
Using Indicators to further Responsible Research and Innovation (RRI)?

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Abstract: Responsible Research and Innovation (RRI) has been high on the agenda of funders such as the European Commission (EC). Encouraging the use of indicators to further implementation of RRI has been a prominent feature in EC RRI funding calls. However, we provide evidence that using indicators for institutional RRI work is far from unproblematic. Indicator use vary considerably along national norms and organizational cultures. Whereas RRI indicators may have advantages in institutions generally governed by indicators, we show that in other settings, indicators may cause outright resistance to RRI and may be seen as curbing learning. If used, indicators should facilitate learning and take up as few resources as possible with respect to reporting. We further show that evaluations that include users, are a viable alternative to indicators with respect to implementation of responsible research and innovation. We finish the paper with practical advice on working with RRI indicators.

Keywords: Responsible Research and Innovation (RRI); Indicators; Science and Innovation system; University management; Science and Innovation Policy; European Union Research Policy; Policy Implementation; Key Performance Indicators (KPIs).

1 Introduction

The European Commission (EC) is pushing for changes in the science and innovation systems along the lines of Responsible Research and Innovation (RRI). The EC describes RRI as an approach that anticipates and assesses potential implications and societal expectations with regard to research and innovation, and where the aim is to foster inclusive and sustainable research and innovation.¹ In the EC understanding of RRI, the term is also sometimes circumscribed by five so-called RRI keys; Ethics; Gender; Open Access; Science Education; and Societal/ Public Engagement. However, the term has also received much academic interest (Schomberg and Hankins, 2019) and alternative definitions of RRI have gained traction, most prominently the AIRR dimensions, also called RRI process

dimensions (anticipation, inclusion, reflection and responsiveness) (Owen et al., 2013). Most RRI approaches emphasize new measures for research and innovation that aim to simultaneously make innovations serve society better and avoid the creation of new risks or societal rejection, such as has been the case with e.g. gene manipulated food in a European context (Schomberg, 2013, Forsberg et al., 2015).

The EC has published several funding calls to further implementation of RRI across all types of organizations in the science and innovation system. An important assumption in many of these calls has been that indicators are necessary (or at least desirable) as means to implement RRI. While indicators for RRI have been developed in the funded projects, our understanding of how indicators may – or may not – support the implementation of RRI in organizations is still scanty.² Additionally, our knowledge of what indicators are currently in organizational use is limited. In this paper, we present findings from 23 research performing and research funding organizations that nuance the assumption of the usefulness of indicators for successful implementation of RRI.

Using indicators is part of a larger discussion on the use of performance measurements, audits, score cards, and (narrowly) specified organizational goals at large. Indicators may aid organizational development in that they provide clear goals and draw attention to priorities in the organization (e.g. Locke and Latham, 1990, Kaplan and Norton, 1996). However, any goalsetting via indicators runs the risk of de-coupling, i.e. goals and policies are formally adhered to, while in reality efforts are directed to something else (Brunsson, 1989), as well as inviting to gaming (Biagioli et al., 2019), and over-focusing organizational attention (Ordóñez et al., 2009).

Using indicators to gauge impact in the science system and in organizational development in general is a well-established practice in other fields than RRI. Expert bureaucracies of all kinds are central to the science and innovation system (Mintzberg, 1979). Public reform in the wake of the New Public Management surge has affected the governance of such organizations, appropriating practices to those of traditional management with an accompanying focus on (Key Performance) Indicators. However, some scholars point out that universities continue to function in ways dissimilar to classic private sector organizations in the service industry (Enders, 2015). Hence, a mapping of actual uses of indicators for RRI in the research and innovation system, as well as a data driven discussion of organizational uses of RRI indicators, is called for.

Thus, in this paper, we survey empirically, with respect to RRI:

1. What type of indicators are currently in use, or deemed acceptable, by organizations in the research and innovation system?
2. How may indicators support or hinder the implementation of RRI in research organizations?
3. What are the potential issues of working with indicators in such implementation efforts?

Our contribution is twofold. First, we map the actual use of types of indicators across a sample of organizations in the global research and innovation system with respect to RRI. Second, we discuss findings on the use of indicators across organizations with regard to challenges and potential pitfalls. We address conceptual ambiguity of the indicator term in use in surveyed organizations and challenges of introducing indicators in new fields. Additionally, we show that indicator use may at times be a barrier to learning in

organizations, and that indicators may also be a barrier to RRI by fostering opposition. We discuss how current indicators for research excellence seem to curb RRI implementation. In addition, we show that a viable alternative to indicator use may be conducting evaluations, involving users of RRI initiatives. Last, we show that indicators need to be sanctioned by higher level governance actors in order to be effective in policy organizations, and that there may be important national differences in indicator use in the management of organizations.

Research design and methodology

Our paper is based on data from a Horizon 2020 project on Responsible Research and Innovation in Practice (RRI-Practice).³ The project researched the use and implementation of RRI across 23 research conducting, funding and policy organizations in 12 countries. Most of the participating research performing organizations are large-scale universities of national importance. Some have a broad profile, while others are technical universities. Some are characterized by a particular orientation or specialty, such as agriculture or energy related sciences. The majority of the participating research funding organizations are large scale national funding providers of major significance in the countries' innovation and research systems. Some of these are tied closely to national policy making organizations under the government, but some operate at arm's length from the policy level.⁴

The project employed document reviews, interviews, focus group interviews and workshops of various formats as sources of data to create national reports on the uptake of RRI.⁵ In total more than 1620 documents were reviewed in the course of the project, about 370 interviews conducted, and more than 174 people participated in focus groups, on top of which more than 274 people participated in workshops (Wittrock et al., Forthcoming 2020). The project had a significant action research component. As an important part of the action research component, the national research teams collaborated with each surveyed organization in developing RRI Outlooks, outlining RRI objectives, targets and indicators for each organization. In this work, researchers identified indicators in use in surveyed organizations and suggested concrete actions for the furthering of RRI in the same organizations, most often accompanied by suggestions on indicators for proposed actions.⁶ In this paper, we rely on reports of identified indicators in use, and indicators accepted for use in the 23 organizations in the course of the 3-year project.

The paper is based on the 12 national reports produced by research teams in the project, using standardized templates for interviews, outlooks and the reporting of findings (Forsberg et al., 2018). We employed an inclusive view of RRI, based on the five RRI keys promoted by the EC, and the AIRR, or process, dimensions, derived from the work of Owen et al. (2012).⁷ The RRI aspects studied were thus Gender Equality & Diversity, Ethics, Open Access and Open Science, Societal/Public Engagement and Science Education, as well as Anticipation & Reflection, Diverse & Inclusive, Openness & Transparency, and Responsiveness & Adaptation. From these reports, we coded each of the elements of RRI (the five keys and the four process dimensions) using qualitative research software for the coding and analysis with respect to several aspects of interest for the implementation and practical use of RRI. Using a hermeneutic approach, we analyzed our coding and derived salient subthemes, further condensed into overarching themes (Alvesson and Sköldberg, 2000). We refer the reader to Wittrock et al. (Forthcoming 2020)

for further details on the definitions, method, and organizations studied. In this paper, our focus is on indicators specifically.

Findings

Indicators constitute an important element in many public and private organizations' reporting and management systems, and research organizations are no exception to this overall trend (Martin and Sauvageot, 2011, Cave et al., 2006). However, in our sample, uses of, and interest in, RRI indicators seems sparse.

Uses of indicators for RRI keys and dimensions

The study showed that ten out of the 23 organizations have indicators for ethics, mostly related to the number of misconduct cases registered with the research ethics or integrity committee. Eight organizations agreed to actions and indicators in the outlooks, often related to broadening up the organizational ethics approaches. Three of the eight organizations introduced indicators for ethics due to the outlook process, whereas five introduced new measures, adding to or changing existing ones.

All organizations have gender indicators, except for an Italian funder, which prides itself of having a strong gender equality culture and thus no need for gender indicators. Eight organizations agreed to further actions and indicators related to this key, sometimes going beyond gender and focusing on ethnographic or other kinds of diversity.

Ten organizations, seven in Europe and both the Australian organizations, have open access policies with indicators. Eight organizations (not completely overlapping with those already having open access indicators) agreed on actions and indicators related to this aspect in the outlook part of the project.

Twelve organizations have indicators related to the Societal Engagement key, both funders and research performing organizations. Seven organizations agreed to actions with indicators on this key. An Italian university is an interesting example of an organization where new indicators related to this RRI aspect is being introduced, but under the title of the University's 'Third Mission' (see Neresini and Arnaldi (2018)). This mission is, however, broader than societal engagement activities in an RRI perspective, and current indicators include scientific and cultural dissemination activities, number of patents in ten years, income from contract research and externally funded research projects, and number of spin-offs in ten years. The Italian report shows that these indicators are regarded as more important than the two-way engagement activities at the core of RRI. However, the Italian report makes an interesting point of relevance for the diffusion of RRI: As Italian universities are measured on the number of externally funded projects, the fact that societal engagement often is called for in Horizon 2020 projects makes this indicator a driver for the inclusion of societal engagement activities in research proposals nationwide. This indirect driver suggests it being important that the EC continues to include RRI aspects in calls for proposals, in order to promote RRI.

Whereas the Science Education key is core to mission statements and policies of some of the organizations surveyed, we find that only nine organizations are using indicators for this RRI aspect. Likewise, only five organizations agreed to any further actions with indicators as a follow-up mechanism on this key.

Very few organizations use indicators for the process dimensions. The exception is Openness & Transparency, where several public organizations are required by law to keep public records. Three organizations (two universities and a funder, of which two were Australian) agreed actions with indicators related to the Openness & Transparency dimension. Four agreed to actions and indicators on the Anticipation & Reflexivity dimension with one overlap to an organization already having measures in place on this dimension. Only two organizations have actions with indicators on the Responsiveness dimension, one other organization already has measures in place.

In four of the organizations, sustainability or sustainable development are mentioned as important RRI related concepts. However, actions and indicators on these concepts were not agreed.

Four of the organizations also address RRI as an integrative concept. Among these are two funding organizations considered best practice examples on RRI among research funders, but neither of these organizations agreed on further actions and indicators on RRI. On the other hand, one research conducting organization that previously did not have a policy on RRI as an integrative concept, agreed to specific actions and indicators for this.

In sum, the use and acceptance of RRI related indicators varied across organizations and RRI aspects. Legal regulations seem to support the use of indicators in the sample, as in the case for the gender and diversity key. Moreover, as we have seen, indicators may drive RRI adoption in an indirect way, for instance through the measurement of funding obtained from the EC programs, where compliance with some RRI aspects is sometimes expected. Similarly, indicators on concepts having some ‘family resemblance’ with RRI may help promote some RRI activities in practice, as it appears to be the case with the Italian ‘Third Mission’ efforts.

Discussion on indicators in use and indicators agreed

The identified uses of indicators above, and our deliberations with the research performing and research funding organizations in the action research part of the study, allow for topical discussions with relevance to European research policy. Use of indicators is limited, and even when RRI – or aspects of RRI – is on the agenda of the organizations surveyed, there is in many cases little interest in engaging with indicators as a follow-up mechanism to support implementation. Why may this be the case, and what are the potential issues of working with indicators?

Conceptual ambiguity

In general, uses of the term ‘indicator’ varies significantly between, and sometimes within, the 12 national reports, reflecting different understandings both across the research teams and in the participating organizations. Indicators are sometimes related to the actual carrying out of an action. For instance, if an action is to establish a policy, an indicator may be that the policy is published. Other indicators may be concerned with whether the policy is known. For instance, it may measure the level of awareness of the policy in the organization (e.g. with a target of 60 percent). Last, some indicators seek to gauge if a policy is effective. An example is a 30 percent reduction in the instance of malpractices related to the policy area in question. In the latter case, the indicator then measures the extent to which the policy is followed in the focal organization, based on assumptions of

magnitude of the effect in output measures. These are approaches to indicators that vary considerably, and they focus attention on differing steps in an implementation process. In some cases, it may be wise to recount which theory of change the focal organization using the measure is assuming (Pawson, 2006). Indicators may need to focus on drivers, processes, or output, depending on what one wants to achieve, relative to an assessment of local circumstances. Different implicit assumptions about what an indicator is, or can be, can perhaps restrict an exploration of what might be useful indicators.

The challenge of introducing indicators in new areas

The analysis shows that most organizations do not have indicators for the RRI process dimensions. Suggesting action plans with indicators in these RRI aspects seems to require a completely different logic than for the RRI keys, even though one should think that e.g. Anticipation & Reflexivity as well as Responsiveness & Adaptation should be of strategic importance to the organizations surveyed (Ahlstrand et al., 2001). There is only one RRI aspect where indicators are found in all the organizations (with only one exception, which is a private funding organization), and that is – unsurprisingly – gender. The reason is that there are gender policies in all the involved countries requiring actions from all public organizations. In these areas, it therefore appears feasible to introduce new indicators, as monitoring this RRI aspect is already part of the organizational logic or culture on this topic. Likewise, we hypothesize that open access and ethics are largely known policy areas to most organizations in the research system, and equally easy to count in internal reporting systems. In addition, several countries have national policies with indicators on open access and in those cases, new indicators have often been proposed in the RRI-Practice project. Some particular organizations may also exhibit a culture of using indicators on issues that have organizational importance, most significantly in Australia, which appears by far the most indicator-oriented country in the sample. If there is a national culture for indicator use and control, it may make indicator use a more straightforward, intuitively applied and institutionally sanctioned mechanism. In conclusion, introducing indicators in organizations that are unfamiliar with the use of indicators in the particular aspect of RRI seems challenging. We suggest that significant process consultancy (Schein, 1969) in the creation of indicators through inclusive measures, will be needed in new areas.

Indicators as a barrier to learning?

A Norwegian research funder provided an example of an organization hesitant to introduce new RRI indicators, and instead focused on a learning approach to RRI (Egeland et al., 2018). Contrary to the understanding in mainstream goalsetting theory (Locke and Latham, 1990), there appears to be a prima facie conflict between these two approaches. A difficulty may relate to varying understandings of goal specification, and difficulties in establishing sensible descriptions of indicators. When indicators are used (for instance that there should be a 20 percent increase in the number of societal engagement activities in a university), there must be a proper description of what counts as a societal engagement activity. However, in order to facilitate learning, that description should also allow for evaluation of that which is reported as a societal engagement activity. It should be evaluated, if it is in fact a good ‘representation’ and in accordance with the underlying value and goal with respect to that RRI key or dimension. A related issue is that all indicators invite to ‘gaming’ and to ‘manipulation,’ where organizations or units are incentivized to adapt activities to

the description of the RRI aspect (Biagioli and Lippman, 2020), but not necessarily to the ethos of the practice. This is for instance the case when a societal engagement activity is not a genuine (and therefore good in an RRI sense) two-way societal engagement activity. An alternative way to fare in promoting societal engagement is a learning approach without the use of indicators: The organization may appreciate the goal and value of societal engagement, and experiment with the best organization of such engagement for the organization, rather than fixating particular practices in a definition that gives a good score on the indicator. Such considerations feeds into discussions in the field of goalsetting, and the potential drawbacks of goalsetting, including how goals may induce unethical behavior (Ordóñez et al., 2009, Locke and Latham, 2009).

Indicators as a barrier to RRI by fostering opposition

Our general impression is that there is willingness to discuss and consider policy on all areas of RRI in the organizations surveyed, but that bringing up the question of indicators very easily closed down those conversations. Indeed, in some organizations there is a clear resistance to indicators, due to fears of indicators leading to loss of academic freedom – for instance in the face of states seeking to control and regulate academic research agendas. In addition, indicators are often perceived as formal measures that need another kind of decision-making procedure than policy work on RRI. The reason is that much policy work in research institutions is distributed, but decisions on indicator use less so. For instance, a department may decide to experiment with citizen involvement. However, if the department suggests measuring itself on the number of citizens involved annually, it is a matter for the faculty or even rector, which then involves deployment of a large organizational machinery, rather than low key experiments and low-cost actions, which may be easily adopted and adapted on a continuous basis.

Establishing indicators – a question of time and work?

Related to the point immediately above, we might have seen more indicators in the project, had it run over a longer time span. Most of the work reported in this study was carried out over a period of 1,5 years. Some actions may in fact end up with indicators when processes have successfully been concluded in the organizational bureaucracies, involving the work of central administrative units in coordination with locally situated institutes or departments. In general, within a 3-year research project, mostly experiments can be concluded. Institutionalized structures need more time in order to settle, in particular in expert bureaucracies. This is an important lesson to European policy makers, as it signals the need for a continued policy emphasis on RRI over time and emphasizes long timespans needed to monitor output effects.

Discussion on perspectives for indicator use and policymaking

In this section, we present overall reflections on our findings of relevance for the practical implementation of RRI by means of indicators as well as for policymaking with regards to RRI.

Adjusting conflicting indicators or creating new ones?

Research indicators exist in all the countries involved in the project. Universities and academic careers are particularly encompassed by, and controlled through, indicators. Funding, hiring, and promotion decisions are related to student flows, publication points, and patents filed (Lepori et al., 2019). In the RRI-Practice project we found that barriers to RRI include various established indicators in the science system that take up the full attention of the organizations and their staff (Wittrock et al., Forthcoming 2020). Accordingly, one may ask if adjusting current indicators in use is potentially more important than creating new RRI indicators. Such a question touches on current debates on how excellence is understood and circumscribed in current academia (Moore et al. 2017). A loosening up or buffering of some indicators in the current research system (such as publication indicators) may create more space in that system for RRI activities such as engaging with the public, reflecting on one's research, or taking time to share one's notebooks. Hence, RRI implementation may require a review of existing indicator use in an organization in the science and innovation system, in order to ensure internal consistency between indicators.

Using indicators versus conducting evaluations

In the RRI-Practice project, researchers mostly had significant goodwill and developed good relations with key people in the organizations we engaged with, and the project exceeded its goals in terms of organizational impact. As a result of the project, many actions were initiated by organizational staff and managers without involving the entire organizational bureaucracy. However, attaching indicators to these programs were in most cases seen as not contributing extra benefits or facilitating good results. Consequently, no such indicators are reported for the project-initiated actions in those cases. Instead, actions are, or will be, *evaluated*. For instance, RRI training is evaluated by the participants. Pre-defined indicators are not necessary for conducting such evaluations; the evaluation will be done in a dialogical and qualitative way, possibly as a bottom-up process (e.g. Krogstrup, 2003). By not relying on hard, and predefined, measures, contextual issues may better be considered in these evaluations.

If used, indicators should be anchored at higher governance levels

Several research funding organizations in our sample did not agree to formal action plans with indicators in the RRI-Practice project. These organizations are all nationally important executors of public policy. They develop formal action plans based on internal processes, and not in a bottom-up process with external researchers (such as the RRI-Practice researchers). Therefore, if they were to introduce new indicators for their own work in any public document, it would need to be agreed at higher governance levels. This means that if the European Commission wants to influence the formal actions of such actors, they need to do this through dialogues with national policy actors, who are more directly influencing the national funding providers, including in their potential use of new indicators. The European Commission appears particularly successful in such policy learning processes in their Open Science policy, which is widely embraced both within and outside the European Union.

National differences on indicator use in management

As discussed, Australia appears to have a high degree of indicator use in the management of organizations in academia (see (Sehic and Ashworth, 2018)). The two organizations in our sample were more receptive to the idea of RRI action plans and indicators than most other organizations studied. In our sample, some organizations outright rejected actions with indicators associated. The reasons for the rejection of indicators seems to differ though. In some countries, there is a strong focus on preserving academic independence due to current perceived threats to academia from various types of political influence (e.g. Reyes-Galindo and Monteiro, 2018). Therefore, the sense is that indicators could be (mis)used to gain political control over the research conducted. In other cases, the use of indicators is perceived as curbing learning processes (e.g. Egeland et al., 2018). In yet other cases, the worry is that indicators on RRI will be difficult to reconcile with current indicators of academic excellence (e.g. Hahn et al., 2018). Although we do not have sufficient data to determine this query, one may theorize that countries in which the academic system is under treat will be hostile to indicators, and countries in which the current perception of excellence is strongly institutionalized may not be favorable to RRI indicators as a way of furthering RRI in organizations.

Conclusion

Even though the use of indicators is encouraged in the EC context, we find that indicator use is limited in our sample of important national players in the science and innovation system and focused mostly around the RRI keys where well established national regulatory regimes support their use, such as in the case of the Gender & Diversity key. Where indicators for the Gender & Diversity key are in use in most organizations surveyed, less than half of the organizations have, or agreed to, indicators on the Ethics keys, the Open Access & Open Science key, the Societal Engagement key, and the Science Education key. For the process dimensions, very few organizations in the sample have, or showed any interest in the use of, indicators to further the implementation of RRI, even in the (many) cases, where RRI was received positively or even (in some cases) promoted as part of the organizational agenda.

We find that there are many cases where indicator use is reported to hamper RRI implementation in various ways. These include prohibiting an atmosphere of learning, creating worries of loss of academic freedom, focusing on output performance rather than development, as well as introducing ambiguity with respect to organizational goals. Likewise, we find that some current indicators in use foster priorities and actions that go against RRI, the most prominent being a focus on research output in the form of publications. We also find many cases of outright rejection of indicators by staff.

In short, the project shows that even though Key Performance Indicator (KPI) oriented management is part of the logic embraced by the European Commission, European policy makers should not assume that such indicator use is the wholesale most effective way to implement practice related changes towards RRI in all organizations across Europe, nor is it necessarily a pathway to institutionalize RRI in the science and innovation system.

Practical implications of the analyses

Based on the results presented above we can deduce the following learning points for working with indicators:

1. Evaluate and review existing indicators against a new policy to obtain coherence.
2. Align indicators with a theory of change; decide on drivers, processes and expected output of processes.
3. Take cultural differences and concerns into consideration, don't just copy measures from elsewhere.
4. Facilitate the development of indicators through inclusive processes across the organization.
5. Minimize time spent on reporting; focus on measures central to the operations of the organization and measures supporting its workflow.
6. Use indicators that create learning opportunities and support on-going experimentation with practices, if they are not yet institutionalized.
7. Be patient in monitoring effects in terms of output measures.
8. Consider inclusive evaluations as an alternative to indicators.

For further findings from the RRI-Practice project on the implementation of RRI in organizations, see Wittrock and Forsberg (2019).

Limitations of the study

As discussed above, we have reported and analyzed what is reported as indicators currently in use in organizations throughout the national reports, as well as what is reported as agreed indicators in connection with specific actions coming out of the project. We should emphasize though that at times it can be difficult distinguishing between constructive suggestions from project researchers in the action research program and indicators that are actually embraced – and will be used – in organizations studied. For instance, in one of the universities, the organizational outlook was presented and embraced in the Research and Development Committee of the university, but we have had no detailed discussion of the indicators with this committee. Hence, within the 3-year scope of the project, it is impossible to determine whether the approved indicators will be applied, as actual implementation cannot be monitored.

Another limitation pertains to the sample used. While most organizations surveyed are of central importance in the national research and innovation systems, we cannot claim that the sample is representative of a known population. This is particularly prudent to keep in mind when national differences are discussed.⁸

Last, relying on national reports produced by various research teams poses its difficulties, despite a concise research protocol, and widespread use of templates for the research process and reporting. Not all researchers were familiar with or supported the use of indicators for RRI issues, so some researchers may not sufficiently have interacted with key decision makers, and some may have felt uncomfortable suggesting 'hard' measures

such as indicators. Even if a standardized and detailed protocol on indicators was developed, there were variations in how this protocol was used by the different teams.

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References and Notes

- 1) See <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation>
- 2) Indicators have been developed and honed through several EC funded projects, most prominently the MoRRI and Super MoRRI projects.
- 3) See www.rri-practice.eu, grant no 709637.
- 4) See Wittrock et al. (Forthcoming 2020) for further details.
- 5) See <https://www.rri-practice.eu/publications-and-deliverables/deliverables-3-1-14-1/>
- 6) Though the protocol implied that indicators should be suggested to the organizations (Forsberg et al., 2018, Shelley-Egan et al., 2018), in the end, indicators were not attached to action plans for all organizations due to factors we discuss in this paper.
- 7) The RRI-Practice project definition of the process dimensions follows the European RRI-Tools project. See <https://www.rri-tools.eu/about-rri>
- 8) The RRI-Practice projects viewed organizations as fundamentally embedded in contexts, and therefore included research on the national climate for RRI, though not specifically targeting the use of indicators nationally.

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