Chapter 4
Organisational Barriers for RRI

Abstract   In this Chapter, we give an overview of structural, cultural and interchange related barriers to implementing RRI in organisations, using a framework derived from neo-institutional theory. We discuss barriers related to different types of organisations, such as research funding and research performing organisations. Finally, we provide overall reflections on the role of barriers, and discuss how barriers to RRI intersect.

Keywords Responsible research and innovation · Structural barriers · Cultural barriers, interchange related barriers · Implementation · Neo-institutional theory

Organisational barriers are those that hinder or work against the uptake of RRI in organisations, and make organisational members reject or de-prioritise the relevance of RRI. The country reports each discuss barriers to RRI for both the keys and process dimensions. Although we have coded barriers for each aspect of the RRI concept, our concern here is the barriers across keys and dimensions, grouped as structural, cultural and interchange in accordance with the theoretical underpinning of our study.

In this section, we address the research questions:

1. What are the barriers across the RRI keys and dimensions?
2. What is the interplay between barriers that are structural, cultural or interchange related?
3. How do barriers relate to research funding and research performing organisations respectively, and what are the differences?
4. How do barriers relate to small and large organisations?
5. How do barriers relate to fields of research and funding?
6. How do barriers relate to groupings of countries?
7. From an organisational perspective, does use of RRI as a phrase make a difference, and how?

4.1 Structural Barriers to RRI Keys and Dimensions

Structural barriers to the adoption and successful use of RRI in organisations are plentiful in the country reports. Whether more prominent or just easier to identify, structural barriers are the dominant reason for hindering the uptake of RRI in organisations, both for funding and research performing organisations. These include:

- Lack of resources (money, time, people, training, expertise).
- Lack of incentives.
- Lack of strategies, policies, frameworks, systems, and formal structures supporting practices pertaining to the aspect of RRI.

While all of these are important, the lack of resources, combined with the lack of incentives seems particularly potent as a barrier. For instance, for large universities, perceived pressures for high profile publications, lack of resources, and lack of (other) incentives (than publishing) seem to severely cripple attempts to engage staff in ethical reflection, public engagement, science education, as well as all the process dimensions. An additional theme is that of fragmentation: fragmentation within organisations and fragmentation of the RRI concept. We discuss the former first, although there are overlaps between the two categories. Fragmentation of organisations has dimensions that include: the lack of dedicated organisational units dealing with RRI or aspects of RRI; the use of non-standardised guidelines and procedures for aspects of RRI within the organisation (most prominent in the case of ethics); disparate programmes with lack of coordination (also within one key); and unclear mandates. RRI aspects that require formal procedures of compliance—such as the Openness and Transparency dimension, and the Open Access and Open Science, as well as the Ethics keys—are often troubled by bureaucracy, a barrier prominent for research funders and research performing organisations alike. Such findings are hardly surprising in professional bureaucracies with many operationally independent departments (and institutes) and a large and fragmented operational apex (Mintzberg 1979). Paradoxically, this barrier can also be a driver, because it allows for dedicated change agents in various units of the organisation to pursue an RRI agenda without the bureaucratic rigidities and strict policing imposed by central administrations.

Structural fragmentation is also a feature of RRI implementations because RRI is an umbrella concept with many institutional homes; there are few centralized RRI offices in organisations, even if there are organisational units for gender issues, outreach, ethics, etc. This fact can render RRI relatively invisible in organisations and do result in little coordination between separate initiatives. A final structural barrier is that the RRI concept, cutting across keys and dimensions, has a long-term perspective, with short-term results that are difficult to trace and document. This is particularly noteworthy, as research on diffusion maintain that lack of clear results—or the ability to track these—are connected to poor diffusion of innovations (Rogers 2003).

4.2 Cultural Barriers to RRI Keys and Dimensions

Cultural barriers represent the second largest group of barriers, often seeming to work in unison with structural ones. However, aspects of academic culture, prominent in both research performing organisations and organisations funding research, *also exhibit drivers* for RRI that are often *closely related to the barriers*. The most prominent cultural barriers across the keys and dimensions are:

- Lack of knowledge and awareness.
- RRI seen as an add-on, rather than as a central activity of the organisation.
- Classic academic values of autonomy and merit that operates in tension with RRI.
- Ingrained ideas of innovation that operates in tension with RRI.
- Perceived lack of clarity in the RRI concept.

The first group of barriers (lack of knowledge and awareness) requires little discussion but is likely to affect the perceived relevance of RRI. In short, the message of what RRI is, and what could be facilitated through the concept, is unclear for most of research funding and performing organisations, outside a limited group of dedicated stakeholders close to EC science policy. Adding to this barrier is the problem of lack of concept clarity that may hamper diffusion, particularly to the academic community, alongside a perception that there exist a number of other concepts that may be doing the same work, such as sustainability. This is particularly pronounced in the case of the ethics key, where other competing concepts include integrity, honesty and responsibility.

With respect to lack of concept clarity, conceptual ambiguity or interpretative variability is generally an important driver for the diffusion of management innovations, as such characteristics enables disparate actors to interpret the concept in line with their own interests (Giroux 2006; Benders and Van Veen 2001). Competing concepts though, can operate as a barrier for the spread of a particular concept, if these other concepts (come to) dominate the public discourse (Thawesaengskulthai and Tannock 2008; Abrahamson and Fairchild 1999). However, plural concepts that draw attention to closely related practices (e.g. sustainability, accountability, integrity, RRI, etc.) also help guide attention to those practices or family of phenomena and should aid the development of organizational practices that support 'de facto rri.' In sum, many concepts pointing to the same types of practices suggest institutional pressures to adopt models of management that accommodates ideas and techniques theorised as core to these concepts (cf. Guillén 1994), whereas competing concepts pointing to disparate organisational practices divert attention. We suggest therefore, that the underlying cause for the barrier discussed (lack of concept clarity), may be perceived lack of relevance, coupled to (misguided) perceptions of RRI as a 'science concept' rather than a mapping of elements which constitutes responsible research and innovation as a practice. The five keys and four process dimensions suggest that RRI practiced has multiple aspects, which are only adequately captured as an umbrella concept (cf. Bort 2015; Hirsch and Levin 1999). Speaking in the language of statistical analysis, RRI is an index for good research and innovation behaviour, not one factor from

a factor analysis uncovering how researchers on average think about good research and innovation behaviour, or rather one particular aspect of it. Notwithstanding these considerations, it is clear that the disparate character of the RRI concept has consequences for its application in practice, as has the differing ways of operationalising RRI across organisations. We discuss this further below.

Two cultural barriers that reinforce the perception of RRI as an add-on to core activities, lies in dominant ideas on academic excellence, and dominant ideas on innovation. On the former, traditional ideas of academic excellence centre on pure curiosity-driven research, the discovering of new knowledge, and the pursuit of truth. According to this model of science policy, examined in more depth in Chap. 6 under the 'linear model' label, lies the idea that the research process governed internally by an autonomous scientific community, unhindered by external agencies or stakeholders (such as ethics boards or governments), which are seen to curb scientific freedom to pursue truth and progress. This reasoning means that science is an activity judged predominantly from the viewpoint of scientific merit, where merit is the discovery or generation of new knowledge. In some countries, particularly those where academic freedom is taken as a given, there is fear that RRI may give governmental bodies a pathway to unduly influence science and possibly science outcomes.

Similarly, dominant ideas on innovation as the driver of progress (Rogers 2003) question if innovation needs to be directed or curbed, with assumptions that economic progress can be related to societal progress and that the marketplace can be trusted to respond adequately and appropriately to societal needs. Curbing the creativity and engagement of the individual, according to these narratives, are likely to hinder progress and economic development (Schumpeter 1983). These two narratives imply that RRI activities should be divorced from research activities, and from the innovation process, and left to other actors, if pursued at all. According to these narratives, RRI is an add-on, a bureaucratic burden. Likewise, some reports mention RRI as a 'luxury' in the face of resource constraints experienced.

These broad streams of cultural barriers to RRI have consequences for multiple keys and dimensions. First, seeing science as driven solely by narrow criteria of excellence (for example, prioritising high impact factor peer reviewed journals) can be in tension with initiatives aimed at aiding women to succeed in fields where they may be at a structural disadvantage. Second, the Anticipation and Reflection and the Ethics key are at times turned into 'check-box' activities, or are outsourced to ethics boards, thus reinforcing their perception as administrative burdens. Many of the keys and dimensions are seen as potential threats to the autonomy of science. Their representation as add-ons helps ensure that RRI aspects do not become integrated into science practice. Other cultural barriers viewed as important across keys and dimensions are:

- De-coupling effects.
- Low buy-in from the 'older generation.'
- Lack of managerial support.

The barriers discussed above seem to lead to de-coupling effects under some circumstances. This is prominent in the Ethics key, and its intersection with the Anticipation and Reflection and the Responsiveness and Adaptation dimensions. For instance, decoupling occurs when compliance with ethics frameworks becomes a matter of box ticking or when ethical reflection is outsourced to external bodies, rather than undertaken by the researchers involved. Some reports explicitly mention a concern with organisational image as both a driver and a barrier. Such concerns may lead to superficial treatment of RRI aspects internally (to the extent that constitutes non-adoption), while broadcasting the use of the very same aspect externally. This is a dynamic well established in institutional theory (Brunsson 1989; Meyer and Rowan 1977). Finally, a number of reports mention a lack of managerial support, with little buy-in from older generations of researchers, and a heavy focus on other concepts (such as scientific excellence) deemed more important.

4.3 Interchange Barriers to RRI Keys and Dimensions

In the group of interchange related barriers, the role of funding organisations, their requirements, standards and systems as well as national policies and expectations— or lack thereof—figure prominently. We discuss the role of funding organisations (including the EC) as a salient element in the environment of research organisations in the section on key findings in the study. Across RRI keys and dimensions, we find the following interchange barriers pronounced in the national reports:

- Lack of policies and clear mandates.
- Lack of clarity in various ways.
- Lack of perceived interest and pressure from the public and political field (including translation issues).
- Organisations not held accountable.
- Privacy and commercial interests.
- Other concepts dominate the public discourse (e.g. accountability or sustainability).

Lack of policies and clear mandates supporting RRI is widespread according to the reports and pertains to both research funding and research performing organisations. In some cases, disparate frameworks used by funding organisations (or across the same funding organisation) seem to alienate the researchers applying for funds and fuels a lack of clarity on what the key or process dimension is supposed to mean. In other cases, national legislation or other policy documents are at odds with each other, or mandates are unclear. Judging from the reports, it appears that national legislation and policies generally are rather fragmented, and often fail to address broader systemic issues in the science and innovation systems as these are understood according to the RRI concept. Across keys and types of organisations, it seems to be

the case that organisations are often not held accountable by national authorities on RRI aspects (keys and dimensions).

A group of barriers relate to the perceived lack of interest and pressure from wider environments of the organisations studied, including both structural and cultural aspects of the environment. For instance, many reports mention that the wider public is perceived as uninterested in what organisations do on science education, on the process dimensions, and on ethics. In some cases, even the national discourse on gender equality may seem to suggest that the broader public find this topic rather superfluous in today's society. In other cases, there are few external pressures, such as dedicated policies or funding schemes, that prioritise aspects of the RRI concept. This seems to be a broader systemic issue across the keys and dimensions. Likewise, national legislation in some cases changes rapidly, complicating compliance, and leading to confusion, or may not be in place at all. Lack of incentives also figure prominently across keys and types of organisations. In the interchange dimensions too, a lack of integration seems dominant. For instance, collaboration in the science system usually do not include the RRI keys or dimensions.

A further interchange related barrier is the general problem of translation. Either good translators of science to broader audiences are unavailable or not sufficiently skilled, or the translation of science to broader audiences is conceived of as difficult. This is pronounced in science education, but also appears as a barrier in other keys where communication to broader audiences outside the science field is required, such as public engagement and some of the process dimensions. As discussed in the section on cultural barriers, it is mentioned in several country reports that other concepts, such as accountability or sustainability, dominate the discourse (here the public discourse), leading to less emphasis on the RRI label. Finally, privacy and commercial interests curb development of several keys and dimensions. For instance, such interests at times create issues in relation to open access, as well as to the dimension Openness and Transparency. In general, such concerns are raised in connection with other public engagement types of activities, and where process dimensions (Responsiveness and Adaptation and Anticipation and Reflexivity) can support such types of efforts. Below, we discuss in further detail how barriers relate to the aspects of RRI overall in the study.

4.4 Interaction of Structural, Cultural and Interchange Related Barriers

Structural, cultural and interchange related barriers interact. In many cases, they mutually reinforce each other, thereby gaining strength. In some cases, barriers are both structural and interchange related, and in conflict. For instance, this happens when national legislation against differential treatment of groups leads to organisation-wide policies that fail to address structural disadvantage of some groups—such as women—as regulation or initiatives helping those groups would be

against the law. This issue is treated at length in the US report (Doezema and Guston 2018). In other cases, cultural barriers and interchange related barriers overlap. This happens when national culture reinforces organisational culture in some way relevant to the RRI keys or dimensions. Gender again provides a good example. We also find notions of the general public not understanding science as a cultural barrier to science education in both the national contexts and the organisational contexts. Similarly, the new political agenda in the US, Brazil and the UK, and corresponding new laws and policy enforcement, have had implications for several of the keys and dimensions. In the US case, gender and diversity seem to be under attack, but the general discredit of science has importance too for other RRI keys, and support for the RRI dimensions seems significantly downplayed in the current climate. Likewise, science is perceived as under treat in a Brazilian context, but here it leads to a strong focus among scientists on preservation of independence (see Brazil report (Reyes-Galindo and Monteiro 2018)). In the UK context, Brexit appears to reinforce an economic growth-oriented science policy agenda which is detrimental to the RRI dimensions, as well as having potential consequences for individual keys, such as science education and possibly research ethics, as power dynamics between industry and researchers shift, and time is seen as scarce by researchers (see UK report (Pansera and Owen 2018)).

4.5 Discussion on Type of Organisation and Embedding

In this section, we return to the research questions on barriers to RRI across keys and dimensions.

Research performing versus research funding organisations

In the section on RRI drivers, we noticed that most drivers cut across RRI dimensions. This is equally true for the RRI keys, although differences are more pronounced. We notice several differences, most of which relate to the differing functions of research funding and performing organisations. These differences are important to current debates, as they showcase structural issues in the current science system, and in particular issues stemming from current ideas of what excellence in science is. Often cited barriers across RRI keys and dimensions that are significantly more pronounced in research performing organisations are:

- Lack of rewards and incentives promoting RRI.
- Lack of time to prioritize RRI aspects in the work.
- Focus on science production, i.e. output mainly in the form of scientific papers.
- Negative experience of bureaucracy, and of RRI as contributing to bureaucracy.
- Aspects of RRI seen as a 'luxury,' external to science, or to be outsourced to third parties.
- The need to protect the independence of research, and RRI as a potential treat in this regard.

- The risk of questioning the status of science (already under pressure) through RRI.
- RRI is not part of the curriculum/lack of training in RRI.
- Pressure from market forces/industry collaborators counteracting RRI aspects.
- No institutional home for RRI aspects or perceived fragmentation in efforts.
- Culture of academia, organisation or country counteracting RRI.

Most of these barriers are apparent across RRI aspects, but some are more pronounced with specific keys. Most clearly, the issue of fragmentation and the lack of an institutional home is cited often in connection with the Societal Engagement and Science Education keys. Similarly, 'cultural' explanations of barriers stand out (comparatively) in the Gender and Diversity key but are also comparatively prominent in the Open Access and the Societal Engagement key. Some of these differences may be attributed to the organisation of large-scale universities and to the current understanding of (quantifiable evidence of) academic excellence, installed in those organisations. Considering in detail salient differences between research funding and research performing organisations, we notice that funding organisations in our study experience comparatively fewer *drivers* in some aspects of the RRI concept. With regards to barriers, this pattern is even more salient and research funding organisations experience:

- Comparatively fewer barriers in the Anticipation and Reflexivity dimension.
- Comparatively fewer barriers in the Societal Engagement key.
- Comparatively fewer barriers in the Science Education key.

For the Societal Engagement and Science Education keys, this suggests that funding organisations could do more. The lack of drivers suggests that even with few barriers the motivation to implement these RRI aspects is lacking. Our impression is that research performing organisations have activities in these keys, but receive little support from research funders to instigate initiatives. Researchers may be responding to policy signals on these dimensions, but without support from research funders. The lack of incentives, rewards, and time to pursue anticipation and reflection, societal engagement, and science education are cited barriers that appear significant for researchers. Research funding organisations have the capacity to provide drivers to mitigate these barriers, and significantly change the way research is evaluated, but may not act on this opportunity until such expectations are laid on them. In other words, while gender and diversity and open access issues are well established in the science system, similar debates on the capacity to foster anticipation and reflection, as well as sustaining and developing societal engagement and science education are far less pronounced.

The data also suggest barriers that are more salient for research funding organisations than for research performing organisations. These centre on governance aspects such as:

- Lack of mandates in relation to RRI keys and dimensions.
- Lack of opportunities for follow-up and for the monitoring of funded activities.

While the former can be addressed through national and local policies, the latter are less easily resolved, not least due to the complexities associated with effective monitoring, where effects may only be spuriously connected to concrete activities (Pawson 2006). This is a known issue when considering institutional change (Dacin et al. 2002; Beunen and Patterson 2019). The finding is striking, as research funders appear to experience about the same level of barriers in the well-established cases of ethics and gender, where initiatives with impact do exist. Where research performers' mentions of barriers cluster around certain themes, the variation and spread in barriers mentioned is much larger for research funders. With neo-institutional theory in mind, this finding points to research funders being much less restricted in their organizational form than research performers (DiMaggio and Powell 1983). I.e. research performers around the globe may answer to much more restricted and clearly defined norms and expectations about their undertakings and organisation than research funders do. If this is correct, inserting institutional change should be significantly easier to commence with funding organizations, than with research performers, as the latter requires change of well-established norms on a global scale. The fact that science since the Middle Ages has been a transnational and highly institutionalised phenomenon supports this idea.

Differences between small and large organisations

In discussing drivers for RRI, we showed that the large universities in our sample had been active in pursuing gender equality and diversity. We do not see parallel patterns in our analysis of barriers, but with one exception:

- Large scale professional bureaucracies experience coordination issues.

This is a known problem in the management literature (Bach and Wegrich 2019). As we argue, large-scale professional bureaucracies, and archetypically the traditional university (Mintzberg 1979), pose both barriers and opportunities for RRI. In our sample, some of the funding organisations qualify as large-scale professional bureaucracies too due to their organisational form (e.g. the Helmholz Association (HFG), and Fondazione Telethon). In these organisations barriers relate to:

- Scattered initiatives across various RRI keys and dimensions.
- Lack of centralized coordination.

This type of barrier appears pronounced for the Societal Engagement and the Science Education keys, as captured in the German national report (Hahn et al. 2018, p. 42):

> The main obstacle for science education is the lack of a cross-KIT, integrative strategic concept and communication structures. Because many activities arise bottom-up, they are highly detached from each other. […] Respondents critically formulated that existing experiences are not recognised although they exist. Cooperation and synergies only take place within a limited framework on an individual basis […]. Respondents pointed out that this lack of communication also leads to competition between the individual units offering science education for funding and recognition.

The issue is not simply a lack of initiatives or coordination, but also a lack of visibility and recognition, as initiatives are not communicated across the organisation. In such circumstances, the institutional interchange dynamic remains weak; the activity internal to the organisation does not succeed in raising external pressures through the nurturing of expectations. If other organisational members were aware of the activities taking place, they may conceive of the organisation as a place where science education is a norm and feel a pressure to conform in their own practices.

Differences with respect to fields of research and funding

Our sample ranged from universities and funding providers oriented to the natural sciences and technology, to classical universities and broad-spectrum national funders. Differences between these groups are not clear-cut although there are pockets of differences, particularly with regards to the Open Access and Open Science key and the Societal Engagement key. In particular, science and technology-oriented organisations tend to cite the following as barriers to open access, open science and societal engagement activities:

- Complaints about the lack of institutional embedding.
- Issues springing from industry collaborations.
- Issues with intellectual property rights.
- Lack of incentives.
- General doubts about the RRI concept.

Conversely, broad-spectrum research funding and performing organisations express more general barriers, such as:

- Tensions between 'curiosity driven' research and application-oriented research.
- Lack of skills and training.
- General lack of awareness.

While these tendencies are not clear-cut in our data, they do point to RRI as addressing general debates in the science and technology field. Broad research performers such as classical universities focus on broader issues and are generally less concerned about current discussions in the science and technology field than the more technology-oriented ones. This observation raises the question of how RRI may be profiled to better suit concerns of large scale universities.

Differences in RRI attitudes related to national embedding

As in the case of RRI drivers, establishing meaningful clustering of countries in their shared perspectives of barriers to RRI is not easy. One such clustering is that of 'old' industrial Western economies (Western Europe, US, Australia) compared to newer and more emerging economies (Brazil, China, India). Ethics appear to be a topic of less concern for emerging economies than for the core of old industrialised countries, with strong economies and infrastructure. Similarly, among research performers, a male dominated culture as a barrier to gender equality and diversity is mentioned only in reports from old industrialised countries. We suggest this implies higher levels

of attention to *cultural issues* with regards to gender issues in old well-established economies, where gender perspectives have been on the agenda since the early 1900. In the Science Education key, research performing organisations in old industrialized countries expressed greater concerns on:

- Lack of coordination.
- Lack of shared approach.
- Scattered initiatives.
- Lack of management focus.

This pattern, however, does not carry over to the Societal Engagement key, where the same organisations cited the lack of financial resources as a significant barrier. In the Open Access and Open Science key, we find 'engrained habits' of researchers as a commonly cited barrier (amongst others). Taken together these findings may reflect organisations who have more established science systems, and more experience of organising research in society. Overall, we suggest that these findings reflect high expectations with respect to results from change initiatives emanating from RRI, in the group of old industrialised countries, rather than the comparative level of conduct for this group of countries. Hence, these results reflect expectations of proper organization in well-established systems, rather than the current level of affairs. Such experience and expectation may function as a barrier as well as a driver for RRI.

What difference does formal recognition of RRI as a term make?

In the Chapter on drivers, we outlined how organisations that both are familiar with and that use the RRI term, mentioned comparatively a greater diversity of drivers, and that these often were more specific. In the analysis of barriers, our analysis suggests that the kinds of barriers are more technical in organisations where the term is in use. For instance, with regards to societal engagement, the UK national report mentions that maximizing influence is not accomplished most effectively through societal engagement activities, that self-selection in who participates in societal engagement activities is a problem for the democratic ideal expressed through the key, and that preference for gold open access can be a barrier for green open access. Similarly, the Dutch national report discusses difficulties in monitoring open access from the viewpoint of funders, as publications often are written only after projects have ended (van der Molen et al. 2018). The Norwegian report discusses funders' challenges in balancing a rigid implementation ethos with a more flexible and listening approach when communicating the open access and open science key with research performing organisations (Egeland et al. 2018).

4.6 Conclusion and Reflections on Barriers to RRI

Just as structural drivers were the most important in explaining successful RRI practices, structural barriers were also the most important in explaining impediments. Where structural drivers are in place, for example, in relation to ethics, gender

and open access, these practices emerge and flourish. Where there are no structural drivers, for example, for the process dimension and for societal engagement, attempts to develop initiatives become fragmented. Not having a formal policy on an RRI aspect is in itself a barrier, as there will be a lack of incentives for a practice. Moreover, there will be counterincentives, such as strong incentives for scientific production (e.g. for published papers), which remain in tension with RRI policy signals or incentives, such as those aimed at promoting societal engagement. The dominant barriers identified in the project are: the lack of resources in the form of money, time, people, training for expertise; the lack of incentives; and the lack of strategies, policies, frameworks, systems and formal structures to support RRI. Fragmentation is a further barrier, arising on account of organisational complexity, and to the configuration of the RRI as an umbrella concept, with disparate keys having multiple institutional homes, such as gender and diversity offices, ethics committees, and outreach offices. We discuss fragmentation both as a barrier and as an opportunity in Chap. 5.

In Chap. 3 we saw that cultural drivers for RRI are less prominent than structural and interchange drivers. This was not the case for barriers, where respondents commonly cited the prioritisation of excellence in the form of producing e.g. papers over societal impact as a significant cultural barrier. Coupled with structural barriers, there remain significant hurdles for those RRI aspects that are not mandated in law or incentivised by funding policy and programmes. Other prominent cultural barriers are lack of knowledge and awareness, RRI perceived as an 'add-on' activity to scientific practice, the prevalence of classical values of autonomy and merit in the academy, narrow and economistic ideas on innovation and finally a lack of clarity on what RRI is.

The main interchange barriers relate to the lack of policy and mandate, lack of clarity on multiple dimensions, lack of perceived interest from external stakeholders, the absence of pressure from the external environment of the organisation (including policy makers), the lack of accountability for compliance with RRI aspects, tensions between RRI and privacy and commercial interests, and competition with other concepts dominating national discourse. This rather broad spectrum of barriers appears to cut across types of organisations. In many cases we find that there is no policy (interchange related structure) on societal engagement at the national level, because there is no culture at the national level for considering this aspect of RRI. Moreover, cultural barriers at the national level can also be mirrored in the culture of the organisations; culture emanates from country to organisation (Hofstede 1980). So, the lack of a driver cam be manifest in all of Scott's three levels, and this unsurprisingly functions as a significant barrier. Where barriers are manifest across Scott's dimensions, we believe change agents have a difficult or even impossible job. If there, in addition, are no or few drivers, which can be utilised in order to gain legitimacy for RRI aspects, we believe change is unlikely.

To break this cycle and to strengthen relevant RRI aspects, a cultural shift is necessary, facilitated perhaps by public communication campaigns to inform the political and organisational discourse. The European Commission could further support the institutional RRI agenda by working to influence the attitudes of key stakeholder

organisations in the European Research Area and public perceptions in European member states. However, this is in itself a difficult task (as evidenced by Brexit and similar movements in members states) and influencing public perceptions outside Europe is even more challenging. The current EC strategy of trying to influence local RRI cultures by experiments in a few research organisations may be only partially effective, but anecdotal evidence from the RRI-Practice project—as well as institutionalist scholarship—show that learning effects can be significant. Such learning effects can be difficult to measure in the kind of empirical work conducted here but should not be disregarded.

Finally, a word on RRI as "*an approach to research and innovation where societal actors work together during the whole research and innovation process in order to better align both the process and its outcomes, with the values, needs and expectations of European society*".[1] It is relevant to observe that national legislation and policies generally do not appear to address broader systemic challenges in the science and innovation system, and instead tend to focus on individual RRI keys in isolation. If RRI is seen as an integrative approach to the relation between science and society, there is a need to emphasize this overall perspective rather than focusing narrowly on the keys. Moreover, the policy focus should be kept over time, with necessary adjustments and updates, as we have seen that a barrier to RRI is rapid change in policy concepts, potentially leading to confusion. Likewise, trying to measure effects too early is a barrier to RRI, as such organisational changes supporting RRI require time to work in practice and get institutionalised.

In terms of differences between types of organisations, we find that research performing organisations experience some drivers more saliently, most likely due to their organisation and function. While this is true across keys and dimensions, the issue of fragmentation and lack of institutional home is cited often in connection with the Societal Engagement key and Science Education key. Similarly, 'cultural' explanations of barriers stand out (comparatively) in the Gender and Diversity key. The impact of current definitions of scientific excellence also appear to cast long shadows on the ability of researchers to undertake other tasks than the ones already rewarded and measured as part of the current production regime. In Chap. 3, we found fewer drivers for the Anticipation and Reflexivity dimension, the Societal Engagement key and the Science Education key for research funding organisations than for research performing organisations. This pattern is mirrored symmetrically in the analysis of barriers, possibly due to a lower level of activity and knowledge among research funders in our sample. Conversely, the lack of mandates and opportunities for follow-up appear more pronounced as barriers among research funders. Unsurprisingly, we find that the classical coordination issues of professional bureaucracies are more pronounced among large scale universities. Science and technology-oriented research performers and funding providers appear to experience more saliently a handful of barriers, which leads us to suggest that they may overall have more experience with, or just be closer to the discourse of RRI.

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[1] https://ec.europa.eu/research/swafs/index.cfm?pg=about Accessed 27 May 2020.

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