

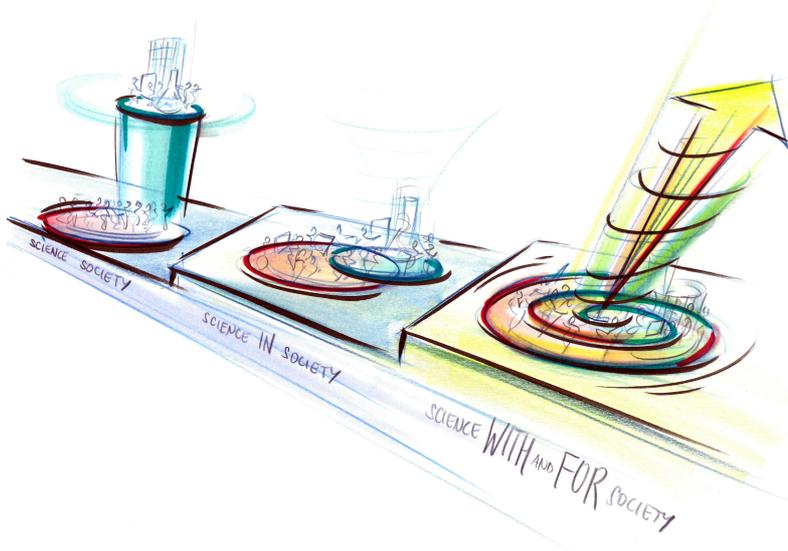
Monitoring the evolution and benefits of Responsible Research and Innovation in Europe

Policy Brief

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“If RRI is to thrive, it must be seen as something that is done by the research and innovation system, not to it”.

This policy brief reports on data collected by the MoRRI (*Monitoring the evolution and benefits of Responsible Research and Innovation*) project between 2014 and 2018¹.



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Key Messages

- Responsible Research and Innovation ensures that science and innovation address social needs.
- Evidence from the MoRRI project shows that RRI has benefits for society, the economy and for science itself.
- Measuring RRI and its evolution is possible. The MoRRI project indicators provide a solid foundation for policy and further study.
- For the ninth framework programme, there is a need to improve evidence for RRI and to expand the scope and scale of RRI activities.

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Introduction

The last two years have reminded us that the social contract for science and innovation must not be taken for granted. A rise in populism and a backlash against globalisation took European and US governments by surprise. The public consensus that has supported science and its public funding now looks fragile. In April 2017 many cities hosted a 'March for Science', as scientists sought to reaffirm the public value of their work. Science must find new ways to connect with the public. Public health, environmental sustainability and economic growth depend on a strong social contract for science.

Despite huge economic progress, inequalities within and between countries are stark. Innovation in green energy, disease prevention and global communications has made great strides. But more needs to be done to connect the world's innovative capacity with its biggest problems. The growing power of innovation makes responsibility more important than ever. The speed of technological change can inspire hope for the future, but it can also bring new risks, exacerbate inequalities and profoundly affect our sense of what it means to be human².

At the same time, Europe is, yet again, at a crossroads. The debate is no longer just about the pace of progress. It is also about the direction.³ Research and innovation lie at the heart of this debate⁴. The benefits of innovation have not been evenly spread, and there is a risk of even greater public disaffection with science⁵. Nevertheless, there are also opportunities to retune science and innovation to meet the world's challenges.

From 'science and society' to 'responsible research and innovation'

The changes in how European science relates to the public are mapped in the terminology of European framework programmes. Scientists and policymakers have come to appreciate that it is neither possible nor desirable to keep science behind closed doors. The Sixth Framework Programme funded work on 'Science *and* society'. The Seventh Framework Programme urged closer integration, with 'Science *in* Society' as a priority. Horizon 2020 pushed for 'Science *with and for* Society', inviting members of the public into the processes of science and innovation as well as into discussions about its purposes. As interest in mission-driven innovation grows⁶, there is a need to consider how social and scientific goals can be aligned.

As with the UN's Sustainable Development Goals, aspirational agendas need to be coupled with measurable indicators⁷. The idea of 'responsible research and innovation' in the service of such global challenges is starting to spread through the European research and innovation system.⁸ The impact of this idea is hard to measure in the abstract. Under the umbrella of RRI, European Commission priorities of gender equality, open access, ethics, science education and public engagement offer one way of evaluating progress. MoRRI data reveals that researchers funded by Horizon 2020 in particular recognise that what is good for society and the economy can also be good for science.

As science comes under growing pressure from its funders to contribute to economic growth, the need for vibrant debate on responsibility only becomes stronger. The growth of RRI suggests a renewal of the scientific ideal of openness. The promise of 'Open Science, Open Innovation, Open to the World'⁹ means making science open to new possibilities and new participants. There is a public appetite for open access to scientific publications,

democratic debate and citizen science activities. Science *for* the people may in some cases involve science *by* the people.

Responsible Research and Innovation means changing the cultures and practices of science, business and policy. The evidence suggests both that not only is change possible, but that it is already happening and that it will bring widespread benefits.

Indicators of Responsible Research and Innovation

Increased public investment in science since the late 20th Century has understandably been accompanied by growing expectations from policy makers. But, as US Presidential science adviser John Marburger observed, the ‘science of science policy’ is immature at best¹⁰. Tracing the impacts of scientific research is fraught with complexity¹¹. Measuring the effects of policies to make research and innovation more responsible is harder still. The old line, often attributed to Albert Einstein, is right: ‘Not everything that counts can be counted’. And there is a wider legitimate concern that indicators may distort the systems they are trying to measure, leading some to call for the use of ‘Responsible Metrics’¹².

Drawing an accurate picture of research and innovation with the aim of assessing and improving RRI therefore demands a broad set of indicators and a recognition that metrics will always be incomplete¹³. A 2015 expert group concluded that the ambiguity of RRI could be a strength rather than a problem, and that metrics, if applied thoughtlessly, could strangle both the ideas and the practices through which the concept develops¹⁴. If used well, indicators could help focus attention on where policy could bring the greatest benefits.

RRI activities can be evaluated in terms of their processes, their products, the people involved and/or the preconditions that enable their success¹⁵. As well as indicators *of* RRI (for example, proportions of publications that are open access), it is therefore important to consider what indicators are necessary *for* RRI (for example, data on funded research and the views of scientists). Most of MORRI’s indicators fall into the former category. RRI should be understood as part of a narrative of evolving governance, illustrated with strong stories from case studies as well as surveys¹⁶.

The 36 MoRRI indicators (see Appendix) are diverse. They include straightforward measures such as the share of female scientific paper authorship and citation scores for open access publications, as well as qualitative indicators of public involvement, research ethics and governance mechanisms collected by national experts. Taken together, they provide a first picture of the status and direction of travel of RRI across Europe, variations between Member States and areas where substantial work is still required. To take one example, MoRRI reveals that, while countries with the largest investments in R&D often have progressive policies on gender equality, progress in improving gender representation has been markedly slower than in some Eastern European countries. This suggests a degree of inertia in large science and innovation systems.

Measuring the impact of RRI is challenging, but there is a growing body of case study and survey evidence that RRI has benefits for society, science and the economy. MoRRI’s survey of scientists’ and innovators’ suggests that most see RRI as beneficial for their work. This effect is particularly pronounced for those funded by Horizon 2020.

Next steps

Horizon 2020 is the world's largest multinational research programme. In July 2017, Pascal Lamy's high-level expert group recommended that European Research and Innovation funding should be doubled, simplified, internationalised and made more mission-oriented. They also recommended greater citizen involvement and a need to capture and communicate impact.

For this ambition to be realised, it needs a strong social contract. The approach needs to work at all levels. At the level of Commissioners and national governments, there needs to be strong leadership and a clear articulation of what Europe sees as the purposes of research and innovation. At the level of researchers, innovators and their funders, there needs to be commitment both to the broad idea of RRI and to practices such as open access and public participation that take it forward. Without a good story and evidence to back it RRI risks ossifying rather than evolving.

Recommendation one: Make use of and apply the MoRRI indicators

MoRRI has developed a first set of indicators, which provide a useful picture of the current system and, in some areas, a story of progress. These indicators should be used to monitor the science and innovation system. They should, however, be used sensitively, recognising that measuring indicators can create perverse incentives.

Recommendation two: Gather more evidence for Responsible Research and Innovation

MoRRI gathered the low-hanging available data, as well as some harder-to-reach evidence. Adding to the evidence base will be challenging. As well as indicators *of* RRI, policymakers need indicators *for* RRI. Evidence of what research gets funded and why remains sparse in most EU member states. The Commission should survey its researchers and innovators to understand how they see their own responsibilities. There is a need for further research aiming to understand *who* benefits from research and innovation and which groups, regions or issues are relatively neglected. Knowledge about the uneven impact of innovation is currently very limited.

Recommendation three: Expand the application and practices of Responsible Research and Innovation

RRI should not be just about ticking boxes to comply with minimum standards for ethics or gender representation, for example. Taking RRI to the next level in the ninth framework programme should involve supporting experimentation and other innovative activities without demanding certainty about impacts. Research and innovation institutions should be supported to develop new approaches to this. New ideas to improve gender representation, public engagement or ethical reflection, from scientists, civil society and elsewhere, should be welcomed. A European hub for RRI could collect and share learning from such activities. Monitoring such activities will demand MoRRI-style indicators as well as qualitative evidence. Understanding the benefits of RRI in context will require theoretical as well as empirical development.

Supporting such work will require a continuation of the dual approach seen in Horizon 2020. First, there needs to be a SWAFS-type programme with a standalone budget (at least 0.5% of the total framework programme). This

should support building on MoRRI’s survey of researchers’ perceptions of RRI. Secondly, the mainstreaming of RRI approaches into other parts of the framework programme needs to be developed, building on lessons learned through Horizon 2020. Tools for further mainstreaming could include the establishment of a matched fund, through which researchers funded by FP9 can apply for additional funds for RRI activities. SWAFS researchers must not be too protective of the agenda: if RRI is to thrive, it must be seen as something that is done *by* the research and innovation system, not *to* it.

Appendix: MoRRI Indicators

RRI dimension	Indicator code	Indicator title	Year(s)	Source
Gender equality	GE1	Share of research-performing organisations with gender equality plans	2014-2016	HEI, PRO surveys
	GE2	Share of female researchers by sector	2007, 2014	Eurostat
	- GE2.1	Share of female researchers – all sectors	2007, 2014	Eurostat
	- GE2.2	Share of female researchers – business enterprise sector	2007, 2014	Eurostat
	- GE2.3	Share of female researchers – government sector	2007, 2014	Eurostat
	- GE2.4	Share of female researchers – higher education sector	2007, 2014	Eurostat
	GE3	Share of research-funding organisations (RFOs) promoting gender content in research	2014-2016	RFO survey
	GE4	Dissimilarity index	2009, 2012	SHE Figures, 2012, 2015
	- GE4.1	Dissimilarity index: higher education sector	2009, 2012	SHE Figures 2012, 2015
	- GE4.2	Dissimilarity index: government sector	2009, 2012	SHE Figures 2012, 2015
	GE5	Share of research-performing organisations (RPOs) with policies to promote gender in research content	2014-2016	HEI, PRO surveys
	GE6	Glass ceiling index	2010, 2013	SHE Figures, 2015
	GE7	Gender wage gap	2010, 2014	Eurostat
	- GE7.1	Gender wage gap – academic professions	2010, 2014	Eurostat
	- GE7.2	Gender wage gap – technicians and associate professionals	2010, 2014	Eurostat
	GE8	Share of female heads of research-performing organisations	2014-2016	HEI, PRO surveys
	GE9	Share of gender-balanced recruitment committees at research-performing organisations	2014-2016	HEI, PRO surveys
	GE10	Share of female inventors and authors	2005-2016	Patstat, Scopus
- GE10.1	Share of female authors	2005-2016	Scopus	

RRI dimension	Indicator code	Indicator title	Year(s)	Source
	- GE10.2	Share of female inventors	2005-2016	Patstat
Science literacy and science education	SLSE1	Importance of societal aspects of science in science curricula for 15 to 18-year-old students	2016	Desk research and interviews
	SLSE2	RRI-related training at higher education institutions	2014-2016	HEI survey
	SLSE3	Science communication culture	2012	MASIS
	SLSE4	Citizen science activities in research-performing organisations	2015, 2016	ECSA, Scopus
	- SLSE4.1	Organisational memberships in ECSA	2015, 2016	ESCA
	- SLSE4.2	Citizen science publications	2015, 2016	Scopus
Public engagement	PE1	Models of public involvement in science and technology decision-making	2012	MASIS
	PE2	Policy-oriented engagement with science	2010	Eurobarometer
	PE3	Citizen preferences for active participation in science and technology decision-making	2013	Eurobarometer
	PE4	Active information search about controversial technologies	2010	Eurobarometer
	PE5	Public engagement performance mechanisms at the level of research-performing organisations	2014-2016	HEI, PRO surveys
	PE6	Dedicated resources for public engagement		Not available. Results from HEI and PRO surveys (MoRRI, 2017) are inconsistent.
	PE7	Embedment of public engagement activities in the funding structure of key public research-funding agencies	2014-2016	RFO survey
	PE8	Public engagement elements as evaluative criteria in research proposal evaluations	2014-2016	RFO survey
	PE9	Research and innovation democratisation index	2016	SiS survey
	PE10	National infrastructure for involvement of citizens and societal actors in research and innovation	2016	SiS survey
Open access	OA1	Open access literature	2010, 2016	DOAJ list, PMC, the ROAD list, CrossRef, and OpenAIRE
	- OA1.1	Share of open access publications	2010, 2016	DOAJ list, PMC, the ROAD list, CrossRef, and

RRI dimension	Indicator code	Indicator title	Year(s)	Source
				OpenAIRE
	- OA1.2	Citation scores for OA publications	2010-2014	DOAJ list, PMC, the ROAD list, CrossRef, and OpenAIRE
	OA2	Data publications and citations		Not available. Underlying data inconsistent and erratic.
	OA3	Social media outreach/take-up of open access literature	2012-2015	WoS and Altmetric.com
	- OA3.1	Ratio of OA and non-OA publications used on Twitter	2012-2015	WoS and Altmetric.com Limited to publications
	- OA3.2	Ratio of OA and non-OA publications used on Wikipedia	2012-2015	WoS and Altmetric.com Limited to publications
	OA4	Public perception of open access	2013	Eurobarometer
	OA5	Funder mandates	2011	DG-RTD
	OA6	Research-performing organisations' support structures for researchers as regards incentives and barriers for data sharing	2014-2016	HEI, PRO surveys
Ethics	E1a	Ethics at the level of research-performing organisations	2014-2016	HEI, PRO surveys
	E1b	Ethics at the level of research-performing organisations (composite indicator)	2014-2016	HEI, PRO surveys
	E2	National ethics committees' index	2012	EPOCH
	E3a	Research-funding organisations' index	2014-2016	RFO survey
	E3b	Research-funding organisations' index (composite indicator)	2014-2016	RFO survey
Governance	GOV1	Use of science in policymaking	2012	MASIS
	GOV2	RRI-related governance mechanisms within research-funding and performing organisations	2014-2016	RFO, HEI, PRO surveys
	GOV3	RRI-related governance mechanisms within research-funding and performing organisations – composite index	2014-2016	RFO, HEI, PRO surveys

References

- © European Union, 2016.
- ¹ A monitoring report describing the evolution of RRI across Europe (D4.3), the final report reflecting on the activities as a whole (D13), and other documents are available at: <http://morri.netlify.com/>.
 - ² Jasanoff, S, 2016, The Ethics of Invention, WP Norton.
 - ³ White paper on the future of Europe, 2017, https://ec.europa.eu/commission/sites/beta-political/files/white_paper_on_the_future_of_europe_en.pdf.
 - ⁴ https://ec.europa.eu/commission/white-paper-future-europe/white-paper-future-europe-drivers-europes-future_en.
 - ⁵ Mulgan, G, 2017, Thesis, antithesis and synthesis: A constructive direction for politics and policy after Brexit and Trump, <http://www.nesta.org.uk/blog/thesis-antithesis-and-synthesis-constructive-direction-politics-and-policy-after-brexit-and-trump>.
 - ⁶ Mazzucato, M, 2018, Mission-Oriented Research & Innovation in the European Union: A problem-solving approach to fuel innovation-led growth.
 - ⁷ In the case of the SDGs, 17 goals and 169 targets are to be measured by 230 agreed indicators.
 - ⁸ Data in The evolution of Responsible Research and Innovation in Europe: The MoRRI indicators' report, 2016.
 - ⁹ Open Innovation Open Science Open to the World – A vision for Europe, Directorate-General for Research and Innovation, 2016.
 - ¹⁰ See Marburger, J. H. (2005). Wanted: better benchmarks. *Science*, 308(5725), 1087-1087. The STAR METRICS (Science and Technology for America's Reinvestment Measuring the Effects of Research on Innovation, Competitiveness and Science) programme was one US response to this knowledge gap, <https://www.starmetrics.nih.gov/>.
 - ¹¹ Royal Society, 2010, The Scientific Century: Securing our future prosperity, https://royalsociety.org/~media/Royal_Society_Content/policy/publications/2010/4294970126.pdf.
 - ¹² The Forum for Responsible Metrics is supported by UK research funders. The San Francisco Declaration on Research Assessment reflects similar concerns.
 - ¹³ Wilsdon, J et al, 2015, The Metric Tide: Report of the independent review of the role of metrics in research assessment and management. <http://www.hefce.ac.uk/pubs/rereports/year/2015/metrictide/>.
 - ¹⁴ Strand et al (2015) Indicators for promoting and monitoring Responsible Research and Innovation Report from the Expert Group on Policy Indicators for Responsible Research and Innovation, European Commission, http://ec.europa.eu/research/swafs/pdf/pub_rri/rri_indicators_final_version.pdf.
 - ¹⁵ Wickson, F. and Carew, A. 2014. "Quality criteria and indicators for responsible research and innovation: Learning from transdisciplinarity" *Journal of Responsible Innovation*.
 - ¹⁶ Such case studies have been developed by projects such as RRI-TOOLS and RESAGORA.