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Issues and opinions

Assessment of science and technologies: Advising for and with responsibility



Ellen-Marie Forsberg^{a, *}, GianLuca Quaglio^b, Hannah O'Kane^b,
Theodoros Karapiperis^b, Lieve Van Woensel^b, Simone Arnaldi^c

^a Oslo and Akershus University College, P.O. Box 4 St. Olavs Plass, N-0130 Oslo, Norway

^b Science and Technology Options Assessments (STOA) Unit, European Parliament, Rue Wiertz 60, B-1047 Brussels, Belgium

^c Centre for Environmental, Ethical, Legal and Social Decisions on Emerging Technologies (CIGA), University of Padova, Viale Porta Adige 45, I-45100 Rovigo, Italy

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ABSTRACT

Responsible governance of science and technologies, in particular through the concept of Responsible Research and Innovation (RRI), is becoming increasingly important among policy makers and researchers alike. In this Issues and Opinions Essay we show that influential contributions to this field highlight the need to rethink the relationship between science and society, including rethinking the roles and responsibilities of the different actors in the innovation systems. In this Essay we will focus on the function and practices of *assessment* of science and technologies. With the Essay we would like to open a discussion with academics, assessment practitioners, policy makers and stakeholders about the potential need for reform of current assessment practices and advisory institutions in light of discussions about responsible governance of science and technology in general and RRI in particular.

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1. The European policy context for responsibility in science and innovation

Europe is still struggling to recover from the economic crisis and European Union (EU) policies consider science, technology and innovation as key to securing smart, sustainable and inclusive growth. European policy initiatives have been developed that aim to modernize the EU industrial base through accelerating the uptake of innovation. It is assumed that industrial modernization in Europe requires the successful commercialization of product and service innovations, the industrial exploitation of

innovative manufacturing technologies and processes, and innovative business models [1].

At the same time Europe has experienced significant public controversy regarding certain novel technology developments. Perhaps the most prominent example was related to genetically modified (GM) foods, leading to a de facto moratorium on GM foods between 1998 and 2005 [2] and there has been a fear that there will be similar public hesitance to other emerging technologies, such as nanotechnologies. Taking this seriously has led the European Commission (EC) to address the relationships between science, technology and society in 'Science, society and the citizen in Europe' [3]. Here it is claimed that 'advances in knowledge and technology are greeted with growing scepticism, even to the point of hostility, and the quest for knowledge no longer generates the unquestioning enthusiasm that it did some decades ago' [4]. Moreover, '[s]earching questions are being asked of the social and ethical

* Corresponding author. Tel.: +47 67 23 50 00.

E-mail addresses: Ellenmarie.Forsberg@hioa.no (E.-M. Forsberg), gianluca.quaglio@europarl.europa.eu (G. Quaglio), hannahmiriam.okane@europarl.europa.eu (H. O'Kane), theodoros.karapiperis@europarl.europa.eu (T. Karapiperis), lieve.vanwoensel@europarl.europa.eu (L. Van Woensel), simone.arnaldi@unipd.it (S. Arnaldi).

impact of the forward march of knowledge and technology and the conditions under which the basic choices are made (or are not made) in this area' [4]. Accordingly, the EU has progressively highlighted the need for a socially and ethically responsible governance approach to science and technology, which has been gradually institutionalized in its science, technology and innovation policy. Such an approach acknowledges that the need to ensure a continued focus on Europe as a global leader in innovation must be accompanied by ongoing attention to secure public support for such efforts.

Additionally, the broad recognition that the translation of research into societal benefits cannot be exclusively based on the market and scientific community's self-regulation [5,6] has triggered an increased political will to mobilize and steer innovation for societal goals. Whereas previously science and society had been seen as separate entities (where society was a benign recipient of results from science), there was a development towards conceptualizing science as embedded in a potentially challenging societal context that placed new demands on the societal legitimacy of research and innovation. This has developed further until the current situation where science and innovation may be seen not only as at the service of society, but in fact co-produced with society. This implies that scientific and innovation ventures, and their capacity to answer the challenges facing our society, rest on the joint efforts of scientists, innovators and a broad range of stakeholders, in a responsive relationship with society at large (see e.g. Kuhlmann and Rip, 2014 [7]).

This is expressed in the current ambitious cross-cutting theme of Responsible Research and Innovation (RRI) in Horizon 2020, the most important EU programme for research and development. As a cross-cutting issue it has an impact on all pillars and work programmes. The European Commission (EC) has operationalized RRI in Horizon 2020 as consisting of the following main elements: engage society more broadly in research and innovation activities, increase access to scientific results, ensure gender equality in both the research process and the research content, take into account the ethical dimension, and promote formal and informal science education [8].¹ The inclusion of RRI in Horizon 2020 followed a broader academic and policy discussion on its features and implications. For instance, the EC appointed an independent expert group on RRI [9]. This group described RRI in the following terms:

Responsible Research and Innovation (RRI) refers to the comprehensive approach of proceeding in research and innovation in ways that allow all stakeholders that are involved in the processes of research and innovation at an early stage (A) to obtain relevant knowledge on the consequences of the outcomes of their actions and on the range of options open to them and (B) to effectively evaluate both outcomes and options in terms of societal needs and moral values and (C) to use these considerations (under A and B) as functional requirements for design and development of new research, products and services. The RRI approach has to be a key part of the research and

innovation process and should be established as a collective, inclusive and system-wide approach (page 3).

Several other definitions also exist (see for instance Owen et al., 2014 [10] and von Schomberg 2012 [11]). However, most approaches to RRI include the following elements [12]:

In order to be responsible, research and innovation needs to

1. address significant societal needs and challenges
2. engage a range of stakeholders for the purposes of mutual learning
3. anticipate potential problems, identify available alternatives, and reflect on underlying values, and
4. respond, act and adapt according to 1–3

It is important to observe that RRI is not only an answer to the policy and regulatory dilemmas arising from technoscientific fields whose impacts are poorly characterized or highly uncertain. Instead, RRI seeks to incorporate considerations and knowledge about ethical acceptability and societal needs to steer innovation towards societal goals, trying to answer the question 'what sort of future do we collectively want innovation to create for Europe?' (Owen et al., 2014 [13], 3). As such it highlights the need for society to be involved in governing the purposes of scientific research and technology-infused innovation, acknowledging the centrality of values, interests and purposes in governance, and shifting the discussion from the control of adverse impacts to the orientation of research and technology development activities in order to achieve the 'right impacts' of and through innovation (von Schomberg, 2012 [10], 39). It is from this perspective that RRI has the ambition to integrate previous approaches to the governance of science and technology and research areas that are its direct antecedents, like technology assessment, ethics of technology, ELSA studies, anticipatory governance and public engagement in science and technology [11].

The European Commission is currently working on several questions and dimensions concerning RRI. These cover how to mainstream RRI in Horizon 2020 and in Europe in general, how to federate the RRI community, and how to promote institutional changes to foster RRI in research institutions. This is usually understood as reaching out to research organizations, universities, funding agencies and industry, engage them in RRI and identify good practices that can be proposed as concrete, feasible actions. However, the insight that science and society are inherently interconnected and co-produced, and the new focus on responsibility in science and innovation policy, has implications not only for research funding and for researchers and innovators. The successful implementation of the RRI principles also requires their effective translations in other institutions significantly affecting the science and innovation system and, if needed, their adaptation and change [14].

In this Issues and Opinions Essay we are specifically interested in how new approaches to responsibility in science and technology affects advisory and assessment bodies in the science and technology domain, such as risk

¹ Increasingly governance is mentioned as a sixth and separate key.

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