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Rethinking societal engagement under the heading of Responsible Research and Innovation: (novel) requirements and challenges

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ABSTRACT

Societal engagement is a key dimension of Responsible Research and Innovation (RRI), aiming at making science, technology and innovation more transparent, interactive and responsive. Within this article, we identify and discuss the specific requirements and challenges for societal engagement under the heading of RRI along five dimensions. First, engagement aims at shaping research and innovation in a socially robust manner. Second, RRI demands a balanced representation of and a balanced view by various actor groups. Third, RRI emphasises engagement moving upstream as well as continuous engagement. Fourth, RRI focusses on forms of invited participation and calls for two-way interactions. Fifth, with the emphasis on ethics as a driving force, RRI favours specific framings of research and innovation. In conclusion, two intertwined challenges arise for societal engagement under RRI: making the political character of science and technology explicit and therefore paying particular attention to framing in 'invited participation'.

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Responsible Research and Innovation; societal engagement; inclusiveness; timing; framing; participation

Introduction

In the past decades, societal engagement has gained importance in science, technology and innovation (STI) in several ways. Regarding *research*, concepts such as post-normal science (Funtowicz and Ravetz 1993), Mode 2 science (Gibbons et al. 1994; Nowotny, Scott, and Gibbons 2001), transdisciplinary research (Pohl 2008) and citizen science (Irwin 1995) suggest new ways of knowledge production and a changing role of science in society. Given complex societal problems, knowledge production can neither remain in isolated disciplinary strands nor be restricted to academia. Concerning *expertise*, the call for democratisation has resonated in changing practices of advisory institutions. For example, technology assessment (TA) initially strongly relied on scientific and technological expertise. From the 1980s onwards, TA has opened up towards societal actors and various publics

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with new approaches, known as 'constructive', 'participatory' or 'proactive' TA (Schot and Rip 1997; Guston and Sarewitz 2002; Joss and Bellucci 2002). In *industry,* we witness increased opening up of innovation spaces to users and communities affected to make innovations more socially robust (von Hippel 2005). The increased importance of stakeholders' participation in the business sector is also suggested, at least on some accounts, in the principle of corporate social responsibility (CSR).

The governance approach *Responsible Research and Innovation* (RRI) was introduced to reconcile the economic imperative of innovation with societal needs and expectations (see for example, Owen et al. 2013; Von Schomberg 2013; von Schomberg and Blok 2019). RRI reinforces the call for societal engagement in research and innovation (R&I) processes (Burget, Bardone, and Pedaste 2017), science, technology and innovation governance and business contexts (Chatfield et al. 2017; Lubberink et al. 2017). However, there is a lack of clarity about what societal engagement under the terms of RRI precisely means. Although there are numerous studies on detailed aspects of societal engagement, a systematic overview of the requirements for societal engagement in the context of RRI is missing. With this article, we aim to fill this gap by providing a critical review of the *specific requirements and related challenges for societal engagement under the heading of RRI*.

First, we specify the key tenets of RRI (section 'Calling for practical ethics and engagement'). Based on an expert workshop and a meta-analysis of EU projects and academic literature (section 'Methods and material'), we discuss the requirements and challenges for societal engagement under RRI along five dimensions: purpose, actors, timing, procedures and framing (section 'Societal engagement under RRI – requirements and challenges'). Concludingly, we discuss two intertwined challenges for societal engagement under RRI: making the political character of science and technology explicit and therefore paying particular attention to framing in 'invited participation' (section 'Conclusions').

Calling for practical ethics and engagement

RRI originated in the mid-2000s in academic and policy discourses on how to govern nanotechnology (Rip 2014). Due to the tenacious conflicts around agri-biotechnology, actors in science, politics and industry aimed at guiding technological development in accordance with societal concerns from the outset. Ever since, a range of academic publications, policy documents and initiatives have referred to RRI. Although (or just because) RRI has become a highly visible governance approach, debates on its precise meaning are still on-going (Strand et al. 2015; Burget, Bardone, and Pedaste 2017). Definitions and frameworks are ranging from general visions to the formulation of concrete requirements for R&I processes. Across the diversity of conceptions, two key tenets have stabilised: (i) the emphasis on the role of ethics, societal needs and values for shaping science, technology and innovation and (ii) the restructuring of how research and innovation are performed (see, for example, Von Schomberg 2013; Owen et al. 2013; Stilgoe, Owen, and Macnaghten 2013; Burget, Bardone, and Pedaste 2017).

First, in the context of RRI, and building on earlier developments mentioned above, *ethics* no longer applies ex-post to assess the societal acceptance of innovations. Instead, ethics becomes a *design element* to shape innovation according to societal values, needs and expectations. Research and innovation should be (ethically) acceptable,

sustainable and societally desirable (Von Schomberg 2013, 65), socially and environmentally beneficial (Sutcliffe 2011), socially relevant, solution-oriented and sustainability-centred (Wickson and Carew 2014). However, what 'ethically acceptable', 'sustainable' or 'socially desirable' means is hardly fleshed out. Following Von Schomberg (2013, 64), the minimum requirement for ethically acceptable research and innovation is compliance with the fundamental values of the EU charter on fundamental rights and the safety protection levels by the EU.

Second, RRI implies specific *process requirements* for R&I activities, including societal engagement, anticipation, reflexivity, responsiveness, openness and transparency (Stilgoe, Owen, and Macnaghten 2013; Kuhlmann et al. 2016; Smallman, Lomme, and Faullimmel 2015; Owen et al. 2013; Strand et al. 2015). At the core is the call for *societal engagement*, i.e. the involvement of a wide range of societal actors in STI (Kuhlmann et al. 2016; Wickson and Carew 2014; Stilgoe, Owen, and Macnaghten 2013; Burget, Bardone, and Pedaste 2017). This call assumes that in a pluralistic society, the visions, values and expectations that should guide research and innovation can neither be determined a priori nor top-down but should be explored in inclusive deliberations by a broad range of societal actors. With this, RRI emphasises collective co-responsibility for R&I (Von Schomberg 2013; Owen, Macnaghten, and Stilgoe 2012). The call for engagement and responsibility is to some extent suggested in the concept of CSR, which therefore potentially builds a bridge to RRI in the business context. Both concepts can include a consideration of ethical aspects and, therefore, in at least some cases, try to integrate a variety of values and worldviews through stakeholder involvement (Gurzawska, Mäkinen, and Brey 2017). Even though our main focus within this article is on publicly funded R&I activities and governance, the current developments in the business sector underline that societal engagement is vital to the future effectiveness of RRI.

Anticipation and *responsiveness* are additional crucial elements of RRI. Following principles of 'anticipatory governance' (Barben et al. 2008), RRI calls for strengthening anticipatory instruments and institutions such as foresight or TA. Anticipation includes epistemic aspects, i.e. the early reflection on consequences, uncertainties, risks and ignorance, as well as techno-social visions. RRI further demands *institutionalised reflexivity*: Researchers and innovators should reflect on their own ethical, political or social assumptions, their framings of problems, their values and expectations, and consider their roles and responsibilities in R&I. The principle of *responsiveness* implies that R&I processes are flexible and open in their direction, trajectory and pace to be continuously adapted to emerging knowledge, changing societal needs, values and expectations (Stilgoe, Owen, and Macnaghten 2013).

While these key tenets have stabilised, the spectrum of what RRI means in practice is broad, introducing considerable ambiguity to the concept (Owen, Macnaghten, and Stilgoe 2012). On the one side, RRI supports the growth agenda in accelerating innovation by identifying potential barriers (e.g. public resistance) (de Saille 2015; Delvenne 2017). On the other side, RRI may also problematise the neoliberal dogma of 'innovation, growth, and welfare' (Guston 2015) when broader global impacts and trade-offs and differing values are considered (de Hoop, Pols, and Romijn 2016; Fisher et al. 2015).

With this article, we aim to further clarify the concept of RRI by a review of the specific requirements and related challenges for one of its key elements, i.e. societal engagement. Our analysis builds on and extends existing studies as it summarises and synthesises the

requirements and challenges, which so far have been discussed mainly in an isolated manner. In addition to providing a condensed review of the debate, we identify cross-cutting challenges for societal engagement under RRI and discuss to which problems and contradictions engagement in the context of RRI may lead. We conclude that societal engagement is realised under conditions that do not always make it easy to fulfil RRI-specific demands.

Methods and material

Our discussion of societal engagement under RRI builds on a meta-analysis of respective academic (and partly practitioner) discourses based on three sources: an expert workshop, ten EU projects and relevant literature. First, we conducted the expert workshop 'Contemporary experiences with societal engagement under the terms of RRI' (held in Vienna in May 2016) to discuss how societal engagement should be (re)conceptualised in the context of RRI. Altogether 18 experts participated, including European scholars involved in the conceptualisation and advancement of RRI, experts on societal engagement more broadly and representatives of public funding agencies.[1] The workshop discussions were recorded, transcribed and analysed by the authors. The following themes emerged as salient: practical experiences with societal engagement, requirements for societal engagement in terms of forms and procedures, different functions and values ascribed to engagement, participant's motivations, barriers in academia to include non-scientific actors and the transformative potential of RRI for R&I governance.

Following this first structuring of the academic and practitioners' debates, we analysed the findings from ten EU FP7 projects (see Table 1). To conceptualise RRI and develop and test appropriate forms of societal engagement, the EU has funded many large-scale projects under the FP7 'Science in Society Programme'.[2] We selected ten projects with different foci: four projects dealt with the question of how to realise RRI with regard to institutional structures (GREAT, PROGRESS, ResAGorA, RRI Tools), four projects specifically asked how to conceptualise and foster societal engagement under RRI (CONSIDER, Engage 2020, PERARES, PE2020), and two projects shed light on the implementation of societal engagement in the context of specific emerging technologies (NERRI, SYNENERGENE). In addition, we based the selection on the projects' advancement and the availability of results, the experts' recommendations and partly our involvement (NERRI, SYNENERGENE). The primary sources of analysis were the projects' deliverables.

We complemented this review of EU projects with a parallel analysis of relevant literature on (a) the conceptualisation of RRI, (b) RRI and societal engagement and (c) societal engagement in general. Regarding (a) and (b), we started with scientific articles and book chapters that prominently addressed RRI or RRI and societal engagement and had gained prominence in the academic discourse (as indicated by citations). We added literature by equally looking for relevant cited literature and more recent citing articles until we reached theoretical saturation, i.e. no new aspects emerged from additional literature. Since the literature on societal engagement and dialogue is vast, we confined ourselves to a re-reading of core contributions. In this respect, we could draw on our own long-standing experience in research on public participation. We analysed the projects and

Table 1. Analysed FP7 projects.

Acronym and name	Duration	Coordinator	Focus
CONSIDER – Civil Society Organisations in Designing Research Governance[a]	02/2012-01/2015	De Montfort University, Leicester, UK	Civil Society Organisations' participation in research (benefits, limits, practice, influencing factors)
Engage 2020 – Engaging Society in Horizon 2020[b]	09/2013–11/2015	Danish Board of Technology Foundation, Denmark	The use of societal engagement methods and policies in R&I (mapping and exploring policies, methods, tools and instruments)
GREAT – Governance for Responsible innovATion[c]	02/2013-02/2016	University of Namur, Belgium	RRI governance (participation, responsible practices, new partnerships in innovation networks)
NERRI – Neuro-Enhancement: Responsible Research and Innovation[d]	03/2013-05/2016	Cienca Viva-Agencia Nacional para a Cultura Cientifica e Technologica, Portugal	RRI in neuro-enhancement in Europe (normative framework for the governance of neuro-enhancement technologies, promotion of societal dialogue)
PERARES – Public Engagement with Research and Research Engagement with Society[e]	05/2010-10/2014	Rijksuniversiteit Groningen, The Netherlands	Public engagement in research (involving researchers and CSOs in the formulation of research agendas and the research process)
PROGRESS – PROmoting Global REsponsible research and Social and Scientific innovation[f]	02/2013-01/2016	Centre for Professional Ethics, University of Central Lancashire, UK	Global network on RRI; RRI debate on a global level
PE2020 – Public Engagement Innovations for Horizon 2020[g]	02/2014-01/2017	University of Helsinki, Finland	Innovative public engagement tools and instruments for dynamic governance in the field of Science in Society
Res-AGorA – Responsible Research and Innovation in a Distributed Anticipatory Governance Frame. A Constructive Socio-normative Approach[h]	02/2013-01/2016	Fraunhofer-Gesellschaft, Germany	Normative and comprehensive governance framework for RRI
RRI Tools[i]	2014–2016	'la Caixa' Foundation, Spain	RRI practices (identification, analysis, development of digital resources, training)
SYNENERGENE – Responsible Research and Innovation in Synthetic Biology[j]	07/2013-06/2017	Karlsruhe Institute of Technology, Germany	Public dialogue and mutual learning processes on synthetic biology

[a]See http://www.consider-project.eu/home (last accessed 23 February 2021).
[b]See http://engage2020.eu/ (last accessed 23 February 2021).
[c]See http://www.great-project.eu/ (last accessed 23 February 2021).
[d]See https://cordis.europa.eu/project/id/321464 (last accessed 23 February 2021).
[e]See https://www.livingknowledge.org/projects/perares/ (last accessed 23 February 2021).
[f]See http://www.progressproject.eu/ (last accessed 23 February 2021).
[g]See https://cordis.europa.eu/project/id/611826 (last accessed 23 February 2021).
[h]See http://res-agora.eu/ (last accessed 23 February 2021).
[i]See http://www.rri-tools.eu/ (last accessed 23 February 2021).
[j]See https://www.synenergene.eu/ (last accessed 23 February 2021).

literature along the following aspects: (a) conceptions of RRI, (b) respective requirements for societal engagement in R&I, (c) changes in the requirements for engagement under the terms of RRI and (d) identified barriers and incentives for societal engagement. The five dimensions on which our following discussion is based (see section 'Societal engagement under RRI – requirements and challenges') emerged as consistently relevant and robust throughout the variety of sources.

Societal engagement under RRI – requirements and challenges

The open and flexible character of RRI implies that a wide range of expectations and demands are placed on societal engagement. Table 2 provides illustrative examples of this diversity in literature and the analysed EU projects.

These examples point to the five distinct dimensions that proved to be central in our analysis of the discourse on societal engagement under RRI: (a) the purposes of societal engagement (Von Schomberg 2015; de Saille 2015), (b) the actor groups that should become engaged (see Strand et al. 2015; Rask et al. 2016), (c) the aspect of timing (Von Schomberg 2015; Asante, Owen, and Williamson 2014), (d) the engagement formats and procedures (Asante, Owen, and Williamson 2014; Rask et al. 2016; de Saille 2015) and (e) the framing of STI in engagement processes (de Saille 2015; Asante, Owen, and Williamson 2014). These five dimensions serve to structure our discussion of the specific requirements and respective challenges for societal engagement under the heading of RRI.

Why societal engagement? – Purposes

Defining the purpose of societal engagement under RRI is fundamental to specify further requirements for the actors, timing, procedures and framing. The literature on public participation has long suggested competing rationales for societal engagement, namely the normative, instrumental and substantial one (Fiorino 1990; Stirling 2008) as well as the constructive rationale (Bauer and Pregernig 2013). Regarding RRI, the principle of responsiveness points to the expectation that societal engagement informs and improves R&I decisions and processes regarding ethical acceptability and sustainability (substantial function). When authors report about the impacts of societal engagement

Table 2. Selected conceptions of societal engagement under RRI.

'*We might define PE as a societal commitment to provide encouragement, opportunities and competences in order to* ***empower citizens to participate in debates around R&I****, with potential* ***feedback and feed-forward*** *for the scientific process. Deeper forms of engagement in science and technology, where* ***citizens are peers*** *in the knowledge production, assessment and governance processes, also deserve attention*' (Strand et al. 2015, 21, emphasis added).

'*On-going public debate and monitoring of public opinion is needed for the legitimacy of research funding and particular scientific and technological advances.* ***Continuous public platforms*** *should replace one-off public engagement activities with a particular technology, and, ideally, a* ***link with the policy process*** *should be established. The function of public debate in viable democracies includes enabling policy makers to exercise agenda and priority setting. Public debate, ideally, should have a moderating impact on 'technology push' and 'policy pull' of new technologies […]*' (Von Schomberg 2015, 68, emphasis added).

'*PE involves different types of processes, where there is a* ***distinct role for citizens and stakeholder*** *groups to* ***contribute to research and innovation activities****. (…) PE is intentional activity that aims to create opportunities for* ***mutual learning*** *between scientists, stakeholders and members of the public. Innovative PE can be defined as new participatory tools and methods that have the potential to contribute to a more dynamic and responsible governance of R&I*' (Rask et al. 2016, 10, 7, emphasis added).

'*Responsible innovation entails an open, collective and continuous commitment to be (…) deliberative –* ***inclusively opening up visions, purposes, questions and dilemmas to broad, collective deliberation through processes of dialogue****, engagement and debate, inviting and listening to wider perspectives from publics and diverse stakeholders. This allows the* ***introduction of a broad range of perspectives to reframe issues*** *and the identification of areas of potential contestation*' (Asante, Owen, and Williamson 2014, 14, emphasis added).

'*(…) responsible forms of innovation should […] include the public as well as traditionally defined stakeholders in* ***two-way consultation****.' (…) '(…) the on-going, bottom-up engagement which is RRI's ideal* ***may reveal that it is necessary to change or even halt a trajectory of research****, or to discuss how RRI might be applied to existing technologies which have already incited widespread public resistance, in order to determine whether they should continue to be developed with public funds*' (de Saille 2015, 153, 63, emphasis added).

processes, they frequently invoke the constructive rationale. In these instances, the focus lies on collaboration, communication, capacity building, learning and empowering (Landeweerd et al. 2015, 17; Rask et al. 2016, 58). Participation results in desirable social interaction and dynamics such as mutual understanding, changes in attitudes and, ultimately, involved participants' actions. Following the instrumental rationale, participation serves certain predefined ends such as increasing legitimacy, trust or acceptance of R&I. Several scholars voice increasing unease regarding current activities and practices of engagement (Horst and Michael 2011; Felt and Fochler 2010; Irwin, Jensen, and Jones 2013). In particular, engagement activities involving the citizenry are suspected of aiming to inform or even persuade the public of the benefits of R&I and consequently to revitalise the notorious deficit model.

Overall, many scholars conclude that the tangible influence of societal engagement on decisions in R&I remains marginal (see, for example, van Oudheusden 2014, 80; Landeweerd et al. 2015, 13). Stated reasons are a low awareness or even scepticism of scientists and policy-makers towards engagement processes, low quality of the results of engagement processes and an insufficient linkage between engagement processes and formal decision-making in science and policy (Rask et al. 2016, 66; Owen, Macnaghten, and Stilgoe 2012; Andersson et al. 2015, 27). Engagement processes resemble laboratory experiments or 'intramural' exercises, used ad hoc rather than systematically (Rip 2003; Bogner 2012; Chilvers and Kearnes 2016). Therefore, a central concern in RRI is the effective embedding of societal engagement in R&I institutions and governance processes (Von Schomberg 2013; Sykes and Macnaghten 2013; Owen, Macnaghten, and Stilgoe 2012). The UK has been a frontrunner in fostering the development of a *science culture* that embraces societal engagement. The Concordat for Engaging the Public with Research[3] lists a range of requirements and measures, including a strategic commitment to public engagement in the institutions' mission statements, the recognition of engagement activities in recruitment and promotion and sufficient opportunities for training and support for researchers.

Regarding *politics*, societal engagement exercises are often perceived as time-consuming and of little value for policy-makers. Scholars demand to link engagement activities to formal policy processes and governance institutions (van Oudheusden 2014, 80; Rask et al. 2016, 58). In this regard, van Oudheusden (2014, 80) considers the adoption of the RRI paradigm by the European Commission and its implementation in Horizon 2020 an advantage compared to previous attempts to change science-society relations. Promoting a more significant role of societal engagement in policy-making raises the question of legitimacy (Newig and Kvarda 2012). Participants in engagement events are neither elected (and, therewith, accountable) nor representative for the whole society. Therefore, participatory initiatives such as consensus conferences have traditionally been assigned an advisory function, with the decision-making power remaining within formal institutions. RRI's ambition to move towards co-decision-making, the principle of responsiveness and the notion of co-responsibility may contribute to an in-depth debate on the role of deliberative elements in a representative democracy.

After all, the notion of '*co-responsibility*' may provoke defensive reactions. A simple attribution of responsibility may seem inappropriate in the light of the complex actor constellations in modern science, technology and innovation (Grunwald 2004). Furthermore, the character of societal engagement threatens to change under the claim of

legitimacy. While public engagement initially was considered to encourage a 'rights-based citizenship', there might be a strong emphasis on civic responsibilities under the heading of RRI (Eaton et al. 2014). Felt and Fochler (2008, 489) state that 'participation might also be seen as an element of a neo-liberal mode of governance if this instrument is used to shift decisions and responsibilities of government to citizen groups'. Public participation might turn out to be a 'new tyranny' (Cooke and Kothari 2001): Citizens are expected to be interested, informed, engaged and active.

Whom to engage? – Actors

Most RRI conceptions demand societal engagement to be inclusive, diverse and – at least to some extent – representative of societal actors, perspectives, values, knowledge sources and material interests (Owen, Macnaghten, and Stilgoe 2012). Following the PE2020 project, engagement processes should ensure 'balanced composition, gender balance and a wide representation of societal perspectives' (Rask et al. 2016, 56) to avoid domination by certain actors. Policy-makers, funding agencies, researchers, industry actors, stakeholders and the public all have a role to play in R&I processes (Owen et al. 2013; Rask et al. 2016). While all actor groups are considered relevant, RRI, with its call for inclusiveness, emphasises the engagement of those societal actors that, so far, have been underrepresented in R&I, namely *Civil Society Organisations (CSO)* and *unorganised publics* (including citizens, consumers, users, etc.) (Sykes and Macnaghten 2013; Kuhn et al. 2014). Regarding the involvement of CSOs, RRI implies to include the whole spectrum of societal perspectives that are organisationally represented (going beyond traditional stakeholder groups and including a broader diversity of perspectives, e.g. environmental, consumer, religious, youth and patient organisations) (Rask et al. 2016). Also, in industry, we find a broadening of the notion of stakeholders, including employees, consumers and end-users (Lubberink et al. 2017; Chatfield et al. 2017). When engaging the unorganised public, a balanced representation traditionally signifies socio-demographic diversity. A different strategy, proposed by the RRI Tools project, is to include vulnerable or minority groups, such as ethnic minorities and those not employed, educated or in training (Kupper et al. 2015).

Beyond *balanced representation*, some scholars call for a *balanced view* (Von Schomberg 2013), challenging participants to exceed their traditional roles: for example, environmental Non-Governmental Organisations (NGOs) should not only emphasise the risks, industry associations not only the benefits of new technologies. This demand implies that organisations change their representational strategies, disengaging from particular interests and objectives and becoming representatives of a common public good (Sutcliffe 2011). Thus, RRI may entail a change in power structures and relations. Previously unheard groups and voices could be empowered, and it is hoped that traditionally powerful actors are open-minded to the concerns given by hitherto marginalised actors. Ultimately, these inclusion requirements aim to prevent a one-sided politics of innovation resulting from the dominance of individual positions and instead enable a debate that addresses fundamental issues of the common good, a future society worth living in, etc. However, the call for inclusiveness, balanced representation and balanced views also brings old and new challenges for engagement processes regarding motivation, capacities and capabilities of actors to participate.

Regarding the engagement of *unorganised publics*, several scholars have diagnosed the discrepancy between a general approval of public engagement and the individual willingness to engage (Gaskell et al. 2010; Castell et al. 2014). Engagement incentives include internal motivations such as concern (personal or perceived societal relevance) (Wilkinson, Dawson, and Bultitude 2012) or the expected policy outcomes and impacts, external motivations like monetary compensations (Kleinman, Delborne, and Anderson 2011) as well as emotional and social aspects (Davis, Evans, and Peterson 2014; Jensen and Buckley 2014). Central barriers to citizens' engagement include the time and effort they need to invest. Castell et al. (2014, 8) found that it is particularly challenging to involve women and the less affluent, who often feel less confident in engaging with science, thereby compromising the intention of RRI to engage with so far underrepresented groups in STI. Furthermore, social, political and cultural contexts of engagement offer distinct 'practices, roles, cultural ideologies and available repertoires' (Krabbenborg and Mulder 2015, 474) which can constrain or support citizens' engagement in R&I. Thus, European countries differ considerably in the experiences with and attitudes towards engagement (Landeweerd et al. 2015). While in some countries, it has become a civic virtue to attend deliberative events, in other countries, citizens feel less entitled or willing to engage with science (Andersson et al. 2015). Therefore, the normalisation of public engagement in R&I does not only require adequate incentive structures but simultaneously depends on more sweeping changes in political and innovation cultures.

The willingness and capacities of CSOs to participate is not guaranteed either. CSOs (including environmental NGOs, patient or consumer organisations, religious groups, trade unions, professional associations) vary widely in their missions, clientele, organisation and resources (Rainey, Wakunuma, and Stahl 2017). As shown by the CONSIDER project, participation of CSOs in EU policy processes and research projects requires a high degree of institutionalisation and professionalisation to deal with unfamiliar legal and financial rules (Legris Revel 2014). The RRI Tools project found that smaller CSOs with limited financial resources, personnel or access to knowledge often lack the capacities to participate in R&I (Smallman, Lomme, and Faullimmel 2015). Moreover, CSO engagement is often limited to those with a stake in the issue. However, in the context of newly emerging technologies, special interest groups representing a diversity of perspectives often do not exist yet and will come into existence only after the debate has developed to a certain degree. Finally, the call for a *balanced view* might make it difficult for CSOs to communicate their efforts and impacts to their clientele. CSOs may refuse to participate because their organisational interests collide with the interests of the event organisers.

When to engage? – Timing

Frequently, as in the cases of nuclear power and biotechnology, public debates and societal engagement have started only after technological innovations had been introduced or shortly before market introduction. Engagement was reactive, addressing the societal control of existing technologies. Following the principles of anticipation and responsiveness, RRI scholars demand that societal engagement should *move upstream* (Von Schomberg 2015; Asante, Owen, and Williamson 2014). To shape STI effectively, engagement has to set in early, in phases of agenda-setting, policy formation and

research. This has become particularly evident with nanotechnology: as soon as it appeared on the agenda, scholars argued for upstream engagement to stimulate early dialogue (Gavelin, Wilson, and Doubleday 2007; Wilsdon and Willis 2004). Societal actors should get the opportunity to early comment on and influence techno-social visions and directions, giving societal engagement under RRI a performative function rather than a controlling or regulating one (Rask et al. 2016).

In general, upstream engagement entails issues such as the design of funding schemes, thematic prioritisation and other general rules and guidelines for researchers and research funders (Rask et al. 2016). According to the experiences of the Engage 2020 project, the early involvement of citizens, especially those most affected, is helpful to include citizens' needs and concerns into the proposed projects; even consensus-building is considered a realistic aim (Kuhn et al. 2014). An example of CSO engagement in research projects is the MVI Responsible Innovation programme by the Dutch funding agency NWO (Netherlands Organisation for Scientific Research).[4] Projects funded by the programme include a valorisation panel of stakeholders that support the researchers in considering societal needs during the research process.

The demand for engagement *moving upstream* raises the question of whether and when engagement may be too early. Public debate is usually linked to a concrete issue (Marres 2007; Krabbenborg 2016); thus, participatory events gain more attention when they are close to attendants' everyday life or problematised in the media. In contrast, upstream engagement sets in when there are no public controversies yet, due to a lack of applications that could trigger citizens' concerns or stimulate public imaginations (Bogner 2012). The issues at stake are only provisional, giving societal actors little reference points to form their opinions. The absence of controversies or personal concerns may decrease societal actors' willingness to engage with an R&I field. A paradoxical situation emerges that recalls the so-called Collingridge dilemma (Collingridge 1981): when a field of science and technology is new and decision making agendas are relatively open to societal influences, the publics' interest in engaging with these issues is still low (Ribeiro et al. 2018). The consequence is that citizens and CSOs need to be actively interested and motivated to participate.

As a second novelty, RRI considers societal engagement to be a *permanent and continuous* endeavour. While there is still much emphasis on one-time or single events, RRI promotes more continuous forms of societal engagement. As Rask et al. (2016, 49) state, '[c]ontinuity is needed to balance accelerated change caused by increasingly dynamic governance actions. Conversely, if discontinuity prevails between activities, this hinders organisational and institutional learning and limits the effectiveness of interventions as there is no accumulation of the effects'. Continuous engagement implies that organisers of engagement activities have to build bridges between separate events, that new institutions and processes ensuring continuous engagement are introduced, and ultimately that engagement initiatives are firmly institutionalised within existing R&I governance. The PE2020 project found various activities aimed to move beyond an event-based approach and stimulate interactions between institutions such as science centres, ministries and research institutes (Rask et al. 2016). Thus, RRI's call for long-term engagement aligns with ideas from STS calling for comprehensive approaches or 'ecologies of participation' (Chilvers and Kearnes 2016).

How to engage? – Procedures

Over the past decades, an extensive repertoire of engagement formats and tools has been introduced, ranging from public outreach (e.g. science cafés, science centres), dialogue events (e.g. focus groups, citizen's juries), societal consultations (e.g. societal advisory boards) to public participation in research (citizen science). To what extent this engagement repertoire suits the principles of RRI is a crucial question in academic and practitioner debates (Mejlgaard et al. 2012; Sutcliffe 2011; Engage2020 Andersson 2015). On the whole, scholars and practitioners agree that societal engagement under RRI requires a more diverse range of ways in which scientists, policy-makers and innovators can be meaningfully exposed to public perspectives and concerns (Sykes and Macnaghten 2013). Two demands stand out: first, the broadening of participation towards *two-way communication* and second, the consideration of *bottom-up engagement* alongside formats of 'invited participation'.

There is a widespread consensus that societal engagement under RRI should allow for *dialogic interactions between all actors*. Engagement should not only include the communication of activities and contents of research to the public and CSOs but should allow participants to contribute their knowledge, experiences and perspectives and to raise questions and concerns about the direction of R&I. Only if communication flows in all directions, actors in R&I can become mutually responsive (Von Schomberg 2013). This idea is implemented, inter alia, in recent initiatives towards co-creation, either for product development, the re-design of public services (Voorberg, Bekkers, and Tummers 2015) or the identification and shaping of research agendas (Gudowsky and Sotoudeh 2017).

However, several studies conclude that many engagement processes still rely on information and education or even manipulation or tokenism (Sutcliffe 2011, 13; for original evaluation, see Laffite and Pierre-Beniot 2008; Repo and Matschoss 2019) and hence fall short in terms of mutual dialogue. A wide range of barriers to non-hierarchical two-way deliberation exists (Repo and Matschoss 2019). The PE2020 project, for example, reports institutional ambivalences, i.e. simultaneous support and resistance towards more interactive and dialogic engagement processes. Many engagement processes are perceived as risky interventions, and policy-makers often perceive advisory engagement processes as a threat to existing policy-making practices (Rask et al. 2016, 30). Systemic scepticism towards innovative engagement processes easily results in the retreat to more traditional one-way communication models (Rask et al. 2016, 30).

A second discussion revolves around the role of *bottom-up engagement* in RRI. RRI focuses on organised, invited and top-down initiatives. Participation often takes the form of a project, initiated and organised by experts 'from outside' and with strong pre-determination of certain factors, including the number of participants, timeframe, process structure and issue framing. Among the analysed projects, only PE2020 explicitly accounts for non-formal, 'uninvited' or bottom-up engagement (i.e. public activism). This focus on top-down participation partly results from engagement moving 'upstream'. In this early phase, bottom-up initiatives such as social movements or local interest groups often do not exist yet. In addition, the focus on 'invited participation' is fostered by the professionalisation of public engagement (Sykes and Macnaghten 2013, 100). The benefit of formal, organised processes is that they are more predictable, facilitate

structured conversations and make it easier to implement particular requirements (for example, balanced representation).

However, favouring 'invited participation' over bottom-up initiatives might counteract the idea of RRI. First, formal deliberation processes tend to attract specific participants, often those with higher education. Second, invited participation pre-determines deliberation processes to a certain extent since the issue-framing and key questions are defined in advance (see next section). Third, participants are expected to adhere to deliberation requirements: they need to listen to others, mobilise reasonable arguments, and be open to contextualise and relativise their opinion. Thus, Sykes and Macnaghten (2013, 100) criticise that formal engagement frequently tends 'to reinforce consensus and to homogenise views'. There is a risk that one rationale (often the scientific one) is considered the best way of how to deliberate on the respective subject. While some may welcome this as a better, more rational way to address controversial technologies, others may argue that a non-emotional or even 'sterile' debate conveys the illusion of conflict-free innovation while postponing conflicts. Against this background, it may be advisable to explicitly include bottom-up approaches (given that they exist) in R&I processes. However, the question remains how bottom-up initiatives can be successfully linked with R&I governance structures and institutions without endangering the former's openness, self-organisation, creativity or critical potential.

What is it about? – Framing

Beyond the discussed procedural aspects, the RRI framework provides guidance regarding the issue-framing. Science and technology governance has often been dominated by issues of risk and safety, privacy and precaution, excluding important moral questions such as justice, welfare standards for marginalised groups or politics of exclusion (Landeweerd et al. 2015). RRI aims at transcending this narrow framing, leading to two questions: (a) how framing issues may become barriers for engagement initiatives and (b) how engagement processes can constructively deal with fundamental dissent inherent in different framings.

By setting the agenda and inviting participants, organisers introduce a particular framing that guides deliberations. Consequently, as Landeweerd et al. (2015, 14) state, participatory processes might be framed in ways that are useful to specific actors, even if impartiality and balance are actively pursued. The SYNENERGENE project illustrates how dialogue events on synthetic biology often primarily focus on the potential benefits of the technology at stake (Bauer and Bogner 2020). Such narrow framing implicates challenges and requirements for engagement initiatives. First, by neglecting alternative framings (Sykes and Macnaghten 2013, 100), the engagement initiative risks missing important perspectives and value statements of participants. Particularly in the industry sector, inviting stakeholders who share the same values as the company concerned (Lubberink et al. 2017) tends to exclude dissenting voices. Second, for CSOs, the framing of an event plays a pivotal role in their willingness to participate. CSOs often refrain from participating in engagement activities that are, from their perspective, too uncritical towards technological developments or ignore moral concerns and alternative solutions to societal problems (Schmidt et al. 2009). Third, to make the perspectives and worldviews transparent, organised participants such as CSOs should present their normative and

political background (Rainey and Goujon 2012). Overall, to avoid an overt asymmetry by pre-framed deliberation processes, it might be helpful to explicitly deal with the issue of framing in the deliberation process by asking questions such as: How do we want to talk about new technologies? What kind of challenges should we preferably tackle?

Furthermore, the '*proactive turn*' with regard to the role of ethics in R&I (see section 'Calling for practical ethics and engagement') emphasises the importance of societal engagement since no one can be excluded from value debates for good reasons. However, the question emerges to what degree *consensus* is necessary, desirable and feasible, and how to deal with fundamental dissent on societal needs and ethical aspects. Ethics as a design element might suggest that the reference to morals and values allows a unanimous evaluation and design of innovation and technology. Similarly, the notion of co-responsibility conveys the idea of mutual understanding and the ability to reach consensus. Von Schomberg (2013) expects actors to leave their traditional (antagonistic, interest-laden or worldview-driven) roles and open up to all relevant aspects of the innovation process. In this regard, participants are expected to come up with shared visions on ethically acceptable, societally desirable and sustainable innovation. In contrast, other scholars warn against consensual closure that may iron out differences and minority perspectives and instead call for accepting disagreement and dissent (Kuhlmann et al. 2016, 17; van Oudheusden 2014, 80). In this perspective, consensus on values is not a realistic goal in modern societies characterised by the social division of labour, high specialisation, cultural pluralism and fragmentation. The assumption that innovation can serve society as a whole might draw a too harmonic picture. Following this 'dissent approach', engagement should allow to bring 'uninvited' reasons, rationalities and needs to the fore – all the contradictions and points of critique that characterise pluralist societies. According to van Lente, Swierstra, and Joly (2015), we now move from the ideal of ethical consensus 'towards an ethics of ambiguity', which indicates that there are no simple solutions or best practices to be expected but only fragile compromises based on difficult value trade-offs.

Conclusions

Currently, RRI is one of the most visible, influential and widely disputed R&I governance approaches, claiming to rethink research and innovation fundamentally. It is about shaping innovation processes anew by aligning technology development with ethical values, anticipating uncertainties and risks and involving societal actors at an early stage. In this sense, RRI makes non-technical aspects of innovation, including societal demands and values, visible and puts innovation on a broader normative basis. Besides, RRI is undoubtedly a pleasing catchword; who could argue against responsible innovation? (Guston 2015). Nevertheless, one should not overlook the ambivalences that result from this concept, including the demand for broad societal engagement.

In this article, we reviewed and discussed the main requirements and respective challenges for societal engagement under the heading of RRI and therewith offered a condensed overview and reflection on on-going scholarly and practitioner debates. Societal engagement under RRI can be considered as continuity of the 'participatory' (Jasanoff 2003), 'democratic' (Hagendijk and Irwin 2006) or 'deliberative' turn (Kearnes 2009) in STI governance. Nevertheless, we have shown that RRI places new

emphasis on established demands for societal engagement and formulates new challenges in terms of purposes, actors, timing, procedures and framings (see Table 3 for a summary).

Societal engagement under RRI aims at improving STI decision-making. While this purpose is not new for societal engagement, RRI requires a *permanent* institutional embedding of societal engagement in R&I governance. Concerning actors, RRI strengthens the call for inclusiveness in terms of balanced representation and introduces the call for a balanced view by all actors involved. RRI continues to move engagement upstream and particularly demands engagement to be continuous. Furthermore, societal engagement is mainly conceived as 'invited participation' with a strong emphasis on two-way communication between experts, stakeholders and citizens. In this dialogue, ethics, societal needs, values and concerns take centre stage, shifting the focus from seemingly rational debates about risks and uncertainties to political and value questions. Consequently, we find that societal engagement needs to be open to dissent instead of striving for consensus.

These requirements raise old and new challenges for engaging CSOs and citizens in R&I. Concludingly, we highlight two challenges that are, from our point of view, particularly relevant for further advancing societal engagement under the heading of RRI: (1) making the political character of science and technology explicit ('politicisation') and (2) reflecting the aspect of framing which leads to a new interpretation of the often-lamented ineffectiveness of participation.

First, the call for balanced representations and views of various actors is accompanied by the challenge of motivating these actors to participate. The emphasis on upstream engagement raises the question of how to engage when there is still a lack of public debate, interests or knowledge about the issue at stake. Moreover, the *integration of bottom-up initiatives* in research and innovation, so far, is rarely addressed. However, as uninvited participation is often associated with political protest, emotions and polarisation, it is essential to consider fundamentally different opinions, alternative

Table 3. Requirements and challenges of societal engagement under RRI.

Dimension of engagement	Requirements	Challenges & open questions
Purpose	Substantively improving R&I decisions	Lack of tangible influence
	Embedding of societal engagement in R&I governance	Missing links to decision-making
		Legitimacy
Actors	Inclusiveness	Lack of willingness, capacities and capabilities to participate
	Balanced representation	Individual, organisational and societal experiences with engagement
	Balanced view	
Timing	Upstream engagement	Lack of debate, interests, knowledge
	Continuous engagement	Institutionalisation of engagement
Procedure	Two-way communication	Expert takeover
	Organised engagement	Systematic scepticism
		Integration of bottom-up initiatives
Framing	Ethics and societal needs, values, concerns	Agenda-setting
	Openness	Narrow versus broad framing
		Consensus versus dissent

worldviews and ways of expression in top-down participation. Otherwise, we see the risk that engagement activities are reduced to rational, seminar-like or even sterile exchanges about abstract issues or mere awareness-raising and information campaigns (Bauer and Bogner 2020). In these cases, the political character of technological developments is lost – although or precisely because relevant actors are integrated into the innovation process early on. RRI is not about asking narrowly defined questions about risks and benefits but about linking innovation with fundamental values, images of nature and society, and visions of a better life for everyone. In the past, technologies such as genetic engineering or nuclear power were not only subject to fierce controversies because the concerned citizens or NGOs did not share the risk assessments of influential experts. Rather, the protest movements addressed more fundamental issues such as the tension between capitalism and sustainability, the increasing surveillance by state bodies and the formation of what Eisenhower famously called the 'military-industrial complex' (Rucht 1995). While protests are usually driven by concrete demands ('Stop nuclear power plants!', 'Boycott Monsanto!'), they do not relate solely to one specific issue. Protests equally address broader criticism such as the lack of transparency in political decision-making, alternative imaginations of nature and questions of happiness and good life (Torgersen, Hampel, and Bergmann-Winberg 2002; Radkau 1995). To include these concerns early on, RRI should contribute even more substantially to the politicisation of technology issues. For a more political note of technology and innovation, one must open the debate, bringing values, interests and emotions into play (Roeser and Pesch 2016; Steinert and Roeser 2020). This implies not to be afraid of protests and citizens' initiatives, even if emotions, prejudices and dogmas are involved. On the contrary, in the case of invited participation, organisers must (in the absence of real protests) encourage people to bring their feelings, interests and values into the debate. Only by recourse to the subjective will it be possible to elicit the normative that constitutes the political.

Second, to maintain the idea of rendering technology a political issue, we suggest that RRI initiatives consider the link between invited and uninvited forms of engagement. Whenever protest is missing, it becomes crucial to reflect on the *framing* in invited participation events. A key challenge is how to balance between a too narrow and a too broad framing of the issues at stake to allow an open yet focused debate and how to reconcile the multiple interests, perspectives and concerns available without forcing consensus. Societal engagement under RRI is a means to govern innovation processes in line with fundamental societal values. These attempts will be mostly uncontroversial as long as generally accepted values such as safety or sustainability are addressed. However, when focusing on how such values are spelt out and what role technology plays in their implementation or when the local level is concerned, a common understanding is often missing. A modern, highly individualised society allows the individual a great deal of freedom regarding values, and ethics and morals have at best the function of drawing general and broad boundaries. In the absence of relevant public debates, participants will only accept the predefined framing in RRI engagement events if a common value basis substantiates such a framing. If this basis is missing, it is advisable to explicitly deal with the issue of framing during the deliberation process, asking people how they prefer to frame the issue at stake. This also helps to avoid potential bias and power asymmetry built in by pre-framed deliberation processes.

From this perspective, it becomes clear why the umbrella term of ethics plays such a central role in the context of RRI: Ethics represents the claim that, from a normative basis, all relevant and legitimate voices are heard and acknowledged. As a result, a broad variety of normative standpoints and worldviews should be included in deliberation processes inspired by RRI. Accordingly, societal engagement has only fulfilled its primary purpose when technical issues become political, i.e. when the narrow framing of risk and economic benefits is successfully transcended. However, engagement processes that are kept widely open are at risk of promoting a policy of lengthy and slow negotiation, which is sometimes suspected of unnecessarily delaying important decisions. In some situations, therefore, the RRI-specific demand for openness may conflict with the (rather political) goal of timeliness. To make societal engagement effective for political decision-making, RRI activities are then called upon to reconcile the conflicting claims of diversity, openness and timeliness.

To conclude, while individual requirements for societal engagement are not entirely novel, taken as a whole they are distinctive to the RRI approach. Societal engagement under RRI is conceptualised as inclusive and balanced in terms of actors, perspectives, interests and views. RRI calls for two-way deliberations on ethics, societal needs and values between all participants. Moreover, societal engagement is expected to move upstream in R&I and to be continuous. The latter implies that societal engagement becomes institutionalised in research and innovation governance systems and, as a consequence, societal engagement is predominantly imagined and realised as 'invited participation'. As we have pointed out in our concluding discussion, the emphasis on 'invited participation' raises specific challenges and contradictions for RRI. Individual interests in the respective topic must first be generated by the 'participation professionals' themselves. In this context, participants who pursue a distinctive view from the outset are hardly to be expected. To address such contradictions, a main task for the further realisation of RRI remains to explicitly acknowledge the political nature of science and technology in societal engagement, be it top-down or bottom-up, and to openly address the issue of framing in engagement events. Only if questions and issues that relate to fundamental institutions and values (state, capitalism, environment, distribution, justice, etc.) and thus stimulate deep reflection or open contradiction are raised, the high demands of RRI might be met.

Notes

1. Eight experts employed at universities in Austria, Germany, Belgium, the Netherlands and the UK and seven experts from non-university research institutions in Austria, Germany and Hungary participated. These experts were selected on the basis of their expertise as Consortium leaders in EU projects on RRI or as authors of key publications. In addition, we invited three representatives from funding agencies in Austria, the Netherlands and the UK. The Netherlands and the UK have been frontrunners in implementing RRI in public funding programmes.
2. See https://cordis.europa.eu/programme/id/FP7-SIS (last accessed 17 February 2021).
3. See https://www.ukri.org/files/legacy/scisoc/concordatforengagingthepublicwithresearch-pdf/ (last accessed 17 February 2021).
4. See https://www.nwo-mvi.nl/ (last accessed 17 February 2021).

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