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## Cataloguing the barriers facing RRI in innovation pathways: a response to the dilemma of societal alignment

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### ABSTRACT

Ribeiro et al. ("Introducing the Dilemma of Societal Alignment for Inclusive and Responsible Research and Innovation." *Journal of Responsible Innovation*. doi:10.1080/23299460.2018.1495033) argue for the concept of 'societal alignment' as a new frame for the challenges associated with integrating RRI practices into science and technology innovation systems. The authors mention some of the barriers to integration in public and private sectors. Here, we pay greater attention to the less optimistic side of RRI by exploring the barriers in more detail and organizing them according to multiple levels and stages of innovation. We then argue that our scholarly RRI community should lower its expectations for RRI and societal alignment, while increasing its understanding of innovators' biases and the organizational and political limitations that are very likely to persist. In conclusion, we recommend a larger focus on documenting, identifying, and developing collaborative, realistic and practical approaches for RRI to address the barriers while not compromising on fundamental principles of inclusion, anticipation, reflexivity and responsiveness.

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## Introduction

Ribeiro et al. (2018) discuss the challenges of 'societal alignment,' an objective to achieve a match between the goals of science and technology innovation system actors and those of diverse publics. First, they distinguish societal alignment from the dilemma of social control of emerging technologies presented by Collingridge (1980). This dilemma is more narrowly focused on our inability to predict outcomes associated with emerging technologies in advance of their deployment and before they become locked into a society. The authors view social control and its dilemma as a problem addressed primarily by technology assessment (TA), which, at least in its early form, was conducted under formalized expert and regulatory institutions. In contrast, Ribeiro et al. view societal alignment within the realm of RRI.

Their piece considers institutions and organizations under which societal alignment should take place, using the broad categories of public versus private sector science, technology and innovation. Although their piece raises important challenges about integrating engagement within private and public sectors of R&D, we believe the authors understate

the barriers, especially when one considers science and technology policy domains that operate under high sociopolitical controversy. For example, they state that their preliminary survey results (with EU-funded researchers) suggest that in public sectors of innovation, such as academe, there is a 'rather low degree of tension' between 'outward-looking aspirations' such as openness and transparency, sustainability, public engagement and ethics in research, and the 'inward-looking rationales of the scientific community' (Ribeiro et al. 2018, 9). In contrast, our results studying US biotechnology stakeholders and their attitudes towards RRI reveal significant resistance to key concepts of RRI in both public and private sectors.<sup>1</sup>

As an example, we found that academics as a group were the most hesitant about the concept of responsiveness from RRI (Stilgoe, Owen, and Macnaghten 2013). The attitudes expressed by academics were typically defensive in nature and primarily centered around the notion that too much credence given to those outside of the scientific community threatens the ability of academic scientists to be able to conduct meaningful and necessary research. As one academic scientist in our study stated

responsiveness is where I have – I see the potential for that having a troubling outcome. Because as long as attitudes are changing in directions that we find favorable responsiveness is fine, but what if they take a left turn and suddenly we're in a place where things that we find valuable or even critical are completely dismissed as a non-priority?

Societal alignment via responsiveness is likely to face greater hurdles than anticipated when views of direction and control differ between those within and outside of the scientific community.

On the other hand, the authors do briefly acknowledge some meso-level institutional barriers as important for embedding RRI: lack of recognition, resources, the interests of public and private research funders, as well as the way through which 'narrowly defined commercial interests can prevail over societal concerns in research agendas produced by collaborations between public research organisations and the private sector' (5). Yet, they do not categorize or systemize these problems as a goal of the paper. Therefore, in this response, we propose a few ways in which barriers to implementing RRI practices can be classified in order to further explore a less optimistic, but we hope more effective, approach to RRI and engagement.

From our work,<sup>2</sup> we find that certain components of RRI seem easier or much more difficult to implement within certain stages of innovation, so this response piece pays greater attention to innovation pathways and barriers at specific stages of innovation. We organize our catalogue of barriers along micro (individual), meso (institutional) and macro (sociopolitical and macroeconomic) levels and in terms of classic stages of innovation. As we will illustrate below, our research is finding significant misalignment of public goals with research, technology and innovation systems at all these levels, whether in public or private sectors. Before exploring barriers along these two dimensions (stages and levels), to set the stage, we first consider the authors' concept of 'societal alignment' and its relation to RRI, and then briefly describe stages of innovation.

## **Societal alignment and RRI**

Ribeiro et al. present societal alignment as a complementary dilemma to social control and a way to study RRI. To us, in the piece, the relationship of societal alignment to RRI was

not as clear as the difference between it and the dilemma of social control. We see the concept of societal alignment as an important *goal* of RRI and embedded within all elements of RRI, such as inclusion, responsiveness, reflexivity, and anticipation (Stilgoe, Owen, and Macnaghten 2013). For example, the goals of science, technology and innovation will align with a society's goals if public voices are included at various points in innovation systems (inclusion), if researchers are responsive to these voices (responsiveness), if all parties to the dialogue reflect on what they are hearing from their own and other's voices (reflexivity), and if we implement these three elements in envisioning outcomes of technology long before technological lock-in (anticipation). The elements of RRI seem to us best used as *methods and processes* by which to achieve the *goal (or overcome the challenge)* of societal alignment. Therefore, we find that framings along the lines of the *processes* of RRI shed more light on the barriers to be overcome in efforts to achieve it. In contrast, societal alignment is often treated as an outcome or set of *evaluation criteria* by which to judge whether RRI has worked (Pellé 2016). This is unfortunate in our view as it downplays barriers and invites overly optimistic expectations for achieving RRI. Therefore, in exploring some barriers to RRI (below), we utilize the four elements of RRI described in Stilgoe, Owen, and Macnaghten (2013).

## Innovation pathways

The development of innovation models is a complex and active area of research. Sometimes the models are framed according to the roles and responsibilities of the actors (Markard and Truffer 2008). For simplicity in discussing RRI, we use a temporal pathway model of innovation in which the roles, powers, and responsibilities of actors vary. Key actors holding power change over time and through each stage (although RRI strives to open each stage up to more actors through inclusion). Technological processes and products are represented as coming to be through a combination of funding (may occur iteratively throughout cycle, but is needed upfront), basic research and discovery, applied research, product development, regulatory approval, marketing and monitoring. Although these are iterative stages which often overlap, for illustrative purposes, we consider each separately to highlight barriers to RRI that actors experience at certain points within innovation pathways.

## Recognition of barriers

Different technologies may present unique challenges to RRI as a process and societal alignment as a goal. In the area we are investigating in a current RRI project,<sup>3</sup> US non-medical biotechnologies, there is a historic atmosphere of distrust among public, regulators, innovators, and stakeholders. In our research,<sup>4</sup> we have found barriers to RRI at each level of innovation: with respect to fundamental philosophical differences that actors and stakeholder hold (micro-level); within organizational structures of innovation systems (meso-level); and relating to the larger political, economic, cultural, social contexts (macro-level). These not only challenge but also prevent the expression of RRI principles and processes (and thus contribute to the dilemma or lack of societal alignment that Ribeiro et al. discuss). Below we provide a modest start to categorizing some of these barriers according to the stage of innovation and level of organization.

## Research stages

The upstream researchers that we have studied – whether doing basic, discovery, or early applied-development work – express several concerns about the social science definition of RRI. Summary definitions of the four elements of RRI from Stilgoe, Owen, and Macnaghten (2013) were presented to our focus group and survey participants.<sup>5</sup> These concerns by upstream researchers were most heavily directed towards elements that relinquish control to those outside of their research networks. For example, many worry that if RRI was a mandate for funding programs (a meso-level concern), it would result in onerous restrictions on their work at early stages that ultimately would prevent important, downstream innovations from benefiting society (macro level). Most argue that they simply cannot be responsive to societal concerns given that the technological products are not yet specific, nor can they anticipate downstream impacts if the applications are not envisioned. Some also believe that any delay to the innovation process at this stage, due to for example public engagement or anticipatory activity, puts them at a competitive disadvantage nationally and globally (macro level). Furthermore, funders do not typically provide the flexibility in research projects for innovators to respond and change research directions (meso level), and graduate students who rely on certain streams of research cannot suddenly change course in a socially responsive manner without peril to their progress and ultimately their careers.

In addition to these meso- and macro-level concerns and barriers, at the micro or individual level, many technology researchers hold the view that their work is too complicated for the public to understand and therefore it is dangerous to give the public anything but a nominal role when it comes to deciding what technology is worthy of pursuit. One of our study participants expressed dismay at public responsiveness:

We think we need to go ahead (with the technology), we need to do this, this is something that really could be a great thing to do, but I don't know if we can – I don't know if the public will like it, so we better not. So, forget about it. We just won't do it. Is this what science is all about?

We find this bias is widely prevalent among innovators in academe or industry, especially in the contentious domain of agricultural biotechnology. At the research stages, in both public and private sectors, a significant number of researchers see the social science conception of RRI as infeasible and potentially hazardous to careers, technologies, and ultimately society. These fears were expressed as a need to keep the 'purity' of research, as in one participant's remarks: 'major advancements in technology are driven out of academic research and handcuffing academic research is irresponsible.' The threat posed by the inclusion of non-expert voices was expressed as follows:

To restrict in anyway scientific advancement on an academic scale seems wildly out of place to me. It is a slippery slope and getting into impeding scientific advancement when you don't even understand or care about what the applications are yet is very dangerous.

By comparison, Glerup, Davies, and Horst (2017) find rather that RRI is perceived as 'irrelevant' to the researchers in three countries they studied.

## Development

Typically, product development is centered more in the private sector. However, the lines between academe, government and industry have blurred, especially in the USA since the passage of the Bayh–Dole and Stevenson–Wydler Acts in the early 1980s. Since then, universities have become more aligned with profit motives through intellectual property protection (Slaughter and Rhoades 2004; cf. Glerup, Davies, and Horst 2017). With the recent downturn in percent funding for American universities at the state levels, these universities are also seeking more company donations or contracts. Academic glory in the eyes of many university administrators is bestowed upon faculty who bring in a lot of money, and the business model is taking over in the public sector. Universities also align themselves with the private sector in helping to develop and test products at the stage of technological development.

At the macro level, some biotech innovators see RRI as standing in the way of the economic realities of universities and the private sector. For example, investments in product streams may be jeopardized by opening up the dialogue to public (inclusion) and responding to concerns (responsiveness). These attitudes consider non-expert voices not as a source of ideas, but rather as potential opposition that may put investments at risk. Investors may see early, negative publicity (via national media) as an indicator of future public rejection of the technology and pull the plug on investments in R&D. As such, innovators often see it preferable to keep plans for their inventions confidential to reduce such risk.<sup>6</sup> There is a significant fear of asking the questions associated with RRI (reflexivity) and being transparent about processes, which could open the door for NGOs and advocates to criticize products prior to market, possibly derailing downstream acceptance and laying waste to the years and resources spent to research, envision, and develop product prototypes.<sup>7</sup>

At best, RRI provides unnecessary hurdles that delay the process of translating R&D to marketable products. With venture capital investments, certain time frames and returns on investment are expected (meso-level). Their accountability to their investors or shareholders is of primary importance and trumps implementation of RRI processes, which is seen as a hindrance to meeting investor time goals.<sup>8</sup> It seems that the more RRI can be aligned with these timeframes, while not sacrificing the quality and level of engagement, the more salient it will be to innovators and investors.

## Regulation

Anticipation of regulatory systems is a core of industry efforts at early stages of product development, but any anticipation of socioeconomic harms or indirect harms outside of government regulatory mandates are seen as unnecessary hurdles that will cut into time and resources and lead to lower profits (meso level). After product prototypes are developed, they must be tested and if they fall in a category with pre-market regulation, submitted for regulatory review. Here, the actors with power are generally government staff and product developers (typically in the private sector with resources to develop regulatory packages).

In our research, we found that government representatives were more open to the processes associated with RRI; however, they feel constrained by legal mandates and resources

(meso level). They do not want to exceed their authority for fear of backlash from the industry (macro-level). Industry stakeholders wield significant power over Congressional oversight and appropriations committees (which can feedback to further limit the agency's resources and authorities) (macro level). So, although at the micro-level government staff might see their mission as aligning technologies with society (at least as far as safety and environmental impacts) and recognize that their jobs are accountable to all taxpayers (stakeholders and public), the macro-level political pressures and meso-level institutional mandates prevent inclusion in regulation (beyond comment and rule-making in the Federal Register), responsiveness ('you can't stop' technologies which exhibit impacts outside of the direct health and environmental outcomes under their purview), reflexivity (insufficient resources to create time and space to reflect due to time pressures of approval processes), and anticipation (they receive products already developed and therefore are 'late-to-the-game'). The private sector also often requires regulators to protect confidential business information during regulatory review, preventing meaningful dialogue and broader public inclusion in biotechnology governance (Meghani and Kuzma 2018).

### ***Post-deployment and marketing***

Once a product is on the market, there seems to be less resistance to implementing some facets of RRI, especially inclusion and responsiveness.<sup>9</sup> Letting people know of the technology's existence on the market, even if it comes with some consumer backlash, has lower risk jeopardizing continued development. For example, there is not much formal, post-market monitoring for biotech products, and a high burden of proof exists to remove products from market if any concerns arise. Also, innovators and developers may see inclusion as a way to control the narrative and inform people about the technology's availability and benefits. Collingridge's dilemma comes full circle and the technology becomes locked-in: products are difficult to recall, money has been invested into the technology, and other societal systems may come to rely on those products to operate (macro level). Responsiveness might come in the form of adjusting the technology to better fit user or consumer desires, rather than stopping the technology outright due to fear of rejection.

Product stewardship plans and consumer choice allow for a minimal level of responsiveness (if consumers are aware of the technologies through labeling or identification) at meso and micro levels, respectively. Otherwise, at the macro level, there is no space or place to consider how the impacts of the technology are manifested or will occur (anticipation), include the public in discussion and evaluation of the technology (inclusion), reflect on the motivations and outcomes of the technology, and respond to the concerns and desires of the dialogue and engagement (responsiveness).

Macro-level barriers at all innovation stages are perhaps the most difficult to overcome, as they influence all actors and points of technology research and development. The macro-level context of innovation in the USA and most developed countries arises out of a conglomerate of individual biases at the micro-level (e.g. hierarchical and individualistic worldviews) feeding a market capitalism and neoliberal governance paradigm (Meghani and Kuzma 2018). Anything challenging this paradigm, including additional time and resources for incorporating RRI, seems not to be welcome according to the results of our studies<sup>10</sup> and experiences.<sup>11</sup>

## Towards a more practical RRI

For the reasons above, based on our knowledge of the US biotechnology innovation case, we propose that at least in the short-term that RRI scholars more generally lower their expectations for innovation systems, so that our collective efforts to help translate RRI into practice are not immediately dismissed by innovators and regulators. Rather, we suggest refocusing the RRI agenda on continuing to develop effective tools, concepts and approaches that are tailored to the specific innovation system contexts – including levels, stages, vested interests, and institutional dynamics – those challenges we briefly outline above. What elements of RRI can more readily and feasibly be incorporated into different stages of innovation and at various levels of action? While there is certainly merit in continuing to imagine the ‘ideal RRI’ as so many articles already do, we encourage the broader community to also make room for a ‘practical RRI.’

Although we make no claim to having solutions to the significant challenges of implementing RRI, a starting point would be to take stock of what we already know how to do. Thus, one step would be to catalogue both successful and unsuccessful projects and approaches for including innovators and regulators in co-constructing RRI for practice. The RRI Tools project is a rich source of practical approaches (Groves 2017). The RRI scholarly community has already made notable attempts to contextually specify and collaboratively implement its principles of inclusion, responsiveness, and anticipation using Constructive TA (Greiving-Stimberg, Robinson, and le Gac 2016), Socio-Technical Integration Research (Flipse and van de Loo 2018), Value Sensitive Design (Van den Hoven 2013), and other established approaches. We laud efforts that specifically deploy such tools to help stakeholders within specific technology sectors and innovation pathways identify and address the barriers to RRI and construct RRI models that will work for them (for example see Decker et al. (2017)), as well as attempts to reconceptualize the fundamental practices of RRI in light of specific contexts and their challenges (for example see Wickson and Carew (2014), Demers-Payette, Lehoux, and Daudelin (2016), and Tait (2017)). At the micro level, Bardone and Lind’s (2016) conceptualization of RRI emphasizes that it is ‘ultimately a form of taking care’ with regard to one’s own research and innovation and is expressed through an individual’s discretion and judgment. In practice, this likely means allowing the application of RRI and what constitutes RRI to be defined situationally within different technological areas and at different stages of innovation. Of course, RRI scholars should not dispense with their calls for achieving societal alignment across all stages of innovation. But for now, we need to help innovators place these practices at appropriate and realistic points along the funding, research, development, regulation, and marketing pathways.

Research and innovation are processes undertaken by individuals as much they are by greater organizations and institutions, and successful applications of RRI require congruence among all three levels. Fundamentally, we would agree that if RRI is to become a part of the research and innovation process, it requires ‘internalization of the normative ambitions and orientations of increasing the public value of research’ (Ribeiro et al. 2018, 8). Given the known imbalances between those within and outside of the research and innovation process, it seems prudent to focus on obtaining a ‘buy-in’ from those within rather than attempting to impose guidelines and practices from the outside. We should continue to work on grounding the elements of RRI within the specific temporal and structural



contexts of real innovation pathways. These pathways are as diverse as the technologies themselves, and RRI must therefore continuously adapt and apply its principles to this kaleidoscope to achieve the ‘societal alignment’ that Robeiro et al. suggest. By confronting the barriers to RRI head on, in partnership with skeptical innovators, and without compromising on its fundamental elements, we have a better chance of meeting society’s expectations and values with technology.

## Notes

1. We are in the third and final year of the project “Comparing Cultures of Responsible Innovation across Bioengineering Communities” funded by the National Science Foundation Cultivating Cultures of Ethics program. We have conducted focus groups and surveys on attitudes towards RRI with over 100 stakeholders from biotechnology innovation systems coming from five sectors: academe, industry, government, NGO consumer groups and NGO trade organizations. For more information, see <https://research.ncsu.edu/ges/research/projects/cce-stem/>. We are currently analyzing and writing up the results from the project. This piece is informed by our preliminary analysis of the quantitative and qualitative data.
2. See Note 1.
3. See Note 1.
4. See Note 1.
5. See Note 1.
6. These observations come from the lead author’s experiences of being in the biotechnology community for nearly three decades as an innovator, researcher, risk assessor, and policy scholar and of hearing these attitudes expressed first hand.
7. See Note 2.
8. See Note 2.
9. See Note 2.
10. See Note 1.
11. See Note 2.

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