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# Responsible Research and Innovation: from Science in Society to Science for Society, with Society

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## Abstract

The term responsible (research and) innovation has gained increasing policy relevance in the last two years, in particular within the European Commission's Science in Society programme, framed within the EU Horizon 2020 initiative. We provide a brief historical overview of the concept, and identify three distinct features that are emerging from associated discourses. The first is an emphasis on the democratic governance of the *purposes* of research and innovation, steering these towards the 'right impacts' that are anchored in societal values. The second focuses on *responsiveness*, emphasising the institutionalisation and integration of established approaches of anticipation, reflection and deliberation in and around research and innovation in such a way that it influences the direction of these and associated policy. The third concerns the framing of the concept of *responsibility* itself in the context of research and innovation as collective activities with uncertain and unpredictable consequences. We conclude by reflecting on the motivations for responsible innovation itself, asserting that it must be conducted for substantive and normative reasons, rather than an instrumental approach to expedite the meeting of pre-defined policy goals.

## Introduction: the emergence of responsible innovation in EU policy discourse

The terms 'responsible innovation' and 'responsible research and innovation' have a recent history stretching back over the last decade (e.g. Hellstrom, 2003; Guston, 2006; Owen et al 2009a; Owen and Goldberg, 2010, von Schomberg, 2011 a;b; Lee, 2012; Armstrong et al, 2012), and even further if cognate terms and synonyms relating to it such as 'responsible development' are included ((NNI 2004; National Research Council 2006<sup>1</sup>; Fisher and Rip, in press). Indeed, these terms are heirs to even earlier discussions concerning the ethical, legal and social implications of (e.g. genomic) research, and research integrity. They also evolve from historical visions for collaborations between social, natural and physical scientists to address the wider dimensions of science and innovation early on, visions that can be traced decades back in policy discourse, for example through the 5<sup>th</sup> and 6<sup>th</sup> European Union (EU) Framework programme and its calls for socio-technical integration (Rodriguez et al, in press).

It is however over the last two years that the concept of responsible research and innovation (hereafter, RRI) has gained particular visibility and traction in an EU, and specifically European Commission (EC) policy context. Evolving from discourses of socio-technical integration within and beyond the EC Science in Society programme, it may in part reflect recognition of the limitations of extant policy approaches to managing ethically problematic innovations such as GMOs (Grove-White et al, 2000), synthetic biology (TNS-BRMB, 2000), geoengineering (Royal Society, 2009) and ICT (von Schomberg, 2011a), coupled with an increasing awareness of the global (and intergenerational) impacts of complex innovations in modern society (Jonas, 1984, Adam and Groves, 2011), of which innovations in the financial sector are one notable recent example (Mackenzie, 2010, Armstrong et al, 2011 Muniesa and

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<sup>1</sup> Which states 'Responsible development of nanotechnology can be characterized as the balancing of efforts to maximize the technology's positive contributions and minimize its negative consequences... It implies a commitment to develop and use technology to help meet the most pressing human and societal needs... while making every reasonable effort to anticipate and mitigate adverse implications or unintended consequences.'

Lenglet, in press<sup>3</sup>). These have catalysed an increasing willingness at a policy level to discuss, challenge and rethink linear models of science policy and the social contract for science (in which scientific freedom is exchanged for the promise or expectation of socially – beneficial impacts) and risk-based regulation as a predominant innovation governance paradigm (Owen et al, 2009b; Owen et al, in press).

This has also been fuelled on one hand by a continuing angst concerning the dilemma of control for emerging technologies (Collingridge, 1980; RCEP, 2008) (and how to proceed under conditions of uncertainty and ignorance), and on the other by angst concerning the public value of science, the need to demonstrate research ‘impact’ (Kearnes and Weinroth, 2011), and the place of public participation in both setting research agendas, and modulating research trajectories towards socially-desirable ends (e.g. Fisher et al, 2006; Jones, 2008). Questions of purpose, values-sensitive design (van den Hoven et al, 2012), ethics (von Schomberg, 2007), social desirability, social acceptability and governance (Karinen and Guston, 2010) have all coalesced around an emerging zeitgeist for ‘responsible innovation’ that may seem to intuitively feel right, but which exhibits a lack of clarity in terms of definition, practice and (at a policy level) motivation.

The public emergence of RRI in EU policy discourse is a recent phenomenon. It was in May 2011 that the first public statements emerged indicating its significance at an EU policy level. The first of these was at a workshop held 16-17 May, 2011 at DG Research in Brussels and attended by a number of experts drawn from academia and policy (EC, 2011). Opening the meeting, Octavi Quintana, Director of the European Research Area, stated:

‘We need your help to define responsible research and innovation. After several years of research on the relation between science and society, we evidenced that we need to involve civil society very upstream to avoid misunderstanding and difficulties afterwards.... We cannot guarantee the social acceptability for anything but the more we have dialogue the easier it is to understand the potential obstacles and to work on them..... Your advice is important to help us build a policy for the years to come, notably for the Common Strategic Framework that will begin its life in 2014 and for the European Research Area’ (ERA).

The purpose of the event, to reflect on and develop a shared understanding of the meaning of RRI, was clear. As was its significance: to formulate policy recommendations that would support the development and implementation of a policy underpinned by the concept across the ERA. Although the motivations at an EU policy level were unclear, it was evident that responsible innovation was important to the Commission, at least in sentiment, and that we were being asked to reflect and advise on what it meant, and how it might be defined (Sutcliffe, 2011).

By co-incidence, a week later on the 23-34 May 2011, an international workshop on the theme ‘Responsible Innovation’ was also held at the French Embassy, London<sup>3</sup>. This too brought experts and policy makers together to discuss the concept, building on emerging work in a number of countries including the UK, Holland and the US. This work itself builds on decades of complimentary study in fields of technology assessment (Rip et al,1995; Schott and Rip, 1996; Guston and Sarewitz, 2002; anticipatory governance (Karinen and Guston, 2010), socio-technical integration and ‘midstream modulation’ (Fisher et al, 2006; Fisher, 2007; Schuurbiens and Fisher, 2009; McGregor and Wetmore, 2009) and public and stakeholder engagement (Stirling, 2005; Wilsdon et al, 2005; Sykes and Macnaghten, in press). Again, the purpose of the workshop was to come to a common understanding and definition of responsible innovation, discuss how it might differ from what has come before, and

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<sup>2</sup> For example asset-backed securities – collateralised debt obligations.

<sup>3</sup> <http://www.ambafrance-uk.org/Franco-British-workshop-on,18791>

what it might involve in practice. Would this emerge as a genuinely transformative and even novel approach to governing science and innovation or would it merely be a repackaging of existing concepts to smooth the pathway for pre-defined policy goals?

It was at this meeting that the EC signalled more concrete intentions. First, Gilles Laroche (Head of the Science in Society Programme) announced that the EC would fund a programme of research and co-ordination within the remaining period of the 7<sup>th</sup> Framework Programme on RRI, to include projects developing governance frameworks; that an expert group with the same title would be established to advise the EC; that the EC would seek an Opinion from the European Group of Ethics ; and that it would seek to develop a recommendation on RRI for the ERA, including a possible ‘soft law’ initiative (Laroche, 2011). Reflecting on the fact that “The societal perception and impacts of technology are difficult (impossible) to predict” he stated that ‘early societal intervention may enable anticipation of positive and negative impacts’. The goals, to develop a European model of RRI, would need to be based on the principle of inclusiveness, involving all actors at an early stage (researchers, civil society organisations, industry and policy makers), allowing innovation to be developed in a co-building mode that ‘ensures co-responsibility’. This would herald a transformation from science in society to ‘*science for society, with society*’ (Laroche, 2011).

It was also at this meeting that a paper was circulated by Rene von Schomberg from the European Commission outlining his emerging philosophical thinking (von Schomberg, 2011b). This included a thoughtful discussion concerning the normative targeting of research and innovation towards the ‘right impacts’, anchored within the values articulated within the EU Treaty, more of which we will consider presently. It also included a proposal for a working definition:

“Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products( in order to allow a proper embedding of scientific and technological advances in our society)” (von Schomberg, 2011b)

There have been at least seven international workshops of varying sizes over the last 18 months on the topic of responsible innovation (Fisher and Rip, in press), reflecting growing momentum in both academic and EU policy contexts. One of the more notable of these was held under the auspices of the Danish presidency of the EU: a conference on Science and Society in Europe, with the subtitle, ‘Responsible Research and Innovation’. Opening the conference, Morten Østergaard, the Danish Minister for Science and Education, re-emphasised the evolving ambition at a policy level to support “the best science *for* the world” and not just “the best science *in* the world”. Presenting via video-link, EU Commissioner Mary Geoghegan –Quinn provided the first tangible evidence of high level EC policy support for the concept (Geoghegan-Quinn, 2012). Framing the RRI concept as one supporting the EU Horizon 2020 Strategy, she stated:

‘ to overcome the current economic crisis we need to create a smarter, greener economy where prosperity will come from research and innovation... In the search for prosperity, jobs and a better life for everyone, research, innovation and new technologies present us with many different choices and many possible paths to follow.....Researchers, policy makers, business people, innovators and most of all, the general public, have difficult choices to make as regards how science and technology can help tackle our different societal challenges... we can only find the right answers by involving as many stakeholders as possible in the research and innovation process. **Research and innovation must respond to the needs and ambitions of society, reflect its values and be responsible...our duty as policy makers (is) to shape a governance framework that encourages responsible research and innovation”** (Geoghegan-Quinn, 2012, bolded text as in original statement)

The more instrumental EU policy framing of RRI within the Horizon 2020 Strategy <sup>4</sup> was re-enforced by EC Deputy Head of Cabinet Waldemar Kutt at a panel presentation at the Euroscience Open Forum meeting, July 2012 in Dublin, Eire entitled ‘Can Responsible Research and Innovation expedite Europe’s economic renewal?’ At face value this presentation, and the goals of the strategy to support economic growth, jobs and strengthened economic governance may appear to frame RRI as being narrowly, and instrumentally, motivated to support the delivery of a pre-committed policy (largely framed in terms of economic growth). Quite apart from the fact that the Strategy has other important targets for innovation beyond economic growth, the language of RRI at this meeting and others before it involving the EC (often convened under the Science in Society programme) has in fact been more nuanced and more ambiguous. This ambiguity may reflect a range of motivations in different parts and at different levels of the EC. These may include a desire to reposition the Science in Society programme within the Horizon 2020 initiative in the face of budgetary pressures. It certainly reflects a desire in some parts of the EC to expedite and support the meeting of the Horizon 2020 policy goal. But it may also reflect less instrumental motivations by those who envisage a more normative and substantive process that naturally builds on decades of research and messages emerging from the fields of science and technology studies, philosophy and beyond.

Overall RRI has (at least in sentiment) positive, constructive overtones, where science and innovation are envisaged as being directed at, and undertaken towards socially desirable and socially acceptable ends, through a dynamic and inclusive process that offers both opportunities for innovation as well as opportunities for flexible control before technological ‘lock – in’ (Collingridge, 1980). As a term it seems hard to argue against – few would argue for irresponsible research and innovation. But beyond this sentiment, what features can we distil from the emerging discourse of RRI in both academic and policy circles? And can this approach be of practical value (and implementable at an EU – wide level) given the reality of innovation as a complex, messy, collective and deeply uncertain phenomenon, where irresponsibility is a manifestation of such complexity (what Beck, 1995 described as ‘organised irresponsibility’)?

Our brief overview suggests that RRI is a rapidly evolving concept accompanied by confusion as to motivation, theoretical conceptualisation and translation into practice: in this regard it exhibits traits common to many innovations in their early stages. As with any innovation, its purpose(s), process and products are still shrouded in uncertainty. But even so, we can identify some distinct features, locating these in the context of earlier concepts, some of which we have already highlighted above. We now identify three features of RRI that we suggest are emergent from the evolving discourse. One of these is the call for reflection and deliberation not only on the uncertain products of science and innovation - products which in the fullness of time we have been asked in the past as a society to accept or reject in the face of norms and values- but on the very *purposes* of science and innovation itself, before the innovation journey has begun: why do it, who will benefit and how? In this regard, it is perhaps timely that we collectively reflect on the purposes of RRI as an innovation itself: we conclude with our own reflections in this regard.

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<sup>4</sup> [www.europarl.europa.eu/document/activities/cont/201206/20120620AT47284/20120620AT47284EN.pdf](http://www.europarl.europa.eu/document/activities/cont/201206/20120620AT47284/20120620AT47284EN.pdf) (page 5: ‘introduction of new specific objective: ‘Responsible research and innovation’.

### Three emerging features of Responsible Research and Innovation

#### a) Science for society: democratising the governance of intent

The first emerging feature of contemporary RRI discourse we suggest is one that concerns itself with the purposes of science and innovation, and the underlying motivations and intentions for these. It seeks to consider not only what we do not want science and innovation to do – a well known and well documented pre-occupation with characterising and managing unintended risks (the latter often through regulation) – but what we *do* want it to do. It asks how the targets for innovation can be identified in an ethical, inclusive, democratic and equitable manner. It moves beyond the ‘closing down’ framing of conventional ethical review, limited in scope as it is to research conduct involving people, animals and genetic material. It has a primary purpose to democratically define and realise new areas of public value for innovation (Wilsdon et al, 2005). It asks for inclusive deliberation concerning the direction of travel for science and innovation, from the outset, opening up opportunities for these to be directed towards socially – desirable ends. This immediately opens up a tension between the principle of participation and that of scientific freedom, one that is hardly new but is of particular relevance to RRI. This in turn prompts an important question concerning when (i.e. how far upstream) such participation should be encouraged and supported.

For *innovation* this tension may be less keenly felt. Indeed, the involvement of users and other stakeholders in innovation, whether this is described as market driven or open innovation (Chesborough, 2003), and the acknowledged value of this in new product development and beyond is hardly new. And in the domain of science, one can already witness experiments involving participatory agenda setting and values-sensitive design within research programmes across the EU (e.g. in The Netherlands<sup>5</sup> (van der Hoven et al, 2012) and the UK (Jones, 2008). The Alzheimers’s Society in the UK for example has a research network of some 200 carers and people with dementia who help set research priorities, prioritise grant applications and sit on grant selection panels<sup>6</sup>.

More broadly, the realisation of economic and social value has long been a considered responsibility of scientific institutions (Guston, 2006), morphing as it has into the concept of science to meet societal challenges (Lund Declaration, 2009, Kearnes and Wienroth, 2011). An increasing requirement to articulate societal and economic ‘impact’ has become a condition of funding even ‘blue skies’, curiosity - driven research in many countries. This feature of RRI – science for society- is perhaps then a natural evolution of an existing trend towards challenge-led science and innovation, with a framing that is broader than generating commercial value. What one senses is a desire for a more institutionalised and consistently -applied approach that is inclusive and values-based (or at least values-sensitive), in which the principle of participatory agenda setting, for example through the involvement of publics and stakeholders in the formulation of grand challenges, is embedded in science and innovation policy and its delivery as part of a more generalised management framework, at a pan - European scale.

The RRI definition proposed above, and the statements made at an EU policy level, place a premium on inclusive participation that allows the setting of research and innovation goals, defined in terms of the ‘right impacts’, which are themselves anchored in societal values. The obvious question then becomes, what are the ‘right impacts’ of research and innovation, and what values should these be anchored in? Von Schomberg (2011a,b) suggests that we cannot aspire to the abstract ideals of the Aristotelian ‘good life’ (however contested these may be), and takes a more pragmatic view that, at least in a European context, the ‘right impacts’ are those enshrined in the European Constitution, such as economic growth,

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<sup>5</sup> Maatschappelijk Verantwoord Innoveren (Responsible Innovation) programme run by the Netherlands Organisation for Scientific Research (NWO) [www.nwo.nl/nwohome.nsf/pages/nwoa\\_7e2ezg\\_eng](http://www.nwo.nl/nwohome.nsf/pages/nwoa_7e2ezg_eng)

<sup>6</sup> ([http://alzheimers.org.uk/site/scripts/document\\_pdf.php?documentID=1109](http://alzheimers.org.uk/site/scripts/document_pdf.php?documentID=1109))

jobs and competitiveness, quality of the environment and sustainable development. Meeting these he asserts, should be achieved in a way that is ethically acceptable, socially desirable, safe and sustainable (von Schomberg, in press). In combination such targets for innovation clearly embed complex dilemmas and areas of contestation. Some will be in direct opposition to one another. The Horizon 2020 strategy features a number of high level ‘societal challenges’, to be tackled through science and innovation. These include not only economic growth and jobs, but climate change, developing sustainable transport and mobility, making renewable energy more affordable, ensuring food safety and security, or coping with the challenge of an ageing population. Which should be given more emphasis?

The World Wildlife Fund (WWF, 2012) for example considers the right impacts for innovation as being *dematerialisation* (i.e. products, services or processes that dramatically cut the use of natural resources), *restorative* (i.e. innovations that contribute to net positive environmental impacts and the restoration of biodiversity and the environment, *open loop* (where waste from products is turned back into resource) and *renewable energy and low carbon*. Here there is an explicit prioritisation of the targets for innovation to those that decouple growth from environmental impacts, protect and restore ecosystems and lead to 100% renewable energy future by 2050 (WWF,2011). One might extend these to argue that any process of responsible innovation that serves to target innovation at those ‘right impacts’ which support the increasingly unsustainable grand Capitalist project of modernity in the face of exponential population growth, deepening inequality, increasing resource scarcity, global environmental degradation and the exceedance of planetary boundaries may, in the longer term, be viewed as an irresponsible innovation in itself.

Irrespective of one’s own view, it is clear that the negotiation of the ‘right impacts’ of innovation is a political discussion, involving considerations of power, democracy and equity, and suggests that RRI will always embed a strongly political dimension if it is to involve the governance of intent. Negotiating and prioritising such a constellation of ‘right impacts’ will have difficult ethical dimensions and embed significant dilemmas. It suggests the need for substantive processes of inclusive reflection and deliberative democracy, supported by mechanisms of anticipation that describe the uncertain translation of values through to visions of impact. It is the aspiration to institutionally-embed such integrated processes in such a way that deliberation and reflection can be coupled to action (i.e. responsiveness) that is a second emerging feature of RRI.

#### b) Science with society: institutionalising responsiveness

As with the first feature of the emerging RRI discourse, the second may also arguably be considered as being evolutionary in nature. It emphasises the integration and institutionalisation of established mechanisms of reflection, anticipation, and inclusive deliberation in and around the processes of research and innovation (Owen et al, in press; Stilgoe et al, submitted). We describe these dimensions in terms of a need to a) *anticipate*: describing and analysing intended and potentially unintended impacts that might arise, be these economic, social, environmental or otherwise, supported by methodologies that include those of foresight, technology assessment and scenario development. These not only serve to analyse promissory narratives of expectation but to explore other pathways to other impacts, to prompt ‘what if...’ questions (Guston, in press); b) *ethically reflect* on underlying purposes, motivations and potential impacts, what is known (including those areas of regulation or other forms of governance that currently exist) and what is not known, associated uncertainties, risks, areas of ignorance, assumptions, questions and dilemmas and c) *inclusively open up* such reflection to broad, collective *deliberation* through processes of dialogue, engagement and debate, inviting and listening to wider perspectives from publics and diverse stakeholders.

We have brought these three dimensions together to construct a framework for responsible innovation, stressing the need for this to be an iterative and flexible process of adaptive learning. But individually

these dimensions are hardly new, building for example on concepts of anticipatory governance, technology assessment in its various forms and public engagement – all well known to scholars in science and technology studies. It might be argued that their integration represents a degree of novelty, but socio-technical integration also has a history in EU policy discourse, including the structuring and delivery of the EU Framework Programme (to varying degrees); (Rodriguez et al, in press) and more recent initiatives such as those funded within the US NNI programme (Fisher, 2007). And integration is a key feature of concepts of real – time and constructive technology assessment (which aims to broaden technological design, development and embedding in society by including more actors, and to use insights from such actors to modulate technological dynamics).

It is the institutionalised *coupling* of such integrated processes of anticipation, reflection and inclusive deliberation to policy and decision-making processes – i.e. the dimension of *responsiveness* - that is an important contribution that RRI makes. Over the past several decades there has been a proliferation of public engagement activities concerning science and new technologies, from citizens' juries to consensus conferences. But this has too often been detached from policymaking, which has not been responsive (see Macnaghten and Chilvers, 2012). Social scientists and public engagement practitioners have too often been drawn into a pre-occupation with the processes of public engagement at the expense of a questioning of its purposes (Stirling, 2005; Marris and Rose, 2010) and how science and innovation can change as a consequence – how it can look different in response (Stilgoe et al, forthcoming).

Responsiveness is a dimension that is evident in recent academic experiments involving the 'midstream modulation' of scientific trajectories described by Fisher and others within the field of nanosciences, in which the introduction of social scientists and humanists catalyses reflection and the modulation of research trajectories (Fisher and Rip, in press). There are numerous ways to enact the dimension of responsiveness, from Fisher's 'governance from within' to more formalised processes of innovation stage gating that we have recently explored in the controversial area of geoengineering. Here the application of the responsible innovation framework directly impacted on research- in this case the decision to undertake the first publicly funded field trial of a controversial solar radiation management engineering system (Macnaghten and Owen, 2011), with material influence on decisions regarding the progression and direction of this field of research, at least in the UK. These experiences have also illustrated the need for any RRI approach to be instigated from the initial definition and inception of a research programme, which must be then be multidisciplinary in its construction, resourcing and delivery.

### c) Reframing responsibility

The emerging concept of RRI confers new responsibilities not only on scientists, universities, innovators and businesses, but also on policy makers and research funders. How are grand challenges to be defined? How can they be responsive in their delivery? When should such an approach be used? And at what level (for example with every project, or at a thematic programme level)? How can emerging 'reflexive capital' be communicated to national and international policy making at a governmental level and beyond, particularly in contentious and controversial areas of science and technology? These are responsibilities that require reflection, including at the European Commission itself, on the funding and delivery of science and innovation programmes. Awareness of such responsibilities is developing. Responding to a public dialogue in the UK concerning synthetic biology, David Delpy (the Chief Executive of the UK Engineering and Physical Sciences Research Council) stated:

"Research Councils have a responsibility to scrutinize the potential impacts and risks of emerging technologies, and encourage the researchers we fund to do likewise.... The challenge will be to define an approach that promotes creativity and innovation in research underpinned by a commitment to its responsible development". (Delpy, 2011)



Funders have a leadership role to play in establishing a framework for responsible innovation and its associated expectations, including processes of governance and oversight. They also have a role to play in catalysing the development of capacity for responsible innovation to meet such expectations, through programmes of education and training. But while those with the gift to distribute research funds clearly have a leadership role to play (see for example EC, 2008 for a controversial example of this in the field of nanosciences), it is also clear that innovation is a collective process that requires a *collective* approach to responsibility (Mitcham, 2003; von Schomberg, 2007, Grinbaum and Groves, in press), extending beyond the early stages of research and involving other actors and users who collectively translate ideas into application and value. Von Schomberg (2007) considers that collective responsibility is supported by public debate (i.e. that ‘upon everyone’s shoulders rests a particular moral obligation to engage in the collective debate that shapes the context for collective decision making’), technology assessment, foresight/ knowledge assessment and constitutional change, dimensions which have strong synergies with the dimensions of anticipation, reflection, deliberation and responsiveness we have highlighted above.

The framing of responsibility itself is perhaps one of the greater intellectual challenges for those wrestling with the concept of responsible innovation. Consequentialist models of responsibility which are grounded in the status of various forms of knowledge and in which the consequences of one’s actions are judged in hindsight (e.g. through legal constructs of liability or reasonable foreseeability) are deeply problematic for innovation as a future-oriented, highly uncertain activity (Grinbaum and Groves, in press). Traditionally, crippled by the limits of foresight, the only alternative has been to subscribe to moral luck, to take one’s chances that we can be excused from moral blame in the fullness of time. Reframing responsibility in the context of innovation as a collective, uncertain and unpredictable activity is focussing attention on dimensions of responsibility such as care and responsiveness that are values and not rules-based, and accommodate uncertainty (Jonas, 1984; Richardson, 1999). It is perhaps in this regard that research around the concept of RRI might make a truly novel contribution to intellectual thought.

### **Conclusions: the politics of responsible innovation**

The EC Science in Society Stand at the European Science Open Forum conference in Dublin, July 2012 had the title “Responsible Research and Innovation: Europe’s ability to respond to societal challenges” (Fig 1 below). We have described three emergent features of RRI discourse at an EU policy level, all of which are encapsulated in that title. The first is an emphasis on science for society – a focus on purposes, where research and innovation are targeted at Europe’s societal challenges and the ‘right impacts’, underpinned by a deliberative democracy. The second, linked to the first, is an emphasis on science with society – a focus on the need for research and innovation to be responsive to society in terms of setting its direction, and in modulating its trajectory in the face of the uncertain ways innovation invariably unfolds as part of its naturalisation in the world. RRI calls for institutionalised responsiveness. A third is encapsulated in the explicit linking of research and innovation to responsibility, the ‘responsible’ in responsible innovation (Grinbaum and Groves, in press). This is prompting a re-evaluation of the concept of responsibility as a moral and philosophical social ascription in the context of innovation as a future-oriented, deeply uncertain, often complex and always collective phenomenon. This in turn is challenging scientists, innovators, business partners, research funders and policy makers to reflect on their own roles and responsibilities, acknowledging that the irresponsibility in innovation is a manifestation of a the ecosystem of innovation and requires a collective, institutionalised response, if this is indeed possible.

Any process that asks for reflection on the purposes of innovation should also reflect on the purpose of RRI as an innovation itself. In the field of public engagement, the distinction between instrumental, normative and substantive motivations (Fiorino, 1989; Stirling 2005) has been one useful way to consider and evaluate motivations. Is RRI a process that has normative motivations (e.g. that it is the right thing to do for reasons of democracy, equity and justice), substantive motivations (e.g. that policy choices can be co-produced with publics in ways that authentically embody diverse social knowledge, values and meanings) or instrumental motivations (e.g. that it provides social intelligence to deliver pre-committed policy objectives), (see Sykes and Macnaghten, in press)? Policy statements from the European Commission suggest that RRI has underlying motivations that are not only instrumental (i.e. in supporting the delivery of policy commitments in the Horizon 2020 Strategy) but also normative and substantive (von Schomberg 2011a,b; Laroche,2011). In these position papers and statements one can discern both grand ambition and shorter term policy goals. If RRI risks becoming a new label for business-as-usual, it also risks being used instrumentally, to smooth the path of innovation in society, and/ or to achieve pre-committed policies This, we argue, should be a primary point of discussion and clarification, acknowledging we are at a stage before the term itself becomes locked - in. The purposes and motivations for RRI at a policy level must be clear.

Responsible innovation evokes a collective duty of care, firstly to rethink what we want from innovation and then how we can make its pathway responsive in the face of uncertainty. Acknowledging the power of innovation to shape our collective future, RRI challenges us first and foremost to ask what kind of future we want innovation to bring into the World. Ultimately this has to be a project that is far grander in ambition than the delivery of short term policies. But it must also be practicable and feasible, going beyond aspiration as a mechanism for genuine and transformative change. Responsible innovation must be a process in which innovation looks different in response. There are many in academia and policy who subscribe to this grand ambition, but whether RRI lives up to this challenge remains to be seen.

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Figure 1.EC Science in Society Stand at the ESOF meeting, Dublin

