-agora.eu/case-studies/ [10.10.2015].

Lang, A.; Griessler, E. (2015): Position paper on key elements for the governance of RRI: synthesis report on five thematic stakeholder workshops. Res-AGorA Deliverable D4.10, http://res-agora.eu/assets/ResAGorA-D4_10-Position-Paper-FINAL_correction_02.pdf [09.11.2015].

Leopoldina (Nationale Akademie der Wissenschaften); Acatech (Deutsche Akademie der Technikwissenschaften); Union der deutschen Akademien der Wissenschaften) (2014): Zur Gestaltung der Kommunikation zwischen Wissenschaft, Öffentlichkeit und den Medien. Empfehlungen vor dem Hintergrund aktueller Entwicklungen, München.

Loconto, A. (2010): SustainabiliTea: Shaping Sustinability in Tanzanian Tea Production, East Lansing.

de Lorenzo, V. (2010): Environmental biosafety in the age of synthetic biology: Do we really need a radical new approach? In: BioEssays 32 (11), pp. 926–931.

Macnaghten, P. et al. (2014): Responsible innovation across borders: tensions, paradoxes and possibilities. In: Journal of Responsible Innovation 1 (2), pp. 191–199.

Marchant, G.E.; Abbott, K.W. (2013): International harmonization of nanotechnology governance through "soft law" approaches. In: Nanotechnology Law and Business 9 (4), pp. 393–410.

Marchant, G.E.; Sylvester, D.J.; Abbott, K.W.; Danforth, T.L. (2009): International harmonization of regulation of nanomedicine. In: Studies in Ethics, Law, and Technology 3 (3).

Maynard, A.; Rejeski, D. (2009): Too small to overlook. In: Nature 460 (7252), p. 174.

Mejlgaard, N.; Bloch, C.; Degn, L.; Ravn, T.; Nielsen, M. W. (2012): Monitoring Policy and Research Activities on Science in Society in Europe (MASIS) – Final synthesis report, Brussels.

Ministerie van Economische Zaken (2011): Subsidieverleningsbrief FES-HTSM, Den Haag.

NanoNextNL (2013a): Midterm Self Evaluation Report (2010–2013), Utrecht.

NIA (Nanotechnology Industries Association) (n.d.): Responsible Nano-Code, http://www.nanotechia.org/activities/responsible-nano-code [09.11.2015].

Nielsen, M. V.; Lindner, R.; Bryndum, N.; Burchardt, U.; Schofield, M.; Stilgoe, J. (2015): Navigating towards Responsible Research and Innovation. Challenges for Policy and Governance. In: Michalek, T.; Scherz, C.; Hennen, L.; Hebáková, L.; Hahn, J.; Seitz, S. (eds.): The Next Horizon of Technology Assessment. Proceedings from the PACITA 2015 Conference in Berlin, Berlin, pp. 57–62.

OECD (Organisation for Economic Cooperation and Development) (n.d.): OECD Working Party on Nanotechnology (WPN): Vision Statement, http://www.oecd.org/sti/nano/oecdworkingpartyonnanotechnologywpnvisionstatement.htm [30.12.2015].

van Oudheusden, M. (2014): Where are the Politics in Responsible Innovation? European Governance, Technology Assessments, and Beyond. In: Journal of Responsible Innovation 1 (1), pp. 67-87.

Owen, R.; Stilgoe, J.; Macnaghten, P.; Fisher, E.; Gorman, M.; Guston, D.H. (2013): A framework for responsible innovation. In: Owen, R.; Heintz, M.; Bessant, J. (eds.): Responsible innovation, Chichester, pp. 27–50.

Owen, R. (2014): Responsible Research and Innovation: options for research and innovation policy in the EU, https://ec.europa.eu/research/innovation-union/pdf/expert-groups/Responsible_Research_and_Innovation.pdf [02.02.2015].

Ozolina, Z.; Mitcham, C.; Stilgoe, J, (2009): Global Governance of Science, Report of the Expert Group on Global Governance of Science to the Science, Economy and Society Directorate, Brussels.

Pandza, K.; Ellwood, P. (2013): Strategic and ethical foundations for responsible innovation. In: Research Policy 42 (5), pp. 1112-1125.

Parliamentary Papers (2009): Verslag van een Algemeen Overleg, Den Haag.

Pariotti, E. (2011): Normatività giuridica e governance delle tecnologie emergent. In: Guerra, G.; Muratorio, A.; Pariotti, E.; Piccinni, M.; Ruggiu, D. (eds.): Forme di responsabilità, regolazione e nanotecnologie, Bologna, pp. 509–549.

Peters, A.; Pagotto, I. (2006): Soft Law as a New Mode of Governance: a Legal Perspective, report of the project NEWGOV New Modes of Governance. Integrated Project. Priority 7 – Citizens and Governance in the Knowledge-Based Society, Basel, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1668531&rec=1&srcabs=1876508&alg=1&pos=1 [28.08.2015].

Pellizzoni, L. (2004): Responsibility and environmental governance. In: Environmental Politics 13 (3), pp 541–565.

van de Poel, I. (2011): The Relation Between Forward-looking and Backward-looking Responsibility. In: Vincent, N.A.; van de Poel, I.; van den Hove, I. (eds.): Moral responsibility: beyond free will and determinism, Dordrecht, pp. 37–52.

Polanyi, M. (1962): The Republic of Science; its Political and Economic Theory, In: Minerva 1 (1), pp. 54–73.

Ponce Del Castillo, A.M. (2013): The European and Member States Approaches to Regulating Nanomaterials: Two Levels of Governance. In: NanoEthics 7 (3), pp. 189–199.

Porter, M.E.; Kramer, M.R. (2011): Creating Shared Value. In: Harvard Business Review 89, pp. 62–77.

Randles, S.; Loconto, A.; Walhout, B.; Lindner, R. (2013): Framings and Frameworks of Responsible Research and Innovation: A Proliferation of Micro-level Initiatives. Presentation to the workshop of G04 consortia and the EC SWAFS team, 12–13 October, the European Commission, Brussels.

Randles, S.; Dorbeck-Jung, B.; Lindner, R.; Rip, A. (2014): Where to Next for Responsible Innovation? Report of the Roundtable at S.NET Boston 2013. In: Coenen, C.; Dijkstra, A.; Fautz, C.; Guivant, J.; Konrad, K.; Milburn, C.; van Lente, H. (eds.): Innovation and Responsibility: Engaging with New and Emerging Technologies, Berlin, pp. 19–38.

Randles, S.; Gee, S.; Edler, J. (2015a): Governance and the Institutionalisation of Responsible Research and Innovation in Europe. Transversal lessons from an extensive programme of case studies. Stakeholder Report, http://res-agora.eu/assets/ResAGORA-lessons-Stakeholder-Report_final_formated.pdf [9.11.2015].

Randles, S.; Edler, J.; Gough, C.; Joly, P.-B.; Mejlgaard, N.; Bryndum, N.; Lang, A.; Lindner, R.; Kuhlmann, S. (2015b): Lessons from RRI in the Making, Res-AGorA Policy Note #1, http://res-agora.eu/assets/Res-AGorA-Policy-Note-1_RRI-in-the-Making-1.pdf [04.01.2016].

Randles, S.; Tancoigne, E.; Goos, K. (2015c): Voices: Institutional Entrepreneurs of de-facto responsible research and innovation (rri). Paper presented to the Philosophy of Management Conference, Track 7, Philosophies of Entrepreneurship, Innovation and Creativity, Oxford.

Randles, S.; Laredo, P. (eds.) (2016): De-facto Responsible Innovation: Governance at Stake, Cheltenam (in progress).

Raustiala, K.; Slaughter, A.M. (2002): International Law, International Relations and Compliance. In: Carinaes, W.; Risse, T.; Simmons, B. (eds.): The Handbook of International Relations, London, pp. 538–558.

REACH (2006): Regulation 1907/2006 of the European Parliamentconcerning the Regulation, Evaluation, Authorisation and Restriction of Chemicals (REACH), http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006R1907 [14.12.2015].

Rip, A. (2010): De Facto Governance of Nanotechnologies. In: Goodwin, M.; Koops, B.-J.; Leenes, R. (eds.): Dimensions of Technology Regulation, Nijmegen, pp. 285–308.

Rip, A. (2014): The Past and the Future of RRI. In: Life Sciences, Society and Policy 10 (17).

Ruggiu, D. (2013): Temporal Perspectives of the Nanotechnological Challenge to Regulation: How Human Rights Can Contribute to the Present and Future of Nanotechnologies. In: NanoEthics 7 (3), pp. 201–215.

Schmidt, V. A.; Radaelli, C.M. (2004): Policy Change and Discourse in Europe: Conceptual and Methodological Issues. In: West European Politics 27 (2), pp. 183–210.

Schmidt, M.; Ganguli-Mitra, A.; Torgersen, H.; Kelle, A.; Deplazes, A.; Biller-Andorno, N. (2009): A priority paper for the societal and ethical aspects of synthetic biology. In: Systems and Synthetic Biology 3 (1–4), pp. 3–7.

von Schomberg, R. (2010): Organising Collective Responsibility: On Precaution, Codes of Conduct and Understanding Public Debate. In: Fiedeler, U.; Coenen, C.; Davies, S.R.; Ferrari, A. (eds.): Understanding Nanotechnology, Heidelberg, pp. 61–70.

von Schomberg, R. (2011): Prospects for technology assessment in a framework of responsible research and innovation. In: Dusseldorp, M.; Beecroft, R. (Hrsg.): Technikfolgen abschätzen lehren. Bildungspotenziale Transdisziplinarer Methoden, Wiesbaden, pp. 39–61.

von Schomberg, R. (2013): A vision of responsible innovation. In: Owen,R.; Heintz, M.; Bessant, J. (eds.): Responsible Innovation, London, pp. 51–73.

Schubert, T.; Kroll, H. (2014): Universities' effects on regional GDP and unemployment: The case of Germany. In: Papers in Regional Science.

Scott, C. (2002): The Governance of the European Union: The Potential for Multilevel Control. In: European Law Journal 8 (1), pp. 59–79.

Scott, J.E.; Trubeck, D.M. (2002): Mind the Gap: Law and New Approaches to Governance in the European Union. In: European Law Journal 8 (1), pp. 1–18.

Shamir, R. (2008): The age of responsibilization: on market-embedded morality. In: Economy and Society 37 (1), pp. 1–9.

Shaffer, G.; Pollack, M.A. (2012): Hard and Soft Law. In: Dunoff, J.L.; Pollack, M.A. (eds.): International Law and International Relations: Insights from Interdisciplinary Scholarship, New York, pp. 197–222.

Shore, C. (2011): "European Governance" or Governamentality? The European Commission and the Future of Democratic Government. In: European Law Journal 17 (3), pp. 287–303.

Siemens (2015): Siemens Company Report 2014, http://www.siemens.com/annual/14/en/index/ [26.02.2015].

Siune, K.; Markus, E.; Calloni, M.; Felt, U.; Gorski, A.; Grunwald, A.; Rip, A.; de Semir, V.; Wyatt, S. (2009): Challenging Futures of Science in Society – Emerging trends and cutting-edge issues, Brussels.

Skjærseth, J.B.; Stokke, O.S.; Wettestad, J. (2006): Soft Law, Hard Law, and Effective Implementation of International Environmental Norms. In: Global Environmental Politics 6 (3), pp. 104–120.

Spaapen, J.; van Drooge, L. (2009): Introducing "productive interactions" in social impact assessment. In: Research Evaluation 20 (3), pp. 211–218.

Star, S.L. ; Griesemer, J.R. (1989): Institutional Ecology, "Translations" and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907–39. In: Social Studies of Science 19 (3), pp. 387–420.

Stifterverband für die deutsche Wissenschaft (2010): Mission Gesellschaft. Engagement und Selbstverständnis der Hochschulen: Ziele, Konzepte, internationale Praxis, Essen.

Stilgoe, J.; Owen, R.; Macnaghten, P. (2013): Developing a framework for responsible innovation. In: Research Policy 42 (9), pp. 1568–1580.

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), pp. 262–294, http://doi.org/10.1177/0162243907311265 [09.11.2015].

Stokes, E. (2013): Demand for command: Responding to technological risks and scientific uncertainties. In: Medical Law Review 21 (1), pp. 11–38.

Strohscheider, P. (2015): New Year's Address of the President of the Deutsche Forschungsgemeinschaft, Professor Dr. Peter Strohschneider, Berlin.

Szyszcak, E. (2006): Experimental Governance: The Open Method of Coordination. In: European Law Journal 12 (4), pp. 486–502.

Tancoigne, E.; Randles, S.; Joly, P.-B. (2016): Words of power in the recasting of science and society relations: Responsible Research and Innovation (RRI) as "hype cycle" or the institutionalization of a new academic and policy concept? Discussion Paper under journal submission.

Technology Strategy Board (2012): A synthetic biology roadmap for the UK. Technology Strategy Board – UK Synthetic biology roadmap coordination group, Swindon.

The Royal Society, The Royal Academy of Engineering (2012): Shale gas extraction in the UK: a review of hydraulic fracturing. London, http://royalsociety.org/policy/projects/shale-gas-extraction [20.12.2013].

Tillmann, T.; Baker, P.; Crocker-Buque, T.; Rana, S.; Bouquet, B. (2014): Shortage of public health independence and advocacy in the UK. In: The Lancet 383, p. 213.

Trubek, D.M.; Trubek, L.G. (2007): New Governance & Legal Regulation: Complementarity, Rivalry, and Transformation. In: Legal Studies Research Paper Series, University of Wisconsin Law School, Paper No. 1047.

US EIA (United States Energy Information Administration) (2012): Annual Energy Outlook 2012: with Projections to 2035, www.eia.gov/forecasts/aeo/pdf/0383(2012).pdf [20.10.2015].

US EIA (United States Energy Information Administration) (2014): Natural Gas: shale Gas Production, http://www.eia.gov/dnav/ng/ng_prod_shalegas_s1_a.htm [12.06.2014].

UVP-G (2012): Änderung des Umweltverträglichkeitsprüfungsgesetzes 2000 und des Luftfahrtgesetzes. BGBl I Nr. 77 / 2012.

van de Ven, A.; Andrew, H.; Polley, D.E.; Garud, R.; Venkataraman, S. (1999): The innovation journey, New York.

Vincent, N.A. (2011): A Structured Taxonomy of Responsibility Concepts. In: Vincent, N.A.; van de Poel, I.; van den Hove, I. (eds.): Moral responsibility: beyond free will and determinism, Dordrecht, pp. 15–35.

VTU (2008): RESEARCH2015. Ministry for Research, Technology and Innovation, http://ufm.dk/en/research-and-innovation/political-priority-areas/research2020/research-2015 [09.11.2015].

VTU (2009): Evaluering af FORSK2015. Ministeriet for Forskning, Innovation og Udvikling, http://ufm.dk/publikationer/2009/evaluering-af-forsk2015 [09.11.2015].

Walhout, B.; Kuhlmann, S. (2013): In Search of a Governance Framework for Responsible Research and Innovation. In: 2013 IEEE International Technology Management Conference & 19th ICE Conference, 24–26 June 2013, Den Haag.

Walhout, B.; Kuhlmann, S.; Dorbeck-Jung, B. (2013): Research heuristic and key concepts, Deliverable 2.2, Res-AGorA-Project (Responsible Research and Innovation in a Distributed Anticipatory Governance Frame. A Constructive Socio-normative Approach, http://res-agora.eu/assets/Res-AGorA_321427_Del_2-2_updated.pdf [09.11.2015].

Walhout, B.; Konrad, K. (2015): Practicing Responsible Innovation in NanoNextNL. In: Bowman, D.; Dijkstra, A.; Fautz, C.; Guivant, J.; Konrad, K.; Van Leute, H.; Woll, S. (eds.): Practices of Innovation, Governance and Action – Insights from Methods, Governance and Action, Studies of New and Emerging Technologies 6, Berlin.

WR (Wissenschaftsrat) (2015): Grand Societal Challenges as a Topic for Science Policy, Köln.

Wynne, B. (1992): Misunderstood misunderstanding. Social identities and public uptake of science. In: Public Understanding of Science 1 (3), pp. 281–304.

Zhang, J. Y.; Marris, C.; Rose, N. (2011): The Transnational Governance of Synthetic Biology Scientific uncertainty, cross-borderness and the "art" of governance, BIOS working paper 4, Centre for the Study of Bioscience, Biomedicine, Biotechnology and Society, London.

Zürn, M.; Schreiterer, U. (2011): Research Planning in a New Key? A Plea for Reflexive Governance, Conference proceedings in Conference "Planning Research for the Future?" Freie Universität Berlin, pp. 15–24.

Authors

Arnaldi, Simone, Centre for environmental, ethical, legal and social decisions on emerging technologies (CIGA), University of Padua, Italy
simone.arnaldi@unipd.it

Bedsted, Bjørn, Danish Board of Technology Foundation, Copenhagen, Denmark
bb@Tekno.dk

Bryndum, Nina, Danish Board of Technology Foundation, Copenhagen, Denmark
nb@Tekno.dk

Daimer, Stephanie, Fraunhofer Institute for Systems and Innovation Research ISI, Karlsruhe, Germany
Stephanie.Daimer@isi.fraunhofer.de

Doren, Davy van, Fraunhofer Institute for Systems and Innovation Research ISI, Karlsruhe, Germany
davevandoren@hotmail.com

Edler, Jakob, Manchester Institute of Innovation Research (MIoIR) at the University of Manchester, UK
jakob.edler@mbs.ac.uk

Fan, Cheng, Fraunhofer Institute for Systems and Innovation Research ISI, Karlsruhe, Germany
Cheng.Fan@isi.fraunhofer.de

Filacek, Adolf, Czech Academy of Sciences, Prague, Czech Republic
filacek@kav.cas.cz

Gee, Sally, Manchester Institute of Innovation Research (MIoIR) at the University of Manchester, UK
sallygeeminogue@gmail.com

Gorgoni, Guido, Centre for environmental, ethical, legal and social decisions on emerging technologies (CIGA), University of Padua, Italy
Department of political science, law and international studies, University of Padua, Italy
guido.gorgoni@unipd.it

Gough, Clair, Manchester Institute of Innovation Research (MIoIR) at the University of Manchester, UK
clair.gough@mbs.ac.uk

Griessler, Erich, Institute for Advanced Studies (IHS), Vienna, Austria
egriessl@ihs.ac.at

Joly, Pierre-Benoît, French National Institute for Agricultural Research (INRA),
Institute for Research and Innovation in Society (IFRIS), Université Paris-Est Marne-la-Vallée, France
joly@inra-ifris.org

Kuhlmann, Stefan, Institute for Innovation and Governance Studies (IGS), University of Twente, The Netherlands
s.kuhlmann@utwente.nl

Lang, Alexander, Institute for Advanced Studies (IHS), Vienna, Austria
lang@ihs.ac.at

Laredo, Philippe, Manchester Institute of Innovation Research (MIoIR) at the University of Manchester, UK
philippe.laredo@mbs.ac.uk

Lindner, Ralf, Fraunhofer Institute for Systems and Innovation Research ISI, Karlsruhe, Germany
Ralf.Lindner@isi.fraunhofer.de

Loconto, Allison, French National Institute for Agricultural Research (INRA),
Institute for Research and Innovation in Society (IFRIS), Université Paris-Est Marne-la-Vallée, France
loconto@inra-ifris.org

Mačiukaitė-Žvinienė, Saulė, Mykolas Romeris University, Vilnius, Lithuania
macsaule@gmail.com

Mandl, Christoph E., Mandl, Luethi & Partner, University of Vienna, Austria
christoph.mandl@univie.ac.at

Mejlgaard, Niels, Danish Centre for Studies in Research and Research Policy, Aarhus University, Denmark
nm@ps.au.dk

Ordóñez-Matamoros, Gonzalo, Institute for Innovation and Governance Studies (IGS), University of Twente, The Netherlands;
Facultad de Finanzas, Gobierno y Relaciones Internacionales. Universidad Externado de Colombia
h.g.ordonezmatamoros@utwente.nl

Pariotti, Elena, Centre for environmental, ethical, legal and social decisions on emerging technologies (CIGA), University of Padua, Italy
Department of Political science, law and international studies, University of Padua, Italy
elena.pariotti@unipd.it

Randles, Sally, Manchester Institute of Innovation Research (MIoIR) at the University of Manchester, UK
Sally.Randles@mbs.ac.uk

Revuelta, Gema, University Pompeu Fabra, Barcelona, Spain
gema.revuelta@upf.edu

Seus, Sarah, Fraunhofer Institute for Systems and Innovation Research ISI, Karlsruhe, Germany
Sarah.Seus@isi.fraunhofer.de

Tancoigne, Élise, Institute for Research and Innovation in Society (IFRIS), Université Paris-Est Marne-la-Vallée, France
tancoigne@inra-ifris.org

Tauginienė, Loreta, Mykolas Romeris University, Vilnius, Lithuania
lorataugininene@hotmail.com

Nielsen, Morten Velsing, Danish Board of Technology Foundation, Copenhagen, Denmark
mortenvelsing@gmail.com

Walhout, Bart, Institute for Innovation and Governance Studies (IGS), University of Twente, The Netherlands;
National Institute for Public Health and the Environment
a.m.walhout@utwente.nl

The Res-AGorA project consortium

Fraunhofer Institute for Systems and Innovation Research ISI, Karlsruhe, Germany (Coordinator)

University of Twente, Twente, The Netherlands

University of Padua, Padua, Italy

Danish Board of Technology, Copenhagen, Denmark

Institute for Advanced Studies, Vienna, Austria

University of Manchester, Manchester, The United Kingdom

University Paris-Est de Marne-la-Vallée, Paris, France

University Aarhus, Aarhus, Denmark

Acknowledgement

Co-funded by the European Union

This project is co-funded under the European Union's Seventh Framework Programme for research, technological development and demonstration; grant agreement no. 321427.

Attribution-NonCommercial CC BY-NC

This work is licensed under the Creative Commons Attribution-NonCommercial 4.0 International License.

To view a copy of this license, visit: http://creativecommons.org/licenses/by-nc/4.0/.

Imprint

Publisher
Fraunhofer Institute for
Systems and Innovation Research ISI
Breslauer Strasse 48
76139 Karlsruhe, Germany

www.isi.fraunhofer.de

Contact
Ralf Lindner (co-ordinator)
Phone +49 721 6809–292
Fax +49 721 6809–315
ralf.lindner@isi.fraunhofer.de

Editors
Ralf Lindner
Stefan Kuhlmann
Sally Randles
Bjørn Bedsted
Guido Gorgoni
Erich Griessler
Allison Loconto
Niels Mejlgaard

Further information
www.res-agora.eu

Graphic design
Sabine Wurst
Jeanette Braun

Proofreading
Gillian Bowman-Köhler
Barbara Sinnemann

Printed in Germany by
Stober GmbH
Druck und Verlag
Eggenstein

ISBN
9-783000-517099

Karlsruhe 2016

Photo Credits

pp. 98–99
Title
Concert crowd
iStockphoto.com / AlenPopov
p. 37
Seminar
iStockphoto.com / vm
p. 45
Public library
Shutterstock.com / Connel
p. 73
Audience in the conference hall
Shutterstock.com / Matej Kastelic
pp. 74–75
Fracking drill rig
Bill Cunningham / US Geological Survey / Science Photo Library
pp. 82–83
Scientist
iStockphoto.com / nicolas
p. 89
Discussing working concept
Shutterstock.com / Rawpixel.com
pp. 90–91
Cells
iStockphoto.com / Eraxion
Organic permaculture
Shutterstock.com / iva
pp. 106–107
Engineered bacteria
Equinox Graphics / Science Photo Library
p. 119
Globe
iStockphoto.com / fpm
p. 125
Graduation ceremony
Shutterstock.com / baipooh
p. 140
Multiethnic team
Shutterstock.com / Milles Studio
p. 142
Protest
Shutterstock.com / Eric Crama
p. 144
Dialogue
Shutterstock.com / Uber Images
p. 146
Scientist in a laboratory
Shutterstock.com / wavebreakmedia
p. 148
Global communications
Shutterstock.com / everything possible
p. 150
Conductor
Shutterstock.com / Stokkete
p. 152
University presentation
Shutterstock.com / Matej Kastelic
p. 154
Meeting
Shutterstock.com / Monkey Business Images
p. 156
Female executive
Shutterstock.com / dotshock Images
p. 158
Vote
Shutterstock.com / bikeriderlondon
p. 167
Diversity
Shutterstock.com / Rawpixel.com

The Res-AGorA project

Res-AGorA was a three-year, EU FP7 project (2013–2016) which has co-constructed a good-practice framework, the "Responsibility Navigator", with practitioners and strategic decision makers. This framework facilitates reflective processes involving multiple stakeholders and policy-makers with the generic aim of making European research and innovation more responsible, responsive, and sustainable.

This framework was developed based on three years of intensive empirical research comprising an extensive programme of in-depth case-studies, systematic "scientometric" literature analysis, country-level monitoring (RRI-Trends) and five broad-based co-construction stakeholder workshops.

The resulting Res-AGorA Responsibility Navigator was conceived as a means to provide orientation without normatively steering research and innovation in a specific direction. Furthermore, Res-AGorA's "Co-construction Method" is a collaborative methodology designed to systematically support and facilitate the practical use of the Responsibility Navigator with stakeholders.

The Responsibility Navigator, the Co-construction Method and accompanying materials are ready to be used by actors who wish to navigate Research and Innovation towards higher levels of responsibility.

This book provides an overview of the project's journey, its conceptual underpinnings and main results.

For more information please visit www.responsibility-navigator.eu or www.res-agora.eu.

9 783000 517099

Co-funded by the European Union