

## 4 Technocracy versus experimental learning in RRI

### On making the most of RRI's interpretative flexibility

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#### Introduction

Although, in many respects, Research and Innovation (R&I) has ameliorated the human condition, they also give rise to social, ethical and environmental concerns. One just has to think of the environmental impact of combustion engines or of controversies surrounding genetically modified crops, fracking, UMTS-signals or pre-implantation genetic diagnostics to realize that not all R&I is ethically or socially acceptable or responsive to societal needs. To promote socially desirable, ethically acceptable and environmentally and economically sustainable R&I, the European Commission (EC) has promoted the governance framework of *Responsible Research and Innovation* (RRI) since 2010.<sup>1</sup> RRI is a form of anticipatory governance aimed at modulating R&I trajectories towards the 'right impacts', while strengthening the inclusive nature and democratic legitimacy of the R&I enterprise and stimulating the economy via the deliverance of better innovations.<sup>2</sup>

Although RRI, or its close relatives, can be recognized in a number of national funding schemes in both European countries<sup>3</sup> and the United States, it is hardly an exaggeration to say that the EU is RRI's habitat and the EC its genuine patron. Several years after its nominal launch, however, what RRI precisely entails is still under negotiation. The lack of a univocal definition of RRI becomes especially clear if one juxtaposes the way in which the EC defines RRI with the ways in which scholars of science policy and science and society interactions discuss RRI. Where the former is centred around a core of five internally heterogeneous 'keys' that arguably are best thought of as normative policy agendas, the latter are concerned more with designing ways to contribute to R&I following inclusive democratic processes with an increased chance of harvesting ethically sound and societally pertinent outcomes and achieving desirable impacts.

This observation is at this chapter's basis, as it aspires to narrow the gap between how RRI is conceived of in EC policy circles and how it is conceived of in scholarly circles. As we see it, the policy view of RRI and the scholarly view of RRI each have their strengths and weaknesses and both would be better off if coupled to the other. Major strengths of the policy concept of RRI are its

focus on impact and its institutional support, whereas the academic view of RRI shows more conceptual coherence and displays more openness to the heterogeneous world in which, and for which, R&I takes place. Because, arguably, RRI is first and foremost a policy concept, our entranceway into this issue consists of an analysis of the policy concept of RRI—from now on, pRRI.

When looking at how pRRI has come about and has found its way into policy, we see that it embodies a clear tension. Although it presents a response to bottom-up societal resistance to R&I triggered by ethical and privacy issues surrounding, for instance, genetically modified organisms or electronic patient records (Von Schomberg 2013), in itself it constitutes a top-down policy-driven push on R&I. To complicate matters even more, this push directs R&I towards inclusive practices that are ethically acceptable, societally responsive and sustainable (and, hence, responsible), but the delineation of what it means to be societally responsive appears to be substantiated to a large degree in the EC's pRRI, of which it is unclear precisely how it is informed by bottom-up societal voices.<sup>4</sup> Ultimately, by taking the responsibility of Europe's R&I system to the next level, the latter should produce ethically sound, marketable innovations that simultaneously advance Europe's competitive edge and contribute to the battle against the EC-defined Grand Challenges of our times (von Schomberg, 2011; Lund Declaration, 2009). But whether that is also how Europe's citizens see responsibility, or whether they consider RRI a legitimate framework for governing R&I, is largely unknown.

At the core of this chapter are this and associated tensions in the concept of pRRI as embodied in EC literature. It will be argued, though, that it does not necessarily form an obstacle to reaching RRI's ultimate aims of making R&I more responsive to societal needs, more democratically accountable and delivering more beneficial innovations. To this end, we will, on the one hand, build on the intellectual resources on which RRI has been constructed. On the other hand, the authors' build on their experience in the project *RRI Tools*,<sup>5</sup> a support action funded by the EC's Seventh Framework Programme to contribute to fostering RRI.<sup>6</sup>

In section 2, the chapter discusses pRRI in more detail. Section 3 further elaborates on the tensions in pRRI. In section 4, we discuss how RRI is described in the academic literature on science governance, ethics, science and technology studies (STS) and philosophy of science—what we call aRRI, for *academic* RRI. After this, section 5 confronts pRRI with aRRI, articulating where they differ, followed by a description in section 6 of how in the *RRI Tools* project we have worked around the tensions inherent to pRRI. Finally, in section 7, we draw our conclusions, arguing that anyone's aims with RRI are best served if pRRI and aRRI join forces rather than further develop into two separate fields that run their own independent course.

### **pRRI: Where it comes from and what it is**

Use of the concept of RRI in a policy context seriously took off after the EC gave it a central role in its Horizon 2020 framework program of 2014. Its use

in the context of R&I policy is slightly older than that, though, with first signs of life in 2010.<sup>7</sup>

Owen et al. (2012: pp. 752–754) discuss the history of RRI as an EC-policy concept, and elaborate on the indistinct policy motivations behind the concept. These include both instrumental economic considerations, normative democratic considerations and considerations having to do with the substance of innovation. The latter can be best discerned in the work by ‘EC philosopher’ Renee Von Schomberg, who, building on work in STS and the philosophy of science, suggests that in cases where highly inclusive and deliberative processes are part of R&I trajectories, better innovations are brought forth (i.e., innovations with the ‘right impacts’ and smaller chances of technological lock-in) (Von Schomberg, 2011; 2013).

As can be read on Horizon 2020’s Science With and For Society webpage,<sup>8</sup> today the EC defines RRI as follows:

RRI is an inclusive approach to research and innovation (R&I), to ensure that societal actors work together during the whole research and innovation process. It aims to better align both the process and outcomes of R&I, with the values, needs and expectations of European society. In general terms, RRI implies anticipating and assessing potential implications and societal expectations with regard to research and innovation. In practice, RRI consists of designing and implementing R&I policy that will:

- engage society more broadly in its research and innovation activities,
- increase access to scientific results,
- ensure gender equality, in both the research process and research content,
- take into account the ethical dimension, and
- promote formal and informal science education.

By governing R&I such that it meets this description of pRRI, R&I would allegedly help steer science and innovation towards addressing societal problems, and would do so in such a way as to optimally forestall controversies and deadlocks. The definition of pRRI reflects the EC’s position that these goals will be achieved where R&I manages to engage society, grant access to its results, promote gender equality, accommodate ethical concerns and integrate R&I with science education. To achieve this, the EC uses a variety of policy measures, including the adaptation of funding schemes, offering guidelines and codes of conduct and implementing standards.<sup>9</sup> These five items have come to be known as what the EC sees as RRI’s so-called key dimensions.

That the EC would delineate RRI in terms of such a fixed set of key dimensions was not yet clear in 2012, when Owen *et al.* wrote their history of the EC-policy concept of RRI. In the short history of the concept, some meandering in its conceptualization is visible. Specifically, in the original definition of RRI, the EC had operationalized it in terms of six rather than five such keys. In addition to the five visible in the definition quoted here, *governance* was also originally seen as a key

to RRI. Recognizing that RRI is, in fact, a governance framework for R&I, the EC has decided not to mention this as an isolated and independent key anymore.

What immediately stands out when looking at this list of items is that it constitutes a rather motley collection. *Public engagement* arguably concerns the design of R&I processes such that so-called RRI outcomes might be achieved; *ethics*, like *gender* in R&I, specifies the nature of the content of RRI outcomes, but insofar as it relates to gender equality in R&I organizations, *gender* has more the appearance of a framework condition that the R&I system ought to have met before a responsible R&I process can take off in the first place. And no matter how important both arguably are in and of themselves, we hypothesize that looking at the definition given above up until the itemization of what RRI entails in practice, very few people will, for instance, see either Open Access or Science Education as essentially implicated herein.

More generally, one might even wonder whether this first part of pPRI's definition warrants *any* substantial delineation of what should be done to make R&I RRI—one would expect a procedural indication at best. With its identification of five mandatory points of passage, each with potency in one or more different departments in the governance of R&I, all in all, the pPRI definition separates out substantive content for RRI. It is our fear that, by giving such a definition as the EC offers now, with pPRI's five key dimensions, the EC runs the risk of *preliminarily* prescribing in too much detail what it means “to ensure that societal actors work together during the whole research and innovation process [such that] both the process and outcomes of R&I [better align] with the values, needs and expectations of European society” (see note 8). Rather than conceiving of RRI as space for collaborative experimentation, in which all actors engaged and interested in R&I together with societal actors investigate what RRI's first *R* stands for, pPRI presents something like an action plan that is to be implemented.

### **Tensions in pPRI**

No matter what the definitive and complete set of motivations behind pPRI precisely is, pPRI has obviously been formulated to improve R&I and, through that, to add to the solution of environmental, social and economic problems. In that sense, in its ambitions, pPRI arguably resembles other well-known and large-scale schemes for the improvement of the human (and planetary) condition—ventures traditionally undertaken by states (Scott, 1998), but not always successfully.

In his majestic *Seeing Like a State. How Certain Schemes to Improve the Human Condition Have Failed* (1998), James Scott draws a very detailed picture of what has gone wrong in a number of High Modernist planning efforts, including Russian agricultural collectivization and urban planning in Brasilia. In each such case, the aims with which the planners set out were not reached, and instead, social or ecological disaster ensued. Though there is no reason to think pPRI shall suffer a similar faith—which in this context might, for instance, mean that by attempting to steer R&I through RRI policies, basic research is curtailed, knowledge production stymied and radical innovation impeded—neither do we have

any reason not to learn from such grandiose failures to steer clear of that faith. To do so, let us first briefly sum up some likenesses between, on the one hand, the familiar disasters elaborated on by Scott, and on the other hand, pRRI.

First, good intentions are at the basis of both. Or at least, there is no reason to think the “actions [by pRRI’s advocates are] cynical grabs for power and wealth,” as the policymakers at issue clearly appear to be “animated by a genuine desire to improve the human condition” (Scott, 1998)—just as were the planning schemes described by Scott that failed so miserably in their goal to ameliorate man’s condition. Second, just like state-planned economies, it is hard to deny that pRRI is a top-down effort that comes from ‘visionary intellectuals and planners’—although those employed by the EC are not likely to be as ‘guilty of hubris’ as were Soviet economists or Brazilian urban planners (Scott, 1998: p. 342). Third, and perhaps most important, we can observe that both Scott’s cases and pRRI are rooted in the firm belief that scientific knowledge provides the firmest basis upon which policies can be built. For example, when looking at RRI as a vital element in the EC’s strategy to meet a contemporary grand challenge such as demographic ageing, it appears that the latter is targeted with an idea in mind of science and innovation as providing technical fixes. This focus might distract attention away from thinking about dealing with some of the challenges of demographic ageing through, for instance, a reorganization of labour policies. The latter could, for instance, entail such policies as cutting down working hours in order for working people to be able to take care of their elderly parents, or, on the opposite side of the spectrum, creating jobs especially for the elderly to keep them as engaged and fruitful members of society for longer parts of their lives.

Large and pertinent differences between Scott’s High Modernist projects and pRRI, however, perhaps weigh heavier than do the aforementioned similarities. We will discuss two of these. First, the European Commission and its Member States do not govern with the ‘stick-type’ authoritarianism we associate with the Soviet Union, for instance, and hence RRI is not catapulted at those who have a stake in R&I as were the aforementioned planning disasters. Instead of forcing scientists to engage in RRI, those working in R&I are rather induced into becoming more responsible, more in the way of carrots (Dix, 2014). Changing funding schemes<sup>10</sup> (e.g. Horizon2020, SWAFS, MVI, EPSRC and Vinnova) and instituting awards,<sup>11</sup> on top of raising awareness (e.g. through support acts like *RRI Tools*), are means through which RRI is spread.

A second difference has to do with (some of) the science(s) that so much trust is invested in. And this is where we can clearly discern the central tension constitutive of pRRI. For although hope for the improvement of man’s condition intrinsic to RRI concerns, to a large extent, life and natural sciences, the governance concept of RRI itself has its roots in various strands of academic thinking and doing that played no role in Brazil’s urban planning or Russia’s agricultural reorganizations. These include everything from STS to (constructive) *Technology Assessment (TA)*, from the science of science policy to *Ethical, Legal and Social Aspects (ELSA)* research and (more traditional) research ethics, and from the political theory of deliberative democracy to the science of science communication.

The variety of lessons pertinent to RRI that can be drawn up from these fields of research basically point in the same relatively restricted number of directions (which will be elaborated on in the next section).

- For normative democratic, substantial and instrumental reasons, diverse publics should be involved upstream in programming and performing R&I—even if *how* best to organize such engagement is not always a clear-cut issue (see e.g. Wynne, 1993; Owen *et al.*, 2012; Stilgoe *et al.*, 2014; Te Kulve and Rip, 2011).
- Responsible governance systems share responsibilities among a variety of actors, without thereby organizing irresponsibility (Beck, 1995: p. 24).
- On the one hand, governance of R&I should be robust and sufficiently familiar to be compatible with existing arrangements, and on the other hand, it should be adaptable to the unpredictable development and outcomes of R&I.

Arguably, taking on board all these lessons would capacitate one to bypass the mistakes of High Modernism in the context of science and innovation governance. Bruno Latour (2007) succinctly described what all those failures Scott that elaborated on have in common. In Latour's words, they failed because the 'common good' and the 'public good' were not supposed to be produced by experimental and carefully accountable procedures of inquiries. The 'public', the 'common', the 'disinterested' is supposed to be *by nature and once for all*, radically different from the 'private', the 'commercial', the 'selfish', the 'interested'. There are people who claim, because they are in the position of surveying those accounts, that they know what is for the public good without any *additional* empirical work of inquiry about the consequences of their remedies (Latour, 2007).

Part of the very idea of aRRI, of course, is that this mistake should be avoided. From the perspective of aRRI, doing so would entail more than just engaging various unusual suspects in, for instance, R&I agenda-setting, in research practices through midstream-modulation and for ensuring technology uptake or valorization. It would also entail that the very governance framework of RRI itself be opened up to the collective scrutiny of stakeholders in R&I. This would help secure that the public goods that RRI is supposed to serve emerge from empirical experimentation—instead of being presumed known. The tension we see here, though, relates to an often-observed democratic deficit in European policy-making, especially as concerned with so-called 'input legitimacy' (i.e., the democratic accountability of EU institutions to the electorate) (Pollack, 2015: p. 40). It is insufficiently clear how citizen or stakeholder consultation feeds into the decision-making processes that have determined that what is being captured under the rubric of pRRI indeed amounts to delivering socially responsive R&I. Put somewhat provocatively, pRRI is pushed onto the European R&I system and European community without clear indications that this is precisely what wide audiences of societal stakeholders in R&I consider the answer to the societal question for better R&I governance that, for instance, Eurobarometers have revealed.<sup>12</sup>

In the remainder of this chapter, this tension in pRRI will be further investigated. It will be argued, however, that also in the case of pRRI, things are not as bad as they might seem. On the contrary, the thesis will be defended that, if its proponents are to make RRI into a success, they should really nurture pRRI's essential tension.

### **pRRI's counterpart: aRRI**

At the basis of pRRI, we can identify the recognition that R&I not only offers solutions to the major challenges of our time, but at the same time creates new risks, dilemmas and concerns. This insight, however, is not as new as pRRI is. Since the 1960s and 1970s, observations along these lines have led to the proliferation of approaches attempting to take the societal and ethical aspects of science and innovation into account at increasingly earlier stages of the R&I process. Approaches ranged from an early warning system for negative impacts (Smits and Leyten, 1984) to more participatory forms of TA such as constructive TA (Rip *et al.*, 1995; Schot and Rip, 1997), real-time TA (Guston and Sarewitz, 2002), anticipatory governance (Barben *et al.*, 2008) and public and stakeholder engagement (Stirling, 2007; Wilsdon *et al.*, 2005). No less than is the case for aRRI, this is at the foundation of pRRI, too.

But although these initiatives have certainly opened up science and technology for public scrutiny, the focus has often remained on staging discussions regarding possible consequences of science and technology and facilitating the mitigation of their negative impacts. What aRRI offers, in addition to that, is a vision of R&I according to which the scope of assessing R&I should be much broader than such impacts alone.

Thus, not only in R&I policy but also in circles of scholars studying science and innovation in society, predominantly in Europe and the United States, RRI has become a hot topic of late. What distinguishes the RRI discourse from previous academic work concerning such matters as mentioned just now is its encompassing nature and 'activist' spirit: aRRI scholars build on lessons from a very wide variety of research fields pertinent to understanding the science and society interface and do so with the ambition not only of describing *what is*, but of truly making R&I more responsible.

A rapidly increasing number of scholarly accounts of RRI have been published since the term emerged on the scene. Scholars more or less continued the participatory-deliberative turn that was increasingly made from the 1990s onwards. RRI is sketched as a new governance framework to integrate ethical reflection, public engagement and responsive change (Stilgoe *et al.*, 2013). Recent accounts of RRI that have emerged in the scholarly literature involve a common set of interrelated features: (1) a focus on socio-ecological challenges; (2) active engagement of a range of stakeholders; (3) anticipation of problems, solutions and alternatives and reflection on underlying values, assumptions and beliefs; and 4) a willingness to be responsive, act and adapt (Stilgoe *et al.*, 2013; von Schomberg, 2013; Wickson and Carew, 2014).

What is also very clear in the aRRI literature is that it is fairly conceptual (e.g. Ribeiro *et al.*, 2016). Even when claiming to aid in making RRI more amenable to implementation, aRRI texts tend to a large extent to revolve around conceptual issues concerning, for instance, the concept of innovation (Blok and Lemmens, 2015) or the many meanings of ‘responsibility’ (Pelle and Reber, 2015). In that sense, such texts—and we do not necessarily claim to rise above them or provide an alternative to them with this chapter—run the risk of becoming, through their *disinterested* academic stance, *uninteresting* for policy actors or other change agents in the world of R&I.

The risk that this is indeed the case is probably further increased by the emergence of a veritable community of RRI scholars, for whom the development of ever-more nuanced, detailed and theoretically rich accounts of RRI has become something of an industry in and of itself, and which is perhaps best illustrated with reference to the installation in 2014 of the *Journal of Responsible Innovation*. The risk hereof is, of course, that aRRI never reaches the policy-makers, natural and life scientists, engineers, medical scientists and the like, whose R&I supposedly can and should become (even) more responsible, because the community of aRRI-ers is too busy with its internal communication efforts and associated quality standards. Indeed, although much of the aRRI work certainly strives to avoid the sterility that comes with too much disciplinarity—as witnessed by the journals of (applied) science that it is often published in (e.g., Pelle and Reber, 2015)—the possibility of the emergence of a distinct aRRI discipline sounds to us more like something that might jeopardize RRI than something that might accelerate its normalization.

### **pRRI versus aRRI**

As can already be tentatively gathered from the brief descriptions above, aRRI and pRRI can be seen as differently placed on a number of axes. Each of these will be briefly discussed below.

#### ***Top-down versus bottom-up***

Just looking at the chronology of publications that together make up the RRI discourse, one sees that RRI is pushed onto the world of R&I by policy much more than that it has emerged as a bottom-up movement by engaged scholars. Thus, the very idea of RRI, as an empty shell, can be said to have emerged as a topic for discussion in a somewhat top-down way. However, the same holds for the *contents* of the idea. For indeed, this form of top-down advocacy can also be recognized in the way in which what it means to do responsible R&I is elaborated in pRRI. For although in pRRI literature, inclusive and deliberative processes are also referred to when explaining what distinguishes RRI from R&I *simpliciter*, in the EC definition of RRI given above, it is manifest that pRRI already pre-defines that R&I should contribute to the EC’s keys if it is to count as RRI. In other words, to a reasonable extent, it is already beyond negotiation what the so-called ‘values, needs and expectations’ of the European people *are*.



Much of the aRRI literature is critical of both ways of top-down interventions. With regard to the first and more overarching issue, it has, for instance, been argued that through this mode of governance, the politics *of* and *in* deliberation are being neglected (van Oudheusden, 2014; Lövbrand *et al.*, 2010). aRRI criticism of the top-down push of the contents of ‘responsibility’ in the form of the EC-defined *keys*, which in fact are normative agendas beyond deliberation, will be discussed below.

Before we turn to that, though, a not-so-minor qualification concerning this way of relative placement of aRRI and pRRI is in place. For following the line of reasoning, section 4 ended with, it could well be argued, that aRRI is not at all a bottom-up alternative to the top-down approach to RRI that pRRI stands for. Rather, aRRI exists in parallel to the R&I that it studies and aspires to impact on. As it is, it is more in what it argues for than in what it factually realizes that much aRRI work can be described as bottom-up, and it would take (more) natural and life scientists, engineers and the like who *practice* RRI and write about it academically for aRRI to truly make aRRI pRRI’s bottom-up alternative.

### *Universalist versus contextualized*

In the policy literature, we see that a straightforwardly optimistic approach to RRI can be found, which simultaneously is very explicit and universalist about what it means to be responsible—see the definition of RRI cited in section 1. ‘Doing’ engagement, gender, open access, ethics and science education, in this view, is practicing RRI. Full stop. The pRRI concept of RRI gives us RRI’s constitution, so to say.

Central to many of the academic publications on RRI, on the other hand, is a critical analysis of what RRI is and what RRI might mean for the improvement of the responsiveness of the R&I system to societal needs or challenges. More than a once-and-for-all definition of what constitutes RRI, aRRI gives us ideas on what we should do to better understand the meaning of responsibility in the context of R&I. And indeed, this entails that, from aRRI, some criticism can be heard concerning pRRI. For instance, regarding the type of normative orientation often found in policy documents, Macnaghten and Chilvers. (2014) write that

Such attempts at universalism can produce unhelpfully thin normative frameworks which may mask, under the guise of universalism, culturally specific narratives regarding what the full range of stakeholders in different cultural contexts judge to be the aspects of innovation processes and outcomes that matter to them.

(p. 196)

The alternative would be to be more open and responsive to locally identified and prioritized needs in articulating what constitutes a societal challenge R&I should address and what constitutes the right way of doing so.

***In the making versus once-and-for-all***

A further way in which the internal complexity of pRRI plays out is that, with its once-and-for-all definition of what societal responsiveness looks like, it foregoes the fact that not only is scientific knowledge constantly changing, but so too are the societies whose values, needs and expectations R&I is supposed to answer to. With its focus on ways of organizing inclusive R&I processes, again, this is less visible in aRRI.

***Making sense of these distinctions***

Arguably, most of these discrepancies between aRRI and pRRI above can be explained in terms of two more parameters, along which the two can be differentiated—one somewhat philosophical, and one very down-to-earth. To start with the latter, it helps to see aRRI and pRRI as apart in terms of their focus point. pRRI is generally much more focused on *outcomes* or *impacts*, whereas aRRI acknowledges that the *processes* through which these are achieved are at least as important and indeed largely definitive of its success—at least insofar as the definition of what desired outcomes and impacts *are* should be part of what responsibly undertaken R&I processes lead to.

As for the more philosophical parameter: to make sense of these differences collectively, it helps to interpret them in terms of a distinction originally developed in the context of the history and philosophy of science to describe the different roles ‘things’ can play in an experimental system (Rheinberger, 1997)—i.e., we propose to rephrase this issue in terms of Rheinberger’s distinction between ‘epistemic things’ and ‘technical things’. These concepts were crafted in the context of Rheinberger’s investigations into the history and epistemology of molecular genetics, but arguably they are also suitable for understanding the science of science and innovation and the policy *concerning* science and innovation.

On first sight, epistemic things may appear simply as ‘things’ in the colloquial sense of the word—examples Rheinberger discusses include physical structures, chemical reactions and biological functions. Such things, however, are epistemic things only to the extent that they are defined by what has been called a “constitutive vagueness” (Klaassen, 2013). Epistemic things “embody what one does not yet know” (Rheinberger, 1997: p. 28), and in this role, they are the objects of scientific research and “have the precarious status of being absent in their experimental presence” (ibidem). This distinguishes them from the things of our ordinary life and experience.<sup>13</sup> As we see it, only as long as we agree that RRI, too, is only experimentally present will it be capable of living up to its promises. For that, its interpretative flexibility is more of an asset than an obstacle.

In Rheinberger’s view, something that at one point in time was an epistemic thing can come to function as a ‘technical thing.’ To make this happen, epistemic things have to become sufficiently stable—so stable that they can become part of the armoury of experimental systems. Temperature is a good example again: once a matter of much scientific controversy, its stabilized and standardized measurement later became a routine part of all sorts of experimental systems.

When epistemic things are sufficiently stabilized, they are no longer ‘unknowns,’ but rather become things about which all sorts of facts can be stated uncontestably. In the context of our present discussion, pRRI can be said to be used as a technical thing, albeit in the context of science governance rather than in science practice. As we have been arguing here, however, it is vital to RRI that pRRI continues to have to same constitutive and productive vagueness that characterizes epistemic things. Put differently, our suggestion is that in order for RRI to succeed as a governance framework for the promotion of environmentally, socially and economically valuable R&I, pRRI should never diverge too far from aRRI, because its own interpretative flexibility—in the sense elaborated above—is vital to RRI’s potential success. Even in its role as a technical thing, thus, RRI should still *also* continue in its role as an epistemic thing. Only then can it fulfil its role as a catalyst for continuous learning and a driving force of responsible R&I.

### **Releasing the tension**

In this section, we display how, in the FP7 project *RRI Tools*, we have attempted to get the most out of pRRI and aRRI by releasing the tension in our work towards a conceptualization of RRI. As a preparatory step, the next section first briefly describes the project.

#### ***RRI Tools***

*RRI Tools*, a support action funded under the European Commission’s Science in Society program of the Seventh Framework Programme, aimed to promote RRI among five different stakeholder groups involved in R&I—researchers, policy-makers, science educators, Civil Society Organizations (CSO’s) and business and industry. In order to succeed in doing so, *RRI Tools* built a toolkit with various types of instruments that can be used by these stakeholders in R&I to add the extra R of responsibility.

*RRI Tools* had a duration of three years, and in these three years it attempted simultaneously to preach RRI, and to practice what it preached. The project was carried out by a multidisciplinary consortium of 26 partners working in 19 so-called *hubs* and was overseen by an Advisory Board with members whose expertise immediately relates to the RRI keys identified by the EC. Every hub was active in one to three countries and together the 19 hubs covered 30 European countries. With a budget of 6.9 million Euro, the hubs advanced RRI and established a European *community of practice* that brought together people and organizations engaged in R&I.

It was *RRI Tools*’ task to provide stakeholders in R&I with tools for learning about and implementing RRI, and for training stakeholders in using these tools and in *doing* RRI. Theoretically, this could have meant that little more would have been done than setting up working groups to make an inventory of what tools were available for furthering the aforementioned RRI keys, and

to go on promoting and training on these. Although that would probably have been relatively simple, it is not all that has been done. Instead, *RRI Tools* itself tried—to the extent permitted by constraints, including the areas of manpower, time, capacities and project mandate—to engage in an RRI process, finding out about the path we were walking on as we went along. The next section illustrates this process.

***RRI Tools as an experimental attempt at understanding and fostering RRI, responsibly***

Four main steps characterized *RRI Tools*' methodology to find out what responsible R&I means in concept and in practice. Although these individual steps were largely taken consecutively, they allowed for an iterative trajectory towards our contemporary understanding of RRI.

The first step was to develop a working definition of RRI. An early version of the definition was the result of an extensive study of both policy documents and scientific literature on RRI at that time (i.e., 2013). The initially proposed definition combines ideas well-represented in Von Schomberg (2011) and Owen *et al.* (2012) and was optimized during meetings with consortium partners and experts in (aspects of) RRI, including members of our Advisory Board. It ran as follows:

Responsible Research and Innovation is a dynamic, iterative process by which all stakeholders involved in the R&I practice become mutually responsive and share responsibility regarding both the outcomes and process requirements.

*(RRI Tools, 2014)*

To give this definition more substance, we then identified four clusters of process requirements and a tripartite categorization of types of RRI outcomes, again based on both academic and grey literature as well as expert consultation. Box 4.1 presents brief descriptions of all four process requirements; Box 4.2 does the same for RRI outcomes. Especially in the third type of outcome that we distinguished, one recognizes that EC policy was taken very seriously in our work, as *RRI Tools* adopted the EC's prioritization of challenges that R&I should address.

As for the keys defined by the EC, our thoughts were that by classifying everything from ethics to gender and from science education to open access in one and the same category of key dimensions, the EC suggests that they all relate similarly to each other and to R&I, and that each should be addressed in a similar way. However, the keys defined by the EC differ from each other considerably. For instance, ethics is something that applies much more generically and structurally to R&I processes than does open access. The very predicate of *key* suggests that when doing R&I while taking into account the key dimensions, this will automatically lead to RRI practices—as if they are literally the key to unlocking RRI.

There is, however, little reason to agree on this. If one looks at science education, for instance, one immediately observes that communicating about and teaching science can be done, and in fact is often done, in ways that do not reflect the standards of and general motivation behind RRI. And gender is perhaps best thought of as something like a mind-set crosscutting RRI.<sup>14</sup> For these and comparable reasons, we think that the EC's keys are better thought of as *policy agendas*. Approaching them as such enables us to deal with the differences between them in a constructive way. That is to say, without equating RRI with the policy agendas, we can still recognize that they each have their own RRI potential, and are conducive to realizing RRI.

#### **Box 4.1 RRI's process requirements**

##### ***Diversity and inclusion***

Diverse and inclusive RRI processes call for the involvement of a wide range of stakeholders in all phases of R&I—from agenda-setting to implementation. Optimization of diversity and inclusion can be argued for on normative democratic grounds, instrumental grounds having to do with building public trust and acceptance of outcomes and impacts of R&I, as well as substantial reasons concerning R&I quality.

##### ***Openness and transparency***

Openness and transparency are conditions for accountability, liability and thus responsibility. This is, among other things, an important aspect for the public to establish trust in science and innovation.

##### ***Anticipation and reflexivity***

Anticipation concerns both understanding how the present dynamics of R&I practices shape the future, and envisioning the future. This enables R&I to act on future challenges. In order to act adequately and be open to changes in direction, reflexivity is also required. This reflexivity implies learning about the definitions of the problem(s) at issue, commitments, practices and individual and institutional values, assumptions and routines.

##### ***Responsiveness and adaptive change***

Responsiveness means responding to emerging knowledge, perspectives, views and norms. Responsiveness is a condition for adaptive change. RRI requires a capacity to change or shape existing routines of thought and behaviour but also the overarching organizational structures and systems in response to changing circumstances, new insights and stakeholder and public values.

## **Box 4.2 RRI outcomes**

### ***Learning outcomes***

RRI should lead to empowered, responsible actors across the whole range of our socio-technical systems (citizens, scientists, policymakers, NGOs, CSOs, educators, businesses and innovators). Structures and organizations where these actors function should create the opportunity for and provide support to actors to be responsible, ensuring that RRI becomes (and remains) a solid and continuous reality.

### ***R&I outcomes***

RRI practices should strive for ethically acceptable, sustainable and socially desirable outcomes. Solutions are found in opening up science through continuous meaningful deliberation with societal actors. In the end, the incorporation of societal voices in R&I will lead to relevant applications of science.

### ***Solutions to societal challenges***

Today's societies face several challenges. The European Commission has formulated seven 'Grand Challenges' as one of the three main pillars of the Horizon 2020 programme. In order to support European policy, R&I endeavours should contribute to finding solutions for these societal challenges, which are:

- 1 Health, demographic change and wellbeing
- 2 Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bio-economy
- 3 Secure, clean and efficient energy
- 4 Smart, green and integrated transport
- 5 Climate action, environment, resource efficiency and raw materials
- 6 Europe in a changing world—inclusive, innovative and reflective societies
- 7 Secure societies—protecting the freedom and security of Europe and its citizens.

Because the conceptualization of RRI should not only be appealing to experts in RRI but to all R&I stakeholders, the second step entailed that the proposed definition was scrutinized by a wide range of stakeholders during 27 Stakeholder Consultation Workshops held during the fall and winter of 2014 in 22 European countries, with a total of 411 participants.<sup>15</sup> From these workshops, we learned, among many other things, that many stakeholders required more practicable guidelines on how to operationalize RRI and that it should be explicated that RRI requires institutional and operational changes on many levels of action.

The third and fourth steps in our work on RRI were taken in close harmony, and to a large degree answer this need expressed by stakeholders during the workshops. These steps entailed the formulation of criteria for RRI process requirements in Deliverable 1.3 (Kupper et al., 2015a), making these much more accessible to work with, as well as a test for those criteria in the form of the composition of a catalogue of good RRI practices (Kupper et al., 2015b). As for the criteria, we again built on academic literature in the process dimensions we had identified in our working definition, inputs from the Stakeholder Consultation Workshops and feedback from *RRI Tools* consortium partners and from RRI experts in the Netherlands. The catalogue of good practices we built using existing R&I practices in Europe were already regarded as RRI by consortium partners and participants in the aforementioned workshops held across Europe. The guiding ideas behind this step were that lessons learned in these practices could help improve the proposed definition of RRI and that analysing promising and good practices in RRI could help the translation of abstract notions into practical standards, tools and training modules. The final catalogue of good examples of RRI practices also included analyses that fed back into our initial conceptualization of RRI. In Box 4.3, one finds a concise description of the methodology used to develop this catalogue.

### **Box 4.3 Building a catalogue of good practices in RRI**

#### ***Phase I: invitations***

In June 2014, a training on RRI for *RRI Tools*' Hub members took place. Here it was collectively decided that, as part of the work to be done towards the organization of the Stakeholder Consultation Workshops planned for the autumn of 2014, all workshop participants would be prompted to suggest what they conceived to be a promising practice in doing RRI. Also, the Hubs were asked to seek and suggest promising practices. Hub coordinators made a selection of about ten RRI practices that were described in some detail and sent to the Athena Institute for analysis.

#### ***Phase II: first selection***

Subsequently, the Athena Institute analysed the descriptions of the promising practices sent in and discussed these with the Hub coordinators who had made the initial selection. Based on process requirements and challenges covered, selections were then made in dialogue between the Athena Institute and the individual Hub coordinators. The selected practices were analysed more thoroughly using an online survey.

#### ***Phase III: data collection***

Hubs filled in an online survey for the selected practices using SurveyMonkey. The design of the survey was based on the working definition used in the *RRI Tools* project. Basic practical information about the practices was gathered, as well as anything relevant to estimate the practices' RRI-potential. E.g., the

relation to the EC keys was queried (i.e., ethics, gender, governance, open access, public engagement and science education). In many cases, Hubs used the survey as an interview guide and filled in the questions with the direct help of people involved in the specific practices (see annex 2). The survey was open from January 26th to April 30th 2015, during which 51 surveys were completed.

#### ***Phase IV: data analysis***

Analysis of the survey data proceeded as follows:

- a Structuring. To analyse the 51 received and completed surveys, the project details of the practices were ordered in a table: name of the practice, leading organization, country where the practice is implemented, language in which information about the practice is available, starting date, (expected) end date and type of practice.
- b Analysis. The good practices were analysed with regard to:
  - 1 Each of the four pairs of process requirements. For this, the quality criteria formulated for the process requirements in *RRI Tools Deliverable 1.3* were used. Each individual criterion of the process requirements received a mark representing any of the markings *business as usual, on its way, promising, good* or *exemplary*.
  - 2 The outcomes (i.e., learning outcomes, R&I outcomes and solutions to societal challenges). The three types of outcomes were valued in a similar way to the process requirements: *absent, formulated in the aims, explicitly addressed, reached* or *evaluated*.
- c Additional considerations involved in the final selection of practices:
  - 1 Whether or not practices (aim to) contribute to solutions for grand challenges
  - 2 The extent to which practices address both the research and the innovation component of RRI
  - 3 The level of information available.

To minimize researcher bias, four researchers were trained in advance of engaging in these steps. Each analysis was checked by one other team member. In the case of disagreement, analyses were discussed until researchers reached a shared interpretation. This collaborative analysis by four researchers from the Athena Institute resulted in the exclusion of 20 out of 51 practices.

#### ***Phase V: results***

Thirty-one practices were included in the Catalogue. Short summaries of each practice are provided herein, as are project details, most interesting lessons learned, their relationships with EC keys, grand challenges, process requirements and information about the outcomes of the practice. The texts and information presented in the Catalogue have been approved by the Hub coordinators and representatives of the good practices selected.



**Phase VI: analysis II—conclusion and discussion**

Several lessons were drawn from the analysis of this collection of practices. Most pertinent in the present context are the conclusions that practices do not (have to) incorporate all RRI processes and outcomes to be considered RRI, that soft skills are vital to engaging in RRI and that including only a pre-defined set of societal challenges as a criterion for societal relevance is too narrow.

The many analytical steps we went through as we took the steps elaborated on above have motivated us to slightly adjust our conceptualization of RRI. Also, discussions with the Advisory Board played into this, as the Advisory Board stimulated us to devote more explicit attention in our conceptualization of RRI to the keys the EC has identified as being central to it.

The core idea that distinguishes Responsible R&I from R&I *simpliciter* is that the starting point of the former is the realization that science and technology have an impact on the lives of all of us, and not just on those working in R&I or explicitly and knowingly using R&I for achieving their own goals. Given this realization, in RRI, R&I is done with an eye to *societal challenges*, and inclusive and deliberative processes to query what those challenges are and what values are at the basis of the required solutions to them are vital to this. In this sense, RRI stands for a kind of *democratization* of R&I, in which through so-called hybrid forums (Callon *et al.*, 2009) space is made for technical deliberation with stakeholders of all types.

Thus, as a result of the iterative investigative and analytic processes we have gone through in the *RRI Tools* project, we can now conceptualize RRI as

- a trait of the collectives involved in doing, implementing and, to an extent, using R&I
- that pertains to such collectives when R&I practices aim for *the right outcomes* (i.e., those that help solve complex societal problems) and
- on condition that those practices incorporate a certain measure of diversity and inclusion, deliberation, openness, anticipation and reflection, responsiveness and adaptive change and
- taking place in an environment that is conducive to responsible behaviour in the first place—i.e., an environment in which the policy agendas (or the EC's keys) are heeded.

RRI, in other words, is all about deliberating on ends, means and wanted and unwanted consequences of R&I among a wide variety of stakeholders, in such a way that R&I delivers ethically acceptable, environmentally sustainable and socially desirable outcomes and innovations, the implementation of which helps solve the challenges society faces. In this reconceptualization of RRI, the four dimensions of responsible R&I processes we classified earlier are still central,

as are the learning outcomes and ethical, sustainable and socially desirable R&I outcomes. But it is more explicitly acknowledged that RRI requires institutional and operational changes on various levels of action and that what constitutes socially desirable outcomes should not exclusively be specified in terms of the EC's Grand Challenges. What is socially desirable is something that inclusive R&I practices are to tell us, rather than something being decided up front. In this novel conceptualization, the EC's keys receive a more central place, too, be it that they are framed as policy agendas, the deliverance of which is conditional for engaging in RRI today, and that an open mind should be kept as regards other possible agendas that might emerge in the future. Each of the EC's keys gives us something like a normative baseline, a way of stating conditions that somehow have to be met on a systemic level in order for R&I to be able to take the shape of RRI, to become responsible throughout. But rather than implying that doing RRI equals furthering these agendas, this implies that furthering these agendas is a condition for truly responsible RRI processes to be practicable.

## Conclusion

The first public sign of EC support for RRI, according to Owen *et al.* (2012), ran as follows:

Research and innovation must respond to the needs and ambitions of society, reflect its values and be responsible... our duty as policy makers (is) to shape a governance framework that encourages responsible research and innovation.  
(Marie Geoghegan-Quinn, cited in Owen *et al.* (2012): p. 753)

In our view, this is a better conceptualization of RRI than the one that is now featured on the EC website. The reason it is so much better is that it is less specific and restrictive and more interpretatively flexible. Simultaneously, it succeeds in articulating the distinctive feature of RRI by stating that science and innovation are to have a positive impact on society and to be consistent with societal values if they are to be eligible for carrying the predicate 'responsible'. The interpretative flexibility characterizing the view of RRI given here suffers less from the tension that threatens to stymie pRRI—for this conceptualization leaves open much more space for defining what the needs, values and ambitions are which R&I is to contribute to. What we have argued throughout the chapter is that what the governance framework encouraging RRI should further specify are not primarily the ends that are supposed to constitute the solution to societal problems, but rather the means requisite to meeting those societal needs.

That being said, it has to be acknowledged that pRRI has much going for it. Its focus on impact, even if perhaps too much filled in qua substance, is certainly a strength. And the same indubitably holds for the institutional support it has. Nonetheless, we can only express our hope that the latter does not weigh in pRRI's advantage when it comes to bringing the interpretative flexibility thus far inherent to RRI to an end.

*RRI Tools*, on the other hand, could potentially play a pivotal role as regards the realization of RRI and in bringing interpretative closure. For indeed, given the functional role the EC envisioned for the project (i.e., providing the community of stakeholders in R&I with tools for thinking about and training and engaging in RRI), it is arguably in a better position than anyone else to do so. It is our hope that, if *RRI Tools* indeed proves to be capable of fulfilling that role, what will be implemented and become stable is an RRI that is itself construed as never more than the temporary product of a continuous process of experimentation, as something akin to a continuous and collective experimental learning process in which technical things will always also remain epistemic things. If RRI becomes what we envisage it to be, then it ought never to appear as a ship in a bottle, but always at best as one in the process of entering it.

## Notes

- 1 [https://ec.europa.eu/research/swafs/pdf/pub\\_public\\_engagement/responsible-research-and-innovation-leaflet\\_en.pdf](https://ec.europa.eu/research/swafs/pdf/pub_public_engagement/responsible-research-and-innovation-leaflet_en.pdf).
- 2 The Rome Declaration on Responsible Research and Innovation in Europe (2014) translates this to a call for action on many fronts. See: [https://ec.europa.eu/research/swafs/pdf/rome\\_declaration\\_RRI\\_final\\_21\\_November.pdf](https://ec.europa.eu/research/swafs/pdf/rome_declaration_RRI_final_21_November.pdf).
- 3 For instance, the MVI-funding scheme from the Netherlands Organization for Scientific Research comes to mind (with MVI standing for Societally Responsible Innovation).
- 4 Moreover, this is not the only tension in RRI. See MacNaghten *et al.* (2015, pp. 195–196) for the paradox of shared versus individual responsibility and their complex relationship with hierarchical distributions that RRI embodies.
- 5 <http://www.rri-tools.eu/>.
- 6 Although this article presents interpretations of how the *RRI Tools* project has been organized and what it has resulted in, its contents are not themselves a product of or mandated by *RRI Tools*. The authors of this article, though indebted to all they have worked with in the context of this project, take full responsibility for the claims made here. This especially concerns the conceptualization of RRI as it is presented at the end of section 6.
- 7 Again, see [https://ec.europa.eu/research/swafs/pdf/pub\\_public\\_engagement/responsible-research-and-innovation-leaflet\\_en.pdf](https://ec.europa.eu/research/swafs/pdf/pub_public_engagement/responsible-research-and-innovation-leaflet_en.pdf).
- 8 See <http://ec.europa.eu/programmes/horizon2020/en/h2020-section/science-and-society>; last accessed 27 November 2016.
- 9 See, for example, Lund Declaration 2009, Rome Declaration 2014 and EC 2015.
- 10 Horizon 2020 (<https://ec.europa.eu/programmes/horizon2020/>), SWAFS (<http://ec.europa.eu/research/swafs/index.cfm>), MVI (<http://www.nwo.nl/en/research-and-results/programmes/responsible+innovation>), EPSRC (<https://www.epsrc.ac.uk/research/framework/>) and Vinnova (<http://www.vinnova.se/en/>).
- 11 For example, the European Foundations Award for RRI: <http://www.rri-tools.eu/european-foundations-award-for-rri>.
- 12 See especially the ‘Eurobarometer qualitative study Public opinion on future innovations, science and technology’ (2015): [http://ec.europa.eu/public\\_opinion/archives/quali/ql\\_futureofscience\\_en.pdf](http://ec.europa.eu/public_opinion/archives/quali/ql_futureofscience_en.pdf) and ‘Special Eurobarometer 401. Responsible Research and Innovation (RRI), science and technology’ (2013): [http://ec.europa.eu/public\\_opinion/archives/ebs/ebs\\_401\\_en.pdf](http://ec.europa.eu/public_opinion/archives/ebs/ebs_401_en.pdf).
- 13 Moreover, they also differ from ordinary things in that they are constituted by what Rheinberger calls ‘experimental systems’ (i.e., the smallest unit in terms of which scientific research can be understood). Experimental systems, in turn, are built up of

technologies, techniques, tacit and explicit knowledge, assumptions, theories, skills and so on.

- 14 As many have argued, when keeping to the logic of pRRI, gender should perhaps be replaced by a more general notion of diversity, such that in addition to all the complex realities of gender, those of, for instance, social economic, religious, and ethnic diversity are also taken into account in R&I, both qua personnel and qua content.
- 15 Not only *RRI Tools*' working definition of RRI was discussed with participants of the workshops, but also any needs, obstacles and opportunities they envisioned in practicing RRI (Smallman et al., 2015).

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