Chapter 6
Introduction, Methodology and Data

Abstract In Part II of the book, we discuss the national discourses and practices researched in the project. In this chapter, we introduce the topic, the methodology and the theoretical framework used to analyse the data. Because the focus of this research is different from that of Part I—national discourses and practices rather than organisations—we use a different method and analytical framework, namely sociotechnical imaginaries. In Chap. 7, we identify imaginaries of science in each of participating country that we use to explain differences in RRI uptake at a national level. Due to the nature of the project and the data gathered, the focus will be largely on the 'science' part of the science, technology and innovation (STI) system, though we also reflect on the broader STI system, especially where the three elements are strongly linked. In Chap. 8, we discuss the lessons that we draw from comparing the imaginaries.

Keywords Sociotechnical imaginaries · Responsible research and innovation · Linear model · Science for society model · Systems of innovation model

6.1   Introduction

The RRI-Practice project has analysed RRI-related discourses and pathways to implementation in 23 organisations in 12 countries. While differences in those discourses and pathways can partly be accounted for by variation between institutions and research teams, another part has been dependent on factors that prevail at the national level that include national science policies and cultures of participation (see Davies and Horst 2015; Lukovics et al. 2017). At the same time, RRI is not a monolithic concept, but a collection of ideas that have been developed and designed to restructure the relation between science and society for particular reasons, and that can mean very different things, depending on context (Doezema et al. 2019). Hence, the main research question for this part of the book is: '*How can we understand the potential for the uptake of RRI in different national contexts?*'.

Answering this research question requires us to specify how we conceptualise 'national contexts' or 'national discourses and practices' for the purposes of our analysis. This conceptualisation should meet a number of requirements:

- First, it needs to present a consistent and coherent picture of national contexts in which the STI system has evolved, preferably one that spans several decades (for example, for many Western countries, from the Second World War onwards), to show coherence as well as change over time, whether incrementally or suddenly, including the tensions or dilemmas that the system currently finds itself in.
- Second, it needs to be possible to develop the conceptualizations largely derived from the *available data set* (the RRI-Practice national reports). We would like to stress that identifying one 'national context', let alone comparing twelve, requires a degree of generalization and the inevitable blurring of nuance, specificity and local exceptions within each country. It also requires at least two layers of interpretation: those of the report authors and those of the authors of this book.
- Third, the conceptualizations should acknowledge that national contexts—and associated STI policy cultures—typically share elements that are both flexible and contingent as well as enduring. National STI policy contexts and cultures change over time, yet tend to be structured by and through more enduring cultural styles and tropes of governing.
- Finally, the conceptualizations have to offer *guidance to actions*. They should not only describe, but also be usable to derive prescriptions for implementing RRI, or at least, to lay out questions one should ask when intending to introduce RRI in a particular national context.

We now explain why we consider Jasanoff's (2015) *sociotechnical imaginaries* to fit our criteria, and how we use this framework to analyse our case studies, to show what RRI could mean for the national contexts studied.

6.2 Methodology

In this book, we use Jasanoff's *sociotechnical imaginaries* as our analytical framework for researching STI systems in different national contexts. Sociotechnical imaginaries are defined as "*collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology*" (Jasanoff 2015, p. 4). The concept of the sociotechnical imaginary has been developed following the assumption that sociotechnical systems (including national STI systems) are always embedded in a material, moral and social environment. Moreover, Jasanoff argues that the way in which these systems allow us to represent and gather knowledge about the world cannot be seen apart from the way in which we would like to live in our environment and organise it. STI systems, for example, are concerned with developing knowledge about and designing accurate models of the world. At the same time, concerns over issues such as societal responsibility influence research priorities and project designs.

Sociotechnical imaginaries recognise that STI systems across the world can adhere to similar values (e.g. those of validity and accuracy of knowledge claims) while being

subject to different incentives and pressures from the national contexts in which they operate. By highlighting this interplay between STI system and national context, the methodology allows us to *identify* where and how STI systems align with RRI ideas in distinct national contexts, and to *explain* why this is so. For Jasanoff (2015) comparisons are helpful to get a better understanding of both form and content of imaginaries, as they help us to distinguish the universal from the specific. Thus, the availability of the twelve national reports as comparative data sets facilitates the use of this particular methodology.

We offer one methodological caveat. To date, researchers have used the concept of the sociotechnical imaginary to explain why new *technologies/techniques* are received differently in different national contexts. The classic example is the one by Jasanoff and Kim (2009), who examine the effect of national imaginaries in understanding the reception of nuclear technology in South Korea and the US. We are using the concept to perform a slightly different function, namely, to examine why and how *a new model on the relation between science and society, namely, the 'RRI model'* is received differently in different national contexts.

Another point of divergence is that in our usage of sociotechnical imaginaries may not necessarily be *explicitly* held or articulated as such. Sometimes it may be necessary to *reconstruct* some of their aspects, if they are not codified in policy documents, but part of routines or informal arrangements. Finally, imaginaries may be more or less stable, and have more or less competition from other imaginaries. In our analysis, we assume that the imaginaries described in the national case study reports are relatively stable, though we do highlight significant ongoing changes and contestations within theses.

There is no formal method established in the literature to identify an imaginary; no checklist of characteristics to determine its capture. For our method we have considered several characteristics investigated both in earlier work comparing biotechnological innovations across jurisdictions (Jasanoff 2005)[1] as well as in two signature publications (Jasanoff and Kim 2009; Jasanoff 2015) and have chosen two variables, policy structure and policy culture, as the most relevant for our analysis *and* the most manageable, given the number of national contexts to be analysed and the data available.[2]

– *Policy structure*: refers to the values, goals and decision procedures that have been established in public policies and in STI governance systems. This section identifies why STI systems are supported in the national context, and what factors legitimise (particularly public) spending on STI. This has the following aspects:

---

[1]Although Jasanoff's (2005) *Designs on nature* isn't officially a comparison of imaginaries, we consider there to be sufficient overlap in method and aim to group it under the same header.

[2]We have left out the following possible aspects because they were not relevant to our topic or identifiable in the gathered data: *closure*, the moves by which a polity takes some issues or questions out of the domain of politics as usual; *boundaries*: how new scientific and technological developments create boundary objects that require work; *institutional reasoning and discourse*: this is the domain of different work packages within the RRI-Practice project; *changes in actor identities* due to the creation or destruction of categories.

    (a) *STI policy goals*: What are the goals of STI policy? For which reasons do countries support STI?

    (b) *STI framing*: How are the goals of STI policy framed? How is the role of particularly science in society framed? How are the responsibilities of scientists conceived? What alternative/critical frames pertain in society on these topics?

– *Policy culture* is defined as the systematic means by which a political community makes binding collective choices.' (Jasanoff 2005, p. 21). This includes both formal institutionalised processes as well as the tacit unwritten norms that govern institutional behaviour. This has the following aspects:

    (a) *Administrative style*: What is the style of policy-making in a nation-state? For example, is it consensus-oriented or contentious, egalitarian or top-down, bureaucratic or informal?

    (b) *Public participation in STI policy*: Whether, and if so, how, societal actors are involved in scientific processes and in STI policy-making.

In the previous sections we have elaborated our analytical framework for comparing STI policy across nations, using the concept of the sociotechnical imaginary and highlighting in particular distinctions of political structure and political culture. Before analysing the dominant imaginaries of each of our national cases and the implications of these for RRI uptake, we situate them in the wider evolution of paradigmatic models through which science and innovation have been governed at the international level and which have shaped the development of STI systems at the national level (see Flink and Kaldewey 2018; Macnaghten 2020).

The first paradigmatic science policy model is the 'linear model', most famously put forward by Bush (1945), following the end of the Second World War. It became the hallmark of American policy in science and technology, and the blueprint and justification for many decades of increased funding in American science (and beyond). Bush was a strong proponent of the state funding fundamental research, where new fundamental research was then assumed to stimulate applied research in a more or less linear way. This would in turn create societal value by being further developed and commercialised by private sector actors in a response to consumer demand. The autonomy of scientists in doing fundamental research is considered important in this model, as well as adherence to norms of 'good science', such as disinterestedness and organised scepticism (Merton 1973).

As science-based developments gave rise to a number of public controversies such as nuclear energy technologies, the BSE crisis in the UK and later GMOs, calls for an orientation of science towards public goals and values arose. An example of this is the Lund Declaration (European Commission 2009), stating that science should address the grand challenges of our time. In this 'science for society' model, society rather than scientists set the research priorities, and the value generated by research is in (also) addressing those priorities rather than (only) in addressing market demand. Generally, researchers in this model still have considerable autonomy on how to do their research, as long as it is directed in some way towards those priorities.

Both the 'linear model' and the 'science for society' model are often connected to a particular model of science communication, the 'deficit model'. The deficit model assumes that the kind of science communication needed by the public is fundamentally an explanation of science by scientific experts (Wynne 2006). If members of the public oppose particular scientific developments, this is because of lack of information or distrust, which can be remedied by experts explaining their science to the public in an open and transparent way. In both the 'linear model' and the 'science for society' model, scientists are thus presumed to be experts in doing 'good science', as well as in making science work to address societal challenges. Schot and Steinmueller's (2018) 'transformative change' model seems to be an example of this that focuses explicitly on those grand challenges that are posed or created by societal systems that require transformative change, though they do argue that forming networks of societal actors is necessary to achieve such change.

In a parallel development to the 'science for society' model and its focus on societal values, with neoliberalisation and a policy focus on economic growth and competitiveness came the recognition that furthering economic goals required more interaction between different actors in the STI system. This gave rise to the 'systems of innovation' model that emphasised the importance of coordination and learning between the different actors in the STI system (or, more specifically, the innovation system), rather than a linear progression from fundamental science to applications (Schot and Steinmueller 2018). This can involve a meshing of the STI system with the innovation system, e.g. in 'triple helix' collaborations that involve industry, the government and universities. Though not all national reports find strong connections between science and innovation systems, some do, or find the ambition to better connect those systems. Therefore, we mention the model here.

Social scientists have argued that, even if the 'science for society' model recognises the importance of scientific responsiveness to societal values, it doesn't yet recognise the degree to which science and social order co-constitute each other. For example, scientific knowledge and advice shape political debates and social institutions, but the STI system is also a social institution that does not serve all interests in society equally. Where previous models aim to minimise influence of the social environment on the scientific *process*, having it influence its *goals* instead, these social scientists argue that such an endeavour is not only impossible, but also dangerous, as it may obscure the social norms and values that inevitably co-constitute the STI system. This would risk obscuring the influence of powerful actors on the STI system. The alternative is a model in which this co-constitution of science and societal order is explicitly recognised and democratically governed: the 'RRI' model, or to contrast it with its predecessor, the 'science *with and* for society' model. Where the 'systems of innovation' model focuses particularly on economic goals and the inclusion of actors that contribute to the economy, the 'RRI' model focuses on societal goals (which may include economic ones) and the inclusion of all those for whom they are relevant. To show how this 'RRI' model fits the national sociotechnical imaginaries, we make short statements on how RRI fits each of the categories of the sociotechnical imaginary as set out above.

Policy structure:

(a) *STI policy goals*: Definitions of RRI range from the grand and abstract 'taking care of the future through collective stewardship of science and innovation in the present' (Stilgoe et al. 2013, p. 1570) to the concrete and instrumental 'Responsible Research and Innovation is 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 2013, p. 63). Though RRI is mainly concerned with the research and innovation *process*, this process is (sometimes implicitly) supposed to further societal goals/challenges. Proposals for operationalisation include the anticipation, inclusion, reflexivity and responsiveness (AIRR) dimensions (Stilgoe et al. 2013) and the EC policy keys of ethics, gender, open access, public engagement, science education and governance.[3]

(b) *STI Framing*: Responsibility is the guiding concept within RRI. Crucial is a broadening of responsibilities of scientists from maintaining the quality and integrity of the research process to a broader concern with aligning research activities as well as their resulting products with societal values.

Policy culture:

(a) *Administrative style*: RRI emphasizes involving societal actors from an early stage onwards to come to a joint agreement on research governance. As such, its style is decentralized, egalitarian and consensus-oriented.

(b) *Public participation*: Public participation is core to RRI, and indeed, what sets it apart from the other discussed models of the relationship between science and society. Terms such as 'upstream engagement' (Pidgeon and Rogers-Hayden 2007) and 'co-production' (Jasanoff 2004) are often used in the context of RRI, indicating that public participation should start as early as possible, preferably at the problem definition stage, and that scientists and societal actors should aim for consensual solutions.

6.3 Data Used

Data used for this book part are primarily the twelve RRI-Practice national reports that have been created for the RRI-Practice project in the period November 2016–July 2018. Countries reported on are: Australia, Brazil, Bulgaria, China, France, Germany, India, Italy, the Netherlands, Norway, the UK and the US. The national discourse part of these reports has been based on interviews with science policy

---

[3]https://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation. Accessed 11 May 2020. RRI-Practice has investigated the dimensions as well as the keys, with the exception of the governance key. See the introduction to the RRI-Practice study in Part I.

stakeholders and a study of national science policy documents as well as on other sources: a specification of methodology can be found inside each report. These reports are referenced throughout the text as '[name country] report:' in each chapter each first mention of the report is accompanied by a full reference.[4] Report data has been supplemented with other relevant sources, such as the national case study reports from the MASIS project (EU only), OECD and World Economic Forum reports, and scientific literature where appropriate. As the RRI-Practice national case study reports have been the main source, this part of the book compares national STI imaginaries *as their elements have been described in those reports.* It is thus necessarily a selection and abstraction from very rich contexts in order to enable a high-level comparison.

References

Bush, V. 1945. *Science: The endless frontier*. Washington: U.S. Government Printing Office.

Davies, S.R., and M. Horst. 2015. Responsible innovation in the US, UK and Denmark: Governance landscapes. In *Responsible innovation 2*, ed. B.J. Koops, I. Oosterlaken, H. Romijn, T. Swierstra, and J. van den Hoven, 37–56. Dordrecht: Springer.

Doezema, T., D. Ludwig, P. Macnaghten, C. Shelley-Egan, and E.-M. Forsberg. 2019. Translation, transduction, and transformation. *Journal of Responsible Innovation* 6 (3): 323–331.

European Commission. 2009. *The Lund Declaration: Europe must focus on the grand challenges of our time.* Lund, Sweden: European Commission.

Flink, T., and D. Kaldewey. 2018. The new production of legitimacy: STI policy discourses beyond the contract metaphor. *Research Policy* 47 (1): 14–22.

Jasanoff, S. (ed.). 2004. *States of knowledge. The co-production of science and social order*. London: Routledge.

Jasanoff, S. 2005. *Designs on nature. Science and democracy in Europe and the United States.* Princeton: Princeton University Press.

Jasanoff, S. 2015. Future imperfect: Science, technology and the imaginations of modernity. In *Dreamscapes of modernity*, ed. S. Jasanoff and S.-H. Kim, 1–47. Chicago: University of Chicago Press.

Jasanoff, S., and S.-H. Kim. 2009. Containing the atom: Sociotechnical imaginaries and nuclear power in the United States and South Korea. *Minerva* 47: 119–146.

Lukovics, M., S.M. Flipse, B. Udvari, and E. Fisher. 2017. Responsible research and innovation in contrasting innovation environments. *Technology in Society* 51: 172–182.

Macnaghten, P. 2020. *The making of responsible innovation.* Cambridge: Cambridge University Press.

Merton, R. 1973. The normative structure of science. In *The sociology of science*, ed. N. Storer, 267–278. Chicago: University of Chicago Press.

Pidgeon, N., and T. Rogers-Hayden. 2007. Opening up nanotechnology dialogue with the publics. *Health, Risk & Society* 9 (2): 191–210.

Schot, J., and W.E. Steinmueller. 2018. Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy* 47: 1554–1567.

Stilgoe, J., R. Owen, and P. Macnaghten. 2013. Developing a framework for responsible innovation. *Research Policy* 42 (9): 1568–1580.

---

[4]All reports are available at: https://www.rri-practice.eu/publications-and-deliverables/.

von Schomberg, R. 2013. A vision of responsible research and innovation. In *Responsible innovation*, ed. R. Owen, M. Heintz, and J. Bessant, 51–74. London: Wiley.
Wynne, B. 2006. Public engagement as a means of restoring public trust in science—hitting the notes, but missing the music? *Public Health Genomics* 9 (3): 211–220.