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Societal engagement under the terms of RRI

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Content

Introduction

Responsible Research and Innovation (RRI) increasingly gains relevance as a new governance approach to research and innovation across Europe. The concept is continuously evolving, being advanced by academic scholars, political and administrative actors and other stakeholders in science and innovation. However, **RRI represents a liquid governance framework** which may take shape in various and even contradicting forms depending on the technology at stake and the specific innovation culture.

One of the core ideas building the bridge between competing interpretations of RRI is the **strong emphasis on taking stakeholders' and other relevant actors' views and standpoints into accoun**t (Burget et al., 2016). However, there is lack of clarity about what societal engagement under the terms of RRI precisely means. So far there is no clear picture, let alone a common understanding, of appropriate forms, methods and incentives to ensure participation extending the spectrum of societal actors being involved in shaping innovation processes.

As part of the H2020-project PROSO (PROmoting SOcietal Engagement under the terms of RRI), **this deliverable aims at providing a critical review on societal engagement under the header of RRI.** It builds on a systematic overview on findings from EU funded projects (especially Res-AGorA, RRITools, Consider, GREAT, Engage2020, Public Engagement 2020), as well as on the scholarly work in the social sciences, with an emphasis on Science and Technology Studies (STS). Furthermore, it contains findings from the PROSO expert workshop on 'Contemporary experiences with societal engagement under the terms of RRI' held in Vienna in May 2016 (Bauer et al., 2016).

This report is dedicated to exploring the notion of RRI and investigating the specific expectations towards societal engagement from an RRI perspective. That means, even though it focuses on the nagging questions of what RRI exactly means, how this flexible governance approach can be operationalized and, last but not least, what at all is new about RRI in comparison to related approaches, it highlights **the specific requirements for societal engagement under the header of RRI**.

In the **first chapter** we critically review different and partly competing notions of RRI, specifying key tenets, to facilitate a common understanding. In a **second step**, after a historical overview over participatory approaches in science and innovation, we show what kind of new aspects may arise from applying the RRI concept to societal engagement. **Chapter three** is dedicated to the question of who should become engaged and which societal actors have to be taken into account under the terms of RRI. **Chapter four** focuses on the time aspect of engagement and the implications for the various roles taken up by different participants. Subsequently, **chapter five** elaborates on typologies of engagement processes aligned with the intended purposes of the respective format.

In **chapter 6**, we discuss content-related aspects of societal engagement, especially the question how to introduce abstract R&I issues without restricting the scope of deliberation. In the last chapter (**chapter 7**), we elaborate on functions and impacts of societal engagement under RRI, before summing up and concluding our findings (**chapter 8**).

1. Introduction to RRI

The governance of science, technology and innovation is a pivotal challenge of modern societies. On the one hand, science, technology and innovation (STI) have been main pillars of **economic growth and social prosperity** over the last century (Schumpeter, 1939). Public and private institutions are therefore highly interested in promoting STI to gain a competitive advantage. On the other hand, technologies and innovations have proved to be increasingly problematic, undermining their benefits. **Unintended and unforeseen side-effects, increasing risks and neglected ethical questions** of STI efforts characterise the **organised irresponsibility** of modern societies (Beck, 1988). Examples are manifold, including the risks and long-term effects of nuclear power, health issues due to asbestos, climate change as a consequence of unsustainable energy production and consumption or a wide range of medication that promised rescue but failed to deliver. The growing awareness of potentially negative consequences of technology and innovation triggered a demand for control and regulation of STI apart from their promotion.

1.1   The rise of RRI

Over the last decades, a variety of approaches and institutions have addressed the ambivalence of STI (Landeweerd et al., 2015). The growing awareness of risks and unintended side-effects gave rise to a **wide range of expert institutions**. In the 1970s, **Technology Assessment (TA)** emerged as a prominent expert-led approach to early identify and warn politics and society of potentially negative environmental or social consequences of technological developments. Initially, the focus of TA was on economic, environmental and health risks leaving implicit ethical issues aside (Stilgoe et al., 2013). With medical progress resulting in ethical dilemmas, as indicated by controversies over the definition of death as well as over the moral acceptability of in vitro fertilisation or abortion, ethical aspects of STI got highlighted (Zwart et al., 2014). From the 1990s on, **bioethics** got established as an increasingly important factor in policy advice; it has been institutionalised in the form of national ethics councils and as an accompanying research approach known as ELSI research (ethical, legal and social issues). Based on inputs from experts such as ethicists, philosophers or social scientists, these approaches have often reduced bioethics to procedural aspects of ethical deliberation and to the process of weighing up different principles in order to provide rapid and efficient advice (Toulmin, 1982). However, the focus on expert knowledge increasingly got challenged. **Public protests** against technologies, the loss of trust in expert authorities and advancements in democratic theory gave rise to calls for the democratization of expertise, science and technology governance. Over the past 40 years a growing number of **participatory and deliberative approaches and instruments** have complemented and partly substituted expert advisory institutions in informing STI processes on societal concerns and ethical aspects (see chapter 3).

Against this background RRI emerged as a new governance approach to **reconcile the demand for techno-scientific progress with requirements of basic social norms and expectations**, and to advance the societal involvement in STI. Its rise reflects the limits to the political management of ethically problematic areas such as GMOs, geoengineering and information technology (Owen et al., 2012). The idea of RRI originated in the early 2000s in the discourse on how to govern nanotechnology (Rip, 2014). After the widespread public debate and refusal of agri-biotechnology, actors in science, politics and industry had become more attentive for potential controversies, uncertainties and risks of emerging technologies and aimed to guide the technological development more responsibly from the outset. This new approach towards **governing research and innovation** was reflected in a range of initiatives and policy documents across the world – starting in the field of nanotechnology.

The **US National Nanotechnology Initiative** (2000) adopted "responsible development" as one of their four strategic goals (Owen et al., 2012). Similarly, in the document "Towards a European Strategy for Nanotechnology" the **European Commission** defined 'responsible development' as a deliberative process based on the idea that nanotechnology could be guided by "ethical principles [which] must be respected and, where appropriate, enforced through regulation" (European Commission, 2004, de Saille, 2015). Subsequently the European Commission developed recommendations concerning the Code of conduct for and the council conclusions on Responsible Nanosciences and Nanotechnologies Research (European Commission, 2008). In 2008 the Royal Society, Insight Investment and the Nanotechnology Industries Association (NIA) developed the "Responsible Nano Code for business" that is supported by companies in Europe, the US and Asia (Insight Investment et al., 2008).

The nowadays quite fashionable term 'Responsible Research and Innovation' was initially coined in 2007 in a constructive technology assessment workshop on nanotechnology in the Netherlands (Robinson, 2009). From 2010/11 on, RRI has rapidly gained prominence and visibility as a pivotal approach or vision for research and innovation governance in the European Union (Owen et al., 2012). Since then, the European Commission, EU Member States and associated countries have **launched various initiatives and activities** under the header of Responsible Research and Innovation (RRI).

Above all, **RRI has been institutionalised as a 'cross-cutting issue'** of Horizon 2020, the EU framework programme for research and innovation 2014-2020 (Strand et al., 2015, von Schomberg, 2013). Citing the European Commission (COM(2011) 809 final, 2011), de Saille (2015) points out that "With the aim of deepening the relationship between science and society and reinforcing public confidence in science, Horizon 2020 should favour an **informed engagement of citizens and civil**

society on matters of research and innovation by promoting science education, by making scientific knowledge more accessible, by developing responsible research and innovation agendas that **meet citizens' and civil society's concerns and expectations** and by facilitating their participation in Horizon 2020 activities" (COM(2011) 809 final, para 20, emphasis added by the authors).

To clarify and operationalize the concept of RRI with regard to better reconcile STI research with societal interests, the EU has funded a **range of large-scale multi-sited projects**, including Res-AGorA[1], RRITools[2], Consider[3], GREAT[4], Engage2020[5], Public Engagement 2020[6] and, as a test-bed for societal engagement with emerging technologies, NERRI[7] and SYNENERGENE[8]. At the national level, the **United Kingdom, Norway and the Netherlands** are forerunners that have started to implement RRI under the funding schemes of their national research councils early on. The **Dutch funding agency NWO** (Netherlands Organisation for Scientific Research) in collaboration with universities and several ministries set up the **MVI Responsible Innovation programme**[9]. It aims at funding research that has both a benefit for society and investigates the potential ethical and societal issues of an innovation at an early stage. In the United Kingdom, the **Engineering and Physical Sciences Research Council (EPSRC)** developed and implemented the AREA[10] framework (anticipate, reflect, engage and act), guiding its approach to emerging technologies.

1.2   What is RRI? Core definitions and key principles

Although RRI has become a highly visible governance approach for research and innovation, there is **no consensual understanding** of what it exactly means (Strand et al., 2015). Definitions and frameworks are currently evolving, amplified by a great amount of academic literature and policy documents shaped by varying political purposes in different institutional contexts. Table 1 shows a selection of key definitions from the academic literature, from policy documents and from EU-funded RRI research projects. An exhaustive overview over current definitions of RRI, from the administrative realm as well as from academia, is provided by Burget (2016).

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[1] See http://res-agora.eu/news/
[2] See http://www.rri-tools.eu/
[3] See http://www.consider-project.eu/
[4] See http://www.great-project.eu/
[5] See http://engage2020.eu/
[6] See https://pe2020.eu/
[7] See http://nerri.eu/eng/home.aspx
[8] See https://www.synenergene.eu/
[9] See http://www.nwo.nl/onderzoek-en-resultaten/programmas/maatschappelijk+verantwoord+innoveren
[10] See https://www.epsrc.ac.uk/research/framework/area/

Table 1: Core definitions of RRI

*"Responsible innovation is a **collective commitment** of care for the future through **responsive stewardship** of science and innovation in the present"* (Owen et al., 2013, 36, emphasis added)**.**
*"Responsible Research and Innovation is a **transparent, interactive process** by which societal actors and innovators become **mutually responsive to each other** with a view to 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, 2013, 63, emphasis added, applied in EU calls on 'Science in Society' since 2012).
*"Responsible Innovation is **an activity or process** which may give rise to previously **unknown designs** pertaining either to the physical world (e.g. designs of buildings and infrastructure), the conceptual world (e.g. conceptual frameworks, mathematics, logic, theory, software), the institutional world (social and legal institutions, procedures and organization) or combinations of these, which – when implemented – expand the set of relevant feasible options regarding **solving a set of moral problems**"* (van den Hoven, 2013, emphasis added).
*"RRI is a higher-level responsibility or meta-responsibility that aims to shape, maintain, develop, coordinate and align existing and novel research and innovation-related processes, actors and responsibilities with a view to **ensuring desirable and acceptable research outcomes**"* (Stahl, 2013, 712, emphasis added).
"*RRI is characterized by **a shift from assessing the desirability of the outcome of innovation processes,** such as evaluating harmful product outcomes in court under liability law, **to assessing the qualities of the innovation process"** (Spruit et al., 2016, 872, emphasis added).*
*"**Responsible innovation means taking care of the future through collective stewardship** of science and innovation in the present"* (Stilgoe et al., 2013, emphasis added).
*"Responsible Research and Innovation (RRI) refers to the **comprehensive approach of proceeding in research and innovation** in ways that allow **all stakeholders** that are involved in the processes of research and innovation at an early stage (A) to **obtain relevant knowledge on the consequences** of the outcomes of their actions and on the range of options open to them and (B) to **effectively evaluate both outcomes and options** in terms of societal needs and moral values and (C) to use these considerations (under A and B) as **functional requirements for design and development of new research**, products and services. The RRI approach has to be a key part of the research and innovation process and should be established as a **collective, inclusive and system-wide approach** (Expert Group on the State of Art in Europe on Responsible Research and Innovation, 2013, emphasis added).*
*"**Responsible Research and Innovation means that** societal actors work together **during the whole research and innovation process in order to** better align both the process and its outcomes, with the values, needs and expectations of European society. **RRI is an ambitious challenge for the creation of a Research and Innovation policy driven by the needs of society and engaging all societal actors via inclusive participatory approaches (EC 2012b)"** (Strand et al., 2015, emphasis added).*
*"Responsible Research and Innovation is a **dynamic, iterative process** by which **all stakeholders** involved in the R&I practice become **mutually responsive** to each other and **share responsibility** regarding the RRI outcomes and process requirements"* (Kupper et al., 2014, emphasis added).

Definitions range from rather general philosophies to concepts of research and innovation to the formulation of quite concrete requirements. The Expert Group's definition, for instance, emphasises

the importance of an early and ongoing involvement of stakeholders. Von Schomberg, in contrast, mainly focuses on the basic values associated with RRI, namely sustainability and ethical acceptability. From a wider sample of literature on RRI that aims at operationalising RRI, evidence emerges that **the number and characteristics of key dimensions specifying RRI vary considerably**. Nevertheless, we also see that certain elements and principles remain across definitions and frameworks. Notably, **most definitions and frameworks emphasize the engagement or inclusion of societal actors** in research and innovation (Kuhlmann et al., 2016, Wickson and Carew, 2014, Stilgoe et al., 2013). This is also supported by a recent study of Burget et al. (2016). Based on a systematic literature review taking more than 200 articles on RRI into account, the authors show that inclusion is key and that it is associated with all other conceptual dimensions (Burget et al., 2016). Second, most definitions and frameworks affirmatively refer to the **increasing importance of moral and ethics** in technology issues. Even though more precise definitions of moral and ethics are lacking, the call for ethics basically implies that we should understand activities and outcomes associated with innovation processes to be ethically relevant. Technologies and innovation, in other words, should be subject to ethical deliberation in order to be ethically acceptable and to be in accordance with basic societal values. Third, several definitions and frameworks aim to **restructure the way research and innovation is performed**. This is generally reflected in the strong emphasis on process requirements such as openness and transparency, anticipation and reflexivity or responsiveness and flexibility (Stilgoe et al., 2013, Kuhlmann et al., 2016, Smallman et al., 2015).

With regard to the first aspect (engagement or inclusion), we will go into further detail in chapter 2. In the following we refer to ethics and the specific process requirements associated with RRI. A closer look at these aspects may help to clarify what is new about RRI.

1.2.1   Practising ethics proactively

Several definitions and frameworks point to the expected quality of research and innovation outcomes: Research and innovation should be aligned with the values, needs and expectations of society, be (ethically) acceptable, sustainable and societally desirable (von Schomberg, 2013, 65), achieve a social or environmental benefit (Sutcliffe, 2011), be socially relevant and solution oriented and sustainability centred (Wickson and Carew, 2014).

By introducing these **normative anchor points,** RRI aims to shift the dominant rationales and foci of research and innovation. Advancing scientific knowledge and driving economic growth, respectively, aren't sufficient parameters of successful or 'good' research and innovation any more. Research and innovation may drive employment and economic growth and still be of little value for society because fundamental ethical principles, societal needs and values are neglected (von Schomberg, 2013, van Oudheusden, 2014). In other words, in the context of RRI the ethical perspective exceeds

the assessment and mitigation of unintended consequences and **proactively addresses** the very **purpose and intent of research and innovation** (Owen et al., 2013). The question is not only what we do not want science and innovation to do – but also what we want them to do (Owen et al., 2013, 28). For Owen et al. (2013) this means **widening the scope of research and innovation governance beyond existing codes of conduct** and formal processes of ethical review for research and innovation towards a far wider, systemic reconfiguration, and indeed a significant culture change. From this perspective, RRI demands the **reflection on purposes, underlying intentions, motivations and desirability** (Stilgoe et al., 2013, Owen et al., 2013): Why doing it? Who might benefit and how? Will such benefits be equitable? Will it confer burdens to some or many? In whose interests is it being undertaken and what are the motivations of those involved? Do we (as a society) want it?

Therewith, research and innovation get a direction; they should serve society at large rather than particular actors and interests. This implies that research and innovation policies, programs and projects should be assessed beyond their publication records, anticipated market benefits or risks (von Schomberg, 2013), considering their potential to elicit impacts for the wider societal good and their compliance with societal values. This shifting focus is reflected, for example, in the European Commission's justification for investing in research and innovation with the Lund declaration, framing this in terms of responding to societal Grand Challenges and further stating that "meeting the grand challenges will be a prerequisite for continued economic growth and for improved changes to tackle key issues" (von Schomberg, 2013, 59).

What "ethically acceptable", "sustainable" or "socially desirable" means, however, is little fleshed out in literature. This is because, in a pluralistic society, normative parameters cannot be defined a priori and top-down in a technocratic manner but **have to be deliberated by a broad range of societal actors** (see below). Following von Schomberg (2013, 64), the minimum requirement for ethically acceptable research and innovation is its compliance with the fundamental values of the EU charter on fundamental rights and the safety protection level set by the EU. In addition, the seven Grand Challenges as formulated by the European Commission are important focal points for a basic conception of sustainable and socially desirable research and innovation. [11] In order to be indicated as responsible, R&I endeavours should contribute to finding solutions for societal challenges such as health, demographic change and wellbeing; food security, sustainable agriculture and forestry; clean and energy and smart transport; and climate action and resource efficiency. "Gender equality" and "social justice", two of the RRI keys by the EU, add further normative guidance.

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[11] https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges

To sum up: **In the context of RRI the issue of ethics is being addressed in a new and innovative way**. Compared to previous technology controversies ethical aspects have taken on a different role. With agri-biotechnology and biomedicine for example, public debate ultimately took ethical aspects explicitly into account as well, after having focused on risks for a long time. However, here **the call for ethics was associated with the idea of taming or restricting innovation** by means of ethics. Ethics, in other words, was practised reactively; it was intended to prohibit the unwanted after the innovation had already been fully developed or even marketed. With the rise of RRI ethics changed its role fundamentally. **Today, ethics is much more referred to as a means of designing innovation**, i.e. a design principle and as a promising way to proactively deal with innovation.

1.2.2   *Shaping innovation collectively*

RRI does not only entail a reframing of the purpose and desired impacts of research and innovation but crucially aims to **restructure the ways research and innovation are done**. This is generally reflected in the strong emphasis on process requirements that are formulated in most definitions and frameworks. The very notion of 'responsiveness' highlights **innovation as a process being open to a variety of societal actors' interventions and even to fundamental change**. In the following we shortly outline central process attributes of RRI, namely anticipation, societal engagement, reflexivity, responsiveness and openness. These dimensions have been primarily elaborated by Stilgoe et al. (2013) and Owen et al. (2013) and are frequently referred to in the current debate on RRI.

In the context of RRI, **anticipation** is a key requirement for research and innovation. Dominant forms of assessing technologies or integrating social and ethical issues in research and innovation only allow regulators and society to passively react (Hurlbut, 2015). Societal debates are triggered by the products of science and innovation at the end of the development chain, rather than during the processes of scientific progress and technology innovation themselves (Landeweerd et al., 2015). RRI calls for the strengthening of anticipatory instruments and institutions such as foresight or technology assessment in order to reflect on what is known and what is not known, on uncertainties, risks, and areas of ignorance. Yet, anticipation in RRI goes beyond these epistemic aspects. When addressing the purposes and intents of research and innovation visions of techno-scientific and societal futures become highly relevant. Visions serve as useful entry points for the reflection on purposes, promises, and possible impacts of innovations and as a means to explore different pathways to desirable futures. In the assessment of visions societal values and norms become the driving force, shaping technology visions rather than serving as a post-hoc corrective.

At the core of most RRI definitions and frameworks is the call for **societal engagement**, i.e. the involvement of a wide range of stakeholders and citizens in science, technology development and innovation (Burget et al., 2016). The stronger focus on the purpose and the intent of innovation, along societal needs and expectations, leads to a stronger appreciation of societal engagement and vice versa: the inclusion of different actors (citizens, stakeholders and other non-scientific actors) is expected to result in discussions focusing especially on values, expectations and concerns. In other words, the inclusion of non-scientific actors is intended to promote aspects which expert knowledge alone cannot address. 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. Funders, researchers, stakeholders and the public all have an important role to play in research and innovation processes (Owen et al., 2013); responsibility in RRI primarily is collective and distributed rather than individual (von Schomberg, 2013).

Besides engagement with a variety of stakeholders and the public, RRI also calls for an institutionalized **reflexivity** within research and innovation systems. Scientists and innovators should not only take into account societal values and norms but also be able to reflect on their own values. Within RRI, scientists can no longer appeal to their detachment from society but should understand themselves as part of society. Such reflexivity goes beyond conventional internal critique within the frame of scientific paradigms and scrutinizes underlying purposes, motivations as well as societal and economic conditions and impacts. Reflexivity requires researchers and innovators to question their own ethical, political or social assumptions, their framings of problems, their values and expectations to enable them to consider their own roles and responsibilities in research and innovation as well as in public dialogue. Often, social scientists or philosophers join natural science research teams and institutions to induce such kind of reflexive processes; in STS, this approach gained attention under the header of "midstream modulation" (Fisher et al., 2006).

Research and innovation should become responsive to external demands in the form of societal needs, values and expectations. The principle of **responsiveness** demands that research and innovation processes are open in their direction, trajectory and pace. Responsiveness requires the flexibility and capacity to adapt research and innovation processes according to emerging knowledge, changing societal needs, values and expectations (Stilgoe et al., 2013). According to Guston and Sarewitz (2002), "the key to successfully grappling with unpredictability is to build a decision process that is continuously reflexive, so that the attributes of and relations between co-evolving components of the system become apparent, and informed incremental response is feasible".

Several RRI frameworks (e.g. Sutcliffe, 2011, Kuhlmann et al., 2016, European Commission, 2014) include **openness and transparency** as additional process requirements. While more openness does not automatically lead to more trust, one could argue that openness and transparency are conditions for accountability and liability and therefore serve responsibility (Kupper et al., 2014). Scientific work, particularly when publicly funded, should be open and accessible to all. As the RRI tools project states, "openness should be meaningful, and enhance quality of the process and enrich the outcomes. […] In addition, information needs to be tailored to the needs of stakeholders and citizens" (Kupper et al., 2014).

1.3   RRI as an open and flexible framework

While the key tenets, as introduced above, may have stabilized, their interpretation and implementation by different actors and institutions vary considerably. Hence, the spectrum of what RRI means in practice is wide, introducing considerable ambiguity to the concept (Owen et al., 2012). Notably, we see opposing interpretations of RRI and its relation to the dominant growth paradigm. Especially with regard to EU institutions, **RRI is mainly understood and implemented as an approach to strengthen the growth agenda**, to speed up innovation by early identifying potential barriers to innovation, e.g. public resistance (de Saille, 2015). In such an interpretation, RRI fits the principles of the current economic system and power structures; there is singular emphasis on innovation as the only solution to economic and social problems, as de Saille (2015, 155) has shown. On the other side of the spectrum, **RRI is understood as an approach to effectively problematize the modern neoliberal dogma of "innovation, growth, and welfare"** (Guston, 2015). In this interpretation, the consideration of ethics and societal values goes beyond "the neighbourhood", including the consideration of wider global impacts and trade-offs.

Moreover, the halting of particular technological developments ("exnovation") or "responsible stagnation" are serious options to be reflected upon (Guston, 2015). RRI in this conception also implies changing current power structures; previously sole decision-makers now have to share their power with others (Kupper et al., 2015b). A second divide runs between those actors in STI that do not see any conceptual novelty in RRI but additional administrative burden rather, and those actors that perceive RRI as an opportunity to transform science-society relations fundamentally (Bauer et al., 2016). Questioning **whether RRI is "old wine in new bottles"** is a core criticism within the wider RRI discourse, asking whether and to what extent RRI activities of the European Commission simply try to bind together and re-label an already ongoing transformation of the science systems in terms of engagement, gender equality, open access or research integrity. Proponents of RRI, in contrast, see a real opportunity to **fundamentally change practices and structures in science and innovations system** (Bauer et al., 2016).

RRI not only gets interpreted in different ways but also is a deeply contextual concept including a variety of potential manifestations (Spaapen, 2015, 28). **RRI applies to a diversity of research and innovation activities, actors and institutions**, ranging from universities, funding agencies, political decision-making to private companies. All these institutions follow different rationales and established practices, in which RRI has to be implemented accordingly. Therefore, **a single list of specific criteria and indicators** to determine the specific manifestation of RRI with regard to all these situations and institutions **is neither feasible nor reasonable** (Strand et al., 2015). Criteria frameworks such as that provided by Wickson and Carew (2014) may well serve the evaluation of single projects, yet often fail when applied to research programmes or innovation agendas. Empirical studies have shown that all RRI requirements are hardly ever met in a single project or institution (Kupper et al., 2015b). Moreover, RRI may manifest differently in **different political cultures across Europe.** While traveling and diffusing through a range of countries and institutions, the RRI approach gets interpreted and implemented differently. Against this background we refrain from defining RRI narrowly and rather conceive it as a **flexible and open framework**.

However, with regard to the governance frameworks and participatory approaches from the fields of TA and STS mentioned above, the question might still be: **What is new about RRI?** First, RRI builds on a variety of preceding governance approaches but transgresses the conventional focus on technology questions, particularly those of risk and ethics. **RRI reflects a change in the ontological conception of science and society**. The concept builds on social-constructionist ideas that science and society are not independent but co-produced (Jasanoff, 2004). Departing from this assumption, RRI provides a normative and political orientation to not artificially separate these areas but to insert societal influence on innovation in a more systematic way. The black box of innovation is opened up for society. Second, RRI challenges scientists, innovators, business partners, research funders, policy makers and (not least) those who use innovations, benefit from and are burdened by innovation to not only focus on their narrow domain but to reflect on their own roles and responsibilities in science, innovation and society (Owen et al., 2013). In this regard, **responsibility is reframed in the context of RRI** (Owen et al., 2012). Previous concepts of responsibility, for example to adhere to norms and laws or to value research integrity, are broadened towards responsibility for the processes and outcomes of research and innovation. RRI "opens up existing divisions of moral labour" (Rip, 2014); responsibility not only is individual anymore but collective. Third, RRI puts **special emphasis on the role of ethics** for shaping innovation processes. In this context, ethics is no longer considered a tool to be applied ex post in order to burden technologies with bans or limitations if they meet public resistance. Rather, in the context of RRI **ethics is used as a design element** to shape innovation in accordance with societal values early-on.

Without doubt, the 'proactive turn' with regard to the role of ethics in innovation is an important innovation. However, **using ethics as a design element might make us assume that innovation can serve society as a whole**, in other words, it might draw a too harmonic picture of modern society. In reality, modern society is highly specialised, differentiated and fragmented into a variety of subsystems (economics, politics, law, etc.) and organisations. The basic questions of **what is ethically responsible will be answered differently according to the particular perspective and the societal affiliation,** which will be determined by the operational logic of the particular subsystem or organisation. Therefore, scholars such as von Schomberg suggest ethical deliberation as a way towards reaching any kind of agreement. However, it is **hard to imagine that deliberation may be a forceful substitute for the old-fashioned idea that modern society can be normatively integrated or stabilised by common ethics**. Even deliberation processes characterised by the 'forceless force of the better argument' (Habermas, 1970) will not result in wide-ranging agreement and consensus. As van Lente et al. (2015) have put it, currently we move from the ideal of ethical consensus "towards an ethics of ambiguity", which means that **there are no simple solutions or best practices to be expected but only fragile compromises based on difficult value trade-offs**. In particular with regard to ethics, it is common belief that with normatively challenging and controversial issues we have to expect, and to deal with, permanent disagreement and dissent. In the context of the academic RRI debate this has already been recognised even though concrete suggestions regarding how to arrive at (at least) temporary agreements or compromises still have to be developed.

2. Participation in science, technology and innovation

This report focuses on the conception of and the **requirements for societal engagement under the header of RRI**. Participation and deliberation in STI are, however, no new demands. They have already been voiced from the 1960s on when thinkers such as Jürgen Habermas criticized political decision-making in the field of science and technology as being 'technocratic' (Habermas, 1970). **Over the past forty years societal engagement approaches**, instruments and tools have increasingly **gained in prominence** in science, technology and innovation governance and beyond. Therefore, in order to contextualize the call for societal engagement under RRI and to identify its peculiarities, in this chapter we shortly recapitulate the diverse developments and approaches to public and stakeholder engagement that have preceded and influenced RRI.

2.1   The participatory turn: Historical benchmarks

While science has long been viewed as being detached from society and free to pursue its own purposes, societal engagement has entered science, technology and innovation in several ways, notably through **a) increasing public resistance** and protests against technologies and the rise of critical movements and NGOs, **b)** the **reconceptualization of science** as post-normal, Mode-2 or transdisciplinary, **c)** the **participatory turn** in advisory institutions such as technology assessment, and **d)** the **concept of user innovations**. Beyond these developments in STI the idea of deliberative democracy has gained influence over recent decades as mirrored in ongoing debates on the relationship between STS and deliberative democracy (Lövbrand et al., 2011, Durant, 2011).

2.1.1   *Resistance, protests and the rise of civil society movements and organisations*

Since the late 1960s public resistance and protests have formed against technological projects and developments (Irwin, 1995), accompanied by a growth in social movements and non-governmental organisations. Nuclear energy and, later, gene technology were focal points of public resistance against technological advancements and policies. More recently, **public protests and social movements have addressed established technologies** such as fracking, or emerging technologies that partly represent mere technology visions such as geoengineering, neuro-enhancement or synthetic biology. Moreover, an increasing awareness of environmental side-effects of many technologies, most prominently of energy production and consumption, has led to a further **loss of trust in technocratic institutions of science and technology**. In many countries, protests and citizen initiatives against technological projects have led to the formation of **civil society organisations (CSOs)** that aim to bring issues related to science and technology to the political agenda. Civil society organisations, notably environmental NGOs, since then have become important actors in the discourse and governance of science and technology. CSOs have further raised awareness for the

risks of particular technologies and therewith have influenced public perception and political discourses on science and technology. Civil society movements and organisations also succeeded in influencing planning processes via public actions and demonstrations, legal interventions, and political engagement (Mejlgaard et al., 2012). The impact that social movements and CSOs had on STI is particularly illustrative in the history of nuclear energy. Many countries such as Austria, Germany or Ireland have withdrawn from or phased out nuclear energy.

2.1.2 *Public participation in science*

Many actors in science, technology and innovation assumed that public resistance and conflicts result from ignorance and misunderstandings from the side of the public (Sykes and Macnaghten, 2013, 87). Based on this assumption, first attempts to foster public engagement by ways of science education focused on the idea of public understanding: to make the citizens scientifically literate through information and education (Royal Society, 1985). Scientists in science and technology studies and sociology, however, have shown that the deficit model does not withstand empirical testing (Wynne, 1996, Michael, 1996).

Since the 1990s, calls for the democratization of expertise and for participatory science have been advanced through concepts such as **post-normal science** (Funtowicz and Ravetz, 1993)**, Mode 2 science** (Gibbons et al., 1994, Nowotny et al., 2001), **transdisciplinary science** (Pohl, 2008, Pohl and Hirsch Hadorn, 2006) or **citizen science** (Irwin, 1995). These concepts suggest empirically and normatively new ways of knowledge production and a changing role of science in society. They are based on the understanding that increasingly, **science is irreducibly uncertain and highly complex;** it involves normative and cognitive questions and consequently goes beyond the problem-solving capacities of single disciplines (Gibbons et al., 1994, Nowotny et al., 2001). New modes of knowledge production recognize that "uncertainty and ignorance can no longer be expected to be conquered; instead, they must be managed for the common good" (Funtowicz and Ravetz, 1991). Following these properties, **knowledge production processes are – or ought to be – opened,** involving many scientific and non-scientific actors (Luks and Siebenhüner, 2007). Sometimes citizens, community groups and local institutions are being called to collaborate to monitor, track and respond to issues of academic science (Conrad and Hilchey, 2011). However, it is often unclear whether academia uses citizens as mere data collectors or whether citizens are encouraged to contribute to processes of issue framing and challenging research strategies. Given the manifold and complex societal problems, knowledge production can neither remain in isolated disciplinary strands nor can it be restricted to academic research institutions. **Transdisciplinary knowledge production** crosses disciplinary boundaries by interdisciplinary work as well as the boundary between science and society via the participation of non-scientific actors in research (Pohl, 2008). Moreover,

transdisciplinary research aims at providing **solutions for real-world problems**. This also has an **impact on the quality, evaluation and legitimacy criteria for science** – science has to be socially accountable rather than peer-approved (Gibbons et al., 1994, Nowotny et al., 2001). The striving for 'true', 'objective' or 'scientifically sound' knowledge is replaced by the search for 'socially robust knowledge' (Gibbons et al., 1994, Nowotny et al., 2001) or 'consensus knowledge' (Bechmann and Frederichs, 1996). In sum, since the early 1990s the 'old' style of science has been delegitimized as being too detached from the real world and therefore incapable of producing societal relevant knowledge. A new mode of knowledge production is introduced claiming to be able to resolve the shortcomings by way of other procedures and the involvement of non-scientific actors.

2.1.3   Participatory approaches in technology assessment

The call for the democratisation of expertise has also resonated in a change of practices of advisory institutions, most notably in the field of technology assessment (TA). TA institutions have increasingly opened up towards societal actors and the public and developed a range of **participatory and deliberative** approaches. While initially, technology assessments strongly relied on fact-based scientific and technological expertise, from the 1980s on TA practitioners and theorists posed emphasis on participation. This was especially observable in the Netherlands and Denmark, where deliberative models of TA, known as "constructive", "discursive", "participatory", or "proactive" TA were developed with the aim of facilitating discussion and deliberation among experts, decision-makers, stakeholders, and/or citizens.

Participatory TA (pTA) describes a "class of methods of assessing socio-technological issues that actively involve various kinds of social actors as assessors and discussants" (Joss and Bellucci, 2002). Participatory TA was developed as a reaction to increasingly contested technological developments and their ethical and normative implications. Consequently, pTA not only is interested in the unintended consequences but also in the potential societal conflicts arising from technological developments and in normative question regarding the desirability of particular technologies (van Est and Brom, 2012). Moreover, pTA is understood as a process of societal mediation and consensus building (Grunwald, 1999, Joss and Bellucci, 2002). A wider range of actors and groups, including citizens or lay persons, stakeholders, civil society organizations, scientific experts, and political decision-makers are involved in technology deliberations (Joss and Bellucci, 2002). PTA also implies a reorientation with respect to the addressees of TA activities, shifting the focus from political decision-makers to both, public and political audiences (Grunwald, 1999, van Est and Brom, 2012). By stimulating societal debates and contributing to consensus building, pTA is used to increase the legitimacy of socio-technical decisions, raise the acceptability of technology and foster public understanding of technological developments (Grunwald, 2009, Joss and Bellucci, 2002).

Concepts such as constructive TA (cTA) (Schot and Rip, 1997), **real-time TA** (Guston and Sarewitz, 2002) or **vision assessment** (Grin and Grunwald, 2000) are based on the notion that technology and society co-evolve (Bijker et al., 1987). Technology is considered to be a socio-technical system shaped by its social context, i.e. human action and societal visions. CTA, for example, redefines TA as an approach of active engagement in the management of technological change processes, as opposed to an independent program of (expert) impact analysis. According to the cTA approach, social problems surrounding technologies must be addressed by broadening the design process (Schot and Rip, 1997) using three strategies: (i) technology forcing, i.e. the modulation of a technology by setting societal goals through regulation; (ii) strategic niche management, i.e. the support for introducing and scaling-up technologies deemed beneficial for society; and (iii) the "loci for alignment-strategy", i.e. the creation of spaces or forums where supply and demand can meet. All three strategies build on early interaction and dialogue with diverse actor groups, including technology actors (such as firms, laboratories or technology programmes) who invest in and facilitate technological developments, societal actors who try to feed back into technological developments (e.g. various societal groups), governmental actors, as well as (potential) consumers (Schot and Rip, 1997). By targeting technology developers, consumers, and regulators equally, "the established division of labour between promotion and control should be mitigated" (Schot and Rip, 1997). The main function of cTA is the co-shaping of technological developments, through their democratization, and to serve as a mechanism for societal learning. In this regard, cTA is frequently connected to debates about the societal and technological transition towards sustainable development (Schot and Rip, 1997).

2.1.4   User Innovation

However, the idea of actor involvement is not restricted to a political context: with regard to industrial processes, one can witness **a decades-long tendency of opening up innovation spaces**, be it in form of collective invention (Allen, 1983), or, more recently towards an involvement of actors external to industry. Roles for consumers or users within a manufacture-centred innovation process (as von Hippel calls it) may encompass providing feedback on their needs and the functionality of the intended product. Thus, functionality and efficiency are main drivers for user involvement resulting in a rather narrow group of involved actors restricted to certain functional tasks. In innovation theory, **involving users and communities affected is seen as a step towards making innovations socially more robust** (von Hippel, 2005). However, besides such traditional innovation processes, technological developments - especially information technologies - have led to a boost of democratization of (industrial) innovations. Easy access to relatively cheap and modifiable resources extends users' capabilities for innovation (von Hippel, 2005). Due to low costs of design resources a

wider distribution of these resources becomes possible. Following von Hippel (2005, 123), "the net result [of such developments] is and will be to democratize the opportunity to create". These developments open up the space of innovation for new forms of collaboration between different spaces of innovation, reshaping the roles of various actors involved in industrial processes as well as modifying the role of innovation within society.

Overall, it becomes clear that the discourse on **RRI** is embedded in a general tendency in Western democracies away **from formal closed hierarchical structures towards more networked and participatory forms of governance** (Fischer and Gottweis, 2012). Theories of **deliberative democracy** have received considerable academic and political attention since the early 1990s and led to a range of democratic innovations, such as modifications to conventional institutions of government, ways of communicating between governmental and civil society agencies, usage of e-governance tools and mass-mediated deliberations, surveys, and citizen panels or 'mini-publics', where lay citizens and non-partisan actors gather together to discuss topical matters of policy relevance (Renn et al., 1995, Renn, 1995, Goodin and Dryzek, 2006, Dietz and Stern, 2008, Pytlik Zillig and Tomkins, 2011).

2.2 Towards societal engagement under RRI

Societal engagement is at the heart of RRI; although the short retrospect already has illustrated that the opening-up of science and technology to public dialogue is not new. In this regard, RRI can be seen as a continuity of the 'participatory' (Jasanoff, 2003), 'deliberative' (Kearnes, 2009) or even 'democratic' turn (Hagendijk and Irwin, 2006) in science and technology governance. Some illustrative definitions of what are the basic aims of and specific requirements for societal engagement under the header of RRI are provided in Table 2.

Table 2: 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).
*Multi-stakeholder involvement in RRI: "projects should bring together **actors from industry, civil society and research to jointly define** an implementation plan for the responsible development of a particular product to be developed within a specific research/innovation field, such as information and communication technology or nanotechnology"* (von Schomberg, 2013, 67, 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, 17, 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 et al., 2014, 14, emphasis added).
*"(…) responsible forms of innovation should be aligned to social needs, be responsive to changes in ethical, social and environmental impacts as a research programme develops, and include the public as well as traditionally defined stakeholders in **two-way consultation**." (…) "(…) the ongoing, 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, 163, emphasis added).

A brief comparison of the key tenets of RRI (as discussed in chapter 1) and the definitions of societal or public engagement (see Table 2) with previous participatory approaches further illustrates the heritage and similarities. Notably, **debates surrounding post-normal or Mode-2 science already introduced ideas about the changing role and function of science in society**. Moreover, the re-

orientation of science from only satisfying pure scientific curiosity towards solving societal problems, combined with the involvement of societal actors, strongly resembles the RRI discourse. Also, pTA and cTA have clearly influenced ideas about societal engagement in RRI. PTA strongly aims at including the values and concerns of citizens in technology debates while cTA is concerned with an early engagement of all stakeholders in order to shape technological developments.

Yet while conceptually, societal engagement under RRI may strongly resemble previous approaches at first glance, we find that **RRI assigns a stronger relevance to societal engagement in the political discourse and in science and innovation systems**. Previous approaches such as cTA or transdisciplinary and citizen science, respectively, gained prominence; however the inclusion of citizens, consumers and stakeholders took place in particular niches only, and it was restricted to single projects. Inclusion was an add-on to academic work rather than a constitutive part of it. Therefore, with the widespread uptake of RRI by the European Commission and European countries **hopes are reared that this ultimately leads to some sort of institutionalisation of societal engagement** in research and innovation. At the political level, RRI implies a shift from the deficit model to a dialogue model that had already been made in academic debate long ago. Moreover, with the widespread uptake of the RRI framework there is an opportunity that societal engagement becomes routine practice and an institutionally embedded culture (Owen et al., 2013) rather than an add-on to academic research.

Against this background, attention to, interest in and practice of societal engagement in R&I continue to grow. And although there is already an established knowledge on 'how to do it well' from previous debates on societal engagement, the new conditions and developments call for a more precise conceptualization, a more thorough testing and a more diligent analysis of societal engagement. Moreover - as for example the MASIS project (see Mejlgaard et al., 2012) has highlighted -research on societal engagement in R&I has produced insights into a whole range of tensions societal engagement is facing. Any attempt to move towards routine societal engagement in R&I, therefore, requires a better understanding of these tensions and associated hurdles for the uptake of societal engagement formats.

In the following chapters of this report we will continue this discussion and **explore how societal engagement should be (re)conceptualized in the context of RRI.** Particularly, we will

– specify the basic requirements for societal engagement under the terms of RRI; and

– identify and specify hurdles and incentives for societal engagement becoming a routine practice in science and innovation.

In order to do so, we will discuss key requirements for societal engagement under the terms of RRI and respective challenges along five central questions. **Chapter three** is dedicated to the question of

who should become engaged and which societal actors have to be taken into account under the terms of RRI. **Chapter four** focuses on the time aspect of engagement and the implications for the various roles taken up by different participants. Subsequently, **chapter five** elaborates on typologies of engagement processes aligned with the intended purposes of the respective format. **Chapter 6** discusses content-related aspects of societal engagement, especially the question how to introduce abstract R&I issues without restricting the scope of deliberation. In **chapter 7**, we elaborate on functions and impacts of societal engagement under RRI.

3. Whom to engage? Inclusiveness

In a pluralist, differentiated and highly diverse society, questions concerning ethics, acceptability and societal desirability of research and innovation are subject to individual reasoning and preferences – and, therefore, to be potentially contested (Kuhlmann et al., 2016). R&I processes should therefore be inclusive, diverse and – at least to some extent – representative in regard to societal actors, different perspectives, values, knowledge sources and material interests (Owen et al., 2012). In the following, we will discuss how to effectively address the claim for inclusiveness in RRI practice.

3.1   Third sector actors and the unorganized public

Inclusiveness and diversity in societal engagement under the header of RRI first and foremost means **to involve of a high number and variety of actors and groups** (Rask et al., 2016). In broad terms the relevant actor groups include the **policy sector** (policy makers, politicians, funders, research councils, parliamentary committees, R&I agencies), the **academic sector** (universities, public and private research institutions), the **industry sector** (companies, service providers, product manufacturers, business leaders), the **third sector** (civil society organisations, non-profit NGOS, science centres, museums) as well as the general, i.e. **unorganized public**[12]. Ever since public authorities, academia and industry play an important role in research and innovation processes. Third sector actors have been increasingly engaged in STI issues over the past decades, particularly in form of well-organized social partners (i.e. organizations representing employers or employees) and, to a lesser degree, environmental NGOs. The unorganized public traditionally has been subject to information campaigns and educational measures but has only rarely been engaged in more dialogic procedures. While all actor groups are considered highly relevant, **RRI** with its call for inclusive engagement, particularly **emphasizes and aims at the engagement of** those societal actors which so far have been underrepresented in R&I**,** i.e. **third sector actors and the unorganized public**, respectively (Sykes and Macnaghten, 2013). This emphasis is reflected in policy documents and a range of dedicated projects such as ENGAGE2020[13] and the present project PROSO.

Although definitions may vary, **the third sector** (sometimes also referred to as the social sector) generally comprises of civil society organisations (CSOs) that are non-governmental and not-for profit

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[12] The project PE2020 categorizes actors in four groups: public, private, social and fourth sector. The fourth sector represents "an emerging field composed of actors or groups of actors whose foundational logic is not in the representation of established interests, but rather in the idea of social cooperation through hybrid networking. Examples of fourth sector actors included hybrid experts, randomly selected participants, 'life world experts' and 'field experts'" (Rask et al., 2016).

[13] The project Engage2020 identified six types of participants whose involvement in R&I should be strengthened: CSOs, citizens, affected populations, consumers, employees, users and others (Kuhn et al., 2014).

(Evers and Laville, 2004). CSOs pursue a shared objective for the public interest, including political, cultural, environmental, social and economic ones. Examples include organizations representing employers or employees, environmental NGOs, religious organisations or consumer organisations. The third sector represents organized societal perspectives.

Further relevant societal perspectives are represented by **the unorganised public** (sometimes only public) or lay citizens. This group includes ordinary non-specifically educated people from all walks of life in their personal capacity (Sutcliffe, 2011), taking, however, into account that individuals may also engage in other roles, e.g. consumers, employees, users, or as those affected by research and innovation activities.

3.2   Balanced representation and balanced view

The engagement of CSOs and the general public serves to capture societal needs, perspectives and values for RRI. To ensure inclusiveness of values and perspectives engagement processes and initiatives should ensure "balanced composition, gender balance and wide representation of societal perspectives" (Rask et al., 2016). Balanced composition is dependent on the respective context, issue and purpose of engagement. However, as a minimum requirement **no particular interest or perspective should dominate the process** (Renn, 2008, Rask et al., 2016). This requirement calls for the engagement of a number of civil society organizations and individuals (rather than a few representatives). Engaged organisations and individuals should be diverse (Stirling, 2007), representing a broad range of values, knowledge and perspectives in a pluralist society (Rowe and Frewer, 2000, Kupper et al., 2015a). Therefore, the selection process is of high relevance when organising engagement processes.

With regard to the engagement of CSOs **RRI implies to include the whole spectrum of societal perspectives** that are organisationally represented. Fostering institutional diversity means **to go beyond traditional stakeholder groups** such as social partners and including a broader diversity of perspectives, including environmental, consumer, religious, youth, and patient organisations. If taken seriously, this requirement would mean to systematically map potentially relevant CSOs in advance and additionally to open the selection process to scrutiny. It has to be asked throughout the R&I process whether all relevant actors are at the table (Rask et al., 2016). Ensuring balance through institutional diversity is one prominent strategy. However, this strategy may limit participation to those who have a stake in the issue discussed. Especially **with regard to emerging technology** this strategy poses a problem since **special publics or interest groups representing this diversity do not exist yet**. These publics have to develop or have to be constituted and will come into existence not until the (usually) experts' driven debate has developed to a certain degree.

Beyond that, other authors call for a more balanced orientation of all involved actors. Following von Schomberg (2013) in RRI roles of responsibility are allocated to all actors involved in the research and innovation process. He demands that actors, including policy, academia, industry and CSOs, "resolve conflicts and **go beyond their traditional roles: companies addressing the benefits and Non-Governmental Organisations the risks**. Co-responsibility implies here that actors have to become mutually responsive, thus companies need to adopt a perspective going beyond immediate market competiveness while NGOs reflect on the constructive role of new technologies for sustainable product development" (von Schomberg, 2013).

This understanding of RRI implies that CSOs change their representational strategies; they should, at least partly, **disengage from particular interests and objectives** and become representatives of a common public good (Sutcliffe, 2011). Following this RRI perspective, the organization of engagement procedures should not only ensure a broad variety of relevant societal perspectives involved (**balanced representation**). Additionally, involved actors should not stick to their habitual roles and interests in technology assessment and innovation but should take the 'whole picture' into account, i.e. apply an independent view and refer to common goods and values (**balanced view**). The balanced representation, in other words, has to be supplemented by a fundamental change of the self-image and the strategies of the actors involved.

When engaging the unorganized public a **balanced representation** of values, knowledge and perspectives is traditionally **ensured through socio-demographic diversity**. In formal engagement processes organizers often use stratified random sampling strategies to account for gender, age, employment, education and regional diversity. In this respect, engagement processes serve as "mini-publics" (Renn, 1995, Goodin and Dryzek, 2006, Dietz and Stern, 2008, Renn et al., 1995, Pytlik Zillig and Tomkins, 2011), providing an illustration of the diversity of society as a whole. A different strategy, as pronounced by the EU project RRITools, is to **actively search for and include vulnerable or minority groups** and so far 'silent voices', such as ethnic minorities and the ones not employed, educated or in training (NEETs). While these groups are particularly hard to reach they are considered to be highly valuable in finding answers to the Grand Challenges (Kupper et al., 2015a). In this regard societal engagement serves also to empower these 'silent groups' by targeting them and, potentially, over-representing them in the samples. Illustrating this strategy, the project PE2020 lists a range of engagement processes, specifically targeting youth or women (Rask et al., 2016).

While the ideal of a **balanced representation may be realised by appropriate search strategies**, it is definitely **more difficult to come close to the ideal of what we have called a balanced view**. How to motivate interest groups and actors used to represent certain worldviews and issue framings to take on a new role and to abandon short-term benefits in order to contribute to 'responsible innovation'?

This fundamental problem has not been sufficiently addressed by the RRI proponents so far. However, to successfully motivate companies and NGOs to refrain from reflecting and operating with a strong focus on their own interests may require a deep change of innovation culture which is hard to imagine.

In sum, societal engagement under the terms of RRI aims at strengthening the roles of so far underrepresented societal groups and perspectives. In this regard diversity and balanced representations are important requirements for societal engagement under RRI. The idea of ensuring a balance of views represents another and rather innovative requirement for the organisation of engagement procedures under the header of RRI. **When implemented rigorously, RRI may entail a change in power structures and relations**. So far, unheard groups and voices could be empowered and it is hoped that traditionally powerful actors might be open-minded in regard to the reasons given by the 'other side' and might respond to these voices. However, the call for inclusiveness and diversity also brings along old and new challenges for engagement processes including the motivation of actors to participate, their capabilities to participate as well as new dynamics of inclusion and exclusion.

3.3   Motivation to participate

The **motivations of the public and CSOs** to be engaged are, so far, **underexplored**. Under what conditions CSOs and citizens are willing to be engaged in R&I processes? For each group distinct challenges ensue.

In regard to the engagement of the **unorganized public** quantitative survey studies provide some information about the general attitudes and willingness of European citizens to actively deal with the issue of research and innovation[14]. In the Eurobarometer survey, one third of the respondents (EU 27) agreed that in political decision-making the public should have their say; especially, with a view to science and technology issues the public should be consulted and the public opinion should be taken into account (Gaskell et al., 2010).

The recent survey **"Public Attitudes to Science 2014"** (Castell et al., 2014) found the following results for the UK – which needs to be seen against the increasing institutionalization of public engagement with science and technology in the UK – namely that:

> *"People overwhelmingly think regulators, governments and scientists should be engaging in dialogue with the public about science. While this does not always translate into a willingness*

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[14] The following paragraphs on the motivations of the public are largely replicated from the PROSO-Deliverable 4.1: Kosow, H., Dreyer, M., Bauer, A., Chonkova, B. (2016): Methodology Citizen Panels. Deliverable D 4.1 for the EU-project PROSO-Promoting Societal Engagement under the terms of RRI, pp 5-7.

to be personally involved, there are still three-in-ten who would at least like to have more of a say on science issues" (Castell et al., 2014, 91).

Castell and colleagues furthermore found that it is most challenging to involve two types of people: women, who often feel less confident in engaging with science, and the less affluent, challenging the intention of RRI to engage with so far underrepresented groups:

"While the less affluent are typically the strongest advocates for involving the public, they tend to be among the most cynical about public consultation and among the least likely to want to get involved themselves" (Castell et al., 2014, 8).

Research already has revealed the role of certain conditions that enable or constrain citizens' engagement in R&I. Qualitative research points out that central barriers for citizens are the **time** and **effort** they need to invest when they engage, especially, when they need to take over **unusual roles** and **tasks** (e.g. Lidskog, 2008, 83). Castell et al. (2014) identified **different types of general attitudes** towards engagement: the Confident Engagers, the Distrustful Engagers, the Late Adopters, the Concerned, the Indifferent and the Disengaged Sceptics.

In contrast, research on engagement in the context of the energy transformation in Germany (see project KomMA-P) has distinguished two types of general attitudes towards engagement: the managerial type who conceives policy making as an efficient management of public affairs and the deliberative type who has (direct-)democratic ideals. The authors argue that engagement formats need to be adapted to the diverging goals of these groups of people.[15] Overall, the relation between people's general attitudes towards engagement and what specifically constrains or incentivises different groups to engage, still remains underexplored.

While research on engagement incentives still seems to be in its infancy, there are a several factors that are assigned a certain role as **engagement incentives**. These are internal motivations such as **concern** which can be personal concern or perceived relevance for society (Wilkinson et al., 2012); the expected **impact** or specific expected policy outcomes, or external motivations like monetary **compensations** (Kleinman et al., 2011). Further research on participants' perspectives on engagement has pointed at the importance of the **emotional** and **social** aspects (see e.g. Davis et al., 2014, Jensen and Buckley, 2012). Furthermore, social, political and cultural **contexts** of engagement play a role. This begins with the participants' level of trust in the initiators of the engagement and touches further aspects of "established practices, roles, cultural ideologies and available repertoires" (Krabbenborg and Mulder, 2015, 474) which can constrain or support citizens' engagement in research and innovation.

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[15] For more information, see URL: http://www.energiewende-akzeptanz.de/ergebnisse/

European countries differ considerably in the experiences with and attitudes towards participatory and deliberative processes (Landeweerd et al., 2015). "In some countries people feel it is a democratic duty/civic virtue to attend and contribute to a deliberative event", while in others there is more reluctance to attend (Andersson et al., 2015). Depending on their familiarity with participatory governance approaches, citizens may feel more or less entitled to engage with science or willing to do so. Hypothetically, the more a political system relies on **representation and delegated power**, the less inclined citizens will be to become engaged. It is characteristic for representative democracies to discharge responsibilities, implying that - also in the case of R&I decisions - the delegation of responsibilities to particular actors (elected politicians) or organisations (e.g. CSOs) might be a legitimate strategy. On the other hand, this observation suggests that the successful normalization of public engagement with science does not only rely on adequate incentive structures but may simultaneously depend on **changes in both the political culture and in the innovation culture** (see chapter 7). For example, while the Dutch research funding system has deliberately opened up towards societal actors over the last decades (Bauer et al., 2016), Germany or Austria seem to remain reluctant towards the engagement of science with civil society organizations. Obviously, German funding organizations fear the politicization of research through the involvement of CSOs, particularly when dealing with potentially controversial technologies.

Although CSOs are much easier to identify and to invite, engagement processes also face challenges concerning their **willingness to participate**. The Consider project found that participation in EU policy processes as well as FP7 projects requires **a high degree of institutionalization and professionalization by CSOs**. For example, when participating in FP7 projects, CSOs have faced unfamiliar legal and financial rules (Legris Revel, 2014). Smaller CSOs with limited financial resources, personnel or access to knowledge (such as journal subscriptions) do not have the capacities to participate in all potentially relevant R&I processes (Smallman et al., 2015).

Moreover, the institutionalization and professionalization "limits the bottom-up character of grass-roots activists, including movements in opposition to public authorities, which are essential features of civil society if it is to fulfil a legitimising and communicative role" (Legris Revel, 2014, 29). In this regard, increased societal engagement under RRI also requires changing routines of policy and research processes to accommodate a variety of different types of CSOs.

It is furthermore important **to ensure mutual benefits for both researchers and CSOs.** CSOs should not be used as a free or cheap resource to capture different views; rather, engagement initiatives need to contain some reciprocal value for them. As the EU project Consider has illustrated CSOs may pursue a variety of objectives and interests with their participation in research projects, including

financial interest, policy outcomes, and social interests, gaining legitimacy, gaining knowledge or academic respectability (Legris Revel, 2014).

CSOs, particularly those with a traditionally critical stance towards emerging technologies may also refuse to participate because their **organisational interests** collide with the interests of the event organisers. Under which conditions is it an attractive option for 'green' NGOs to join, for instance, a transdisciplinary project on developing approaches of 'green nanotechnology', hence to reflect, on the constructive role of new technologies for sustainable product development?

Willingness to co-operate under such terms requires a **high degree of trust** between scientists, industry/business actors and CSOs. Consequently, from a CSO's perspective, engagement with research or even industrial actors might entail the **risk of being used as a source of legitimation and of losing control over the discourse**, particularly when the framing of the engagement activity is outside the CSOs' influence (see chapter 6). Moreover, the consensus-orientation of many engagement activities might make it difficult for CSOs to communicate their efforts and impacts to their clientele or the public.

Protest-like engagement, in contrast, is much more convenient to comprehensively demonstrate the activities and standpoints of CSOs. In this regard a CSO's engagement with established R&I actors and institution may impact the public trust and reputation of the CSO. As Hutter and O'Mahony (2004) point out "CSOs need to be cautious that close relationships with major donors, whether government or business, do not lead to an undermining of public trust in them". In this respect it is particularly "difficult for RRI to reach extreme environments (more autonomic groups, such as bio hackers) and alternative organisations" (Smallman et al., 2015).

4. When to engage? Timing

In regard to the organization of societal engagement procedures the issue of time is pivotal. When should CSOs and the public be involved in research and innovation processes? Usually, as in the cases of nuclear power and biotechnology, public debates have started only after technologies and innovations had been introduced or were shortly before market introduction. RRI aims at the inclusion of societal actors in all phases of the research and innovation process with an emphasis on **engagement moving upstream** to the agenda-setting and research phases.[16] However, even in later phases of innovation engagement remains important in order to monitor innovation processes and to ensure that developments remain in accordance with societal needs and values. Consequently, public engagement under the header of RRI should be understood as a **continuous activity** rather than a one-time event.

4.1   Phases in the R&I process

According to several EU projects dealing with the engagement issue the research and innovation process can be divided in four phases: policy formation, programme development, project definition, as well as research and innovation activities (Rask et al., 2016, Kuhn et al., 2014).

Policy formation concerns the institutional framework for R&I activities. This includes research infrastructures and organisational settings that provide the basic conditions of conducting research and innovation activities, funding strategies and programmes, rules and instruments to ensure responsible research and innovation, the definition of financial instruments, etc. (Rask et al., 2016). Societal engagement in policy formation entails the participation of the public and CSOs in shaping a vision of the future to which research innovation can be directed. CSOs and citizens could be involved in prioritizing research (Gudowsky et al., 2012). A recent example from the Netherlands is the participatory process to define the **Dutch National Science Agenda.**[17] The process invited citizens to send in questions they perceived as important to be addressed by research which were subsequently clustered and translated into 16 roadmaps addressing the most pressing issues in the next couples of years.

Programme development encompasses the process of defining the aims and contents of calls in R&I research programmes (Kuhn et al., 2014). In this context, key actors may be European and national Research Councils and other research funding institutions which could use societal engagement to determine long term research spending. The concrete engagement agenda may entail issues such as the design of funding schemes, thematic prioritisation and other general rules and guidelines for

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[16] See https://ec.europa.eu/programmes/horizon2020/en/h2020-section/public-engagement-responsible-research-and-innovation
[17] See http://www.wetenschapsagenda.nl

researchers and research funders (Rask et al., 2016). To elaborate recommendations for decision-making in issues related to tomorrow's research and innovation CSOs or concerned groups can be involved; additionally, in order to define or prioritise research programmes, one could directly involve citizens who – in close contact with selected experts – formulate visions and expectations for key aspects of future research. The latter aspect has explicitly been addressed by the CIVISTI project (Gudowsky et al., 2012).

Societal engagement in **project definition** deals with research topics, methods applied and resources included in specific research or innovation projects (Rask et al., 2016). According to the experiences of the Engage 2020 project early involvement and engagement of citizens, especially those most affected, is helpful to propose citizens' needs and concerns into the proposed projects; even consensus-building is considered to be a realistic aim (Kuhn et al., 2014). As our historic retrospect shows (see chapter 2.1), related concepts such as transdisciplinary, post-normal or citizen science advocate the idea of engaging societal actors in project definition.

Apart from project definition, CSOs and citizens may also be involved in **research and innovation activities,** i.e. in those core activities which are usually restricted to experts (Rask et al., 2016). Engaging the public in research and innovation activities may for example increase the amount of empirical data for researchers (citizen science), may allow for clarification of normative issues in the scientific process (midstream modulation), or it may improve the relevance and thereby the implementation of research and innovation results (for example through Science Shop related activities). It may also raise citizens' awareness of research and innovation (Kuhn et al., 2014). The FP7-project CONSIDER has shown that CSOs may assume quite different roles in research projects, from being members in the advisory boards to being project members, initiators or even coordinators (Legris Revel, 2014). Consequently their activities differ as well; they may be actively involved in drafting the project proposal, determining the research method and data collection or just in providing feedback on single steps.

An example for CSO engagement in research projects is the **MVI Responsible Innovation programme**[18] by the **Dutch funding agency NWO** (Netherlands Organisation for Scientific Research). The Responsible Innovation programme aims at funding research that has a benefit for society and at investigating ethical and societal issues at an early stage. In order to do so projects funded by the programme are not only interdisciplinary, involving humanities, social sciences as well as natural and technical sciences but also always include a valorisation panel consisting of (potential) users supporting the researchers to take societal needs into consideration during the research process.

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[18] See http://www.nwo.nl/onderzoek-en-resultaten/programmas/maatschappelijk+verantwoord+innoveren

4.2   Engagement moving upstream

In the days when participatory procedures were initially developed and tested, the technologies at stake (such as agricultural biotechnology) were already developed to a degree as to provide an idea what they were for. In contrast, **RRI primarily addresses new and emerging technologies** such as nanotechnology or synthetic biology that are far less developed; often, their supporters do not even share a common definition (Torgersen and Schmidt, 2013). In this context, talking about emerging technologies implies talking about a new socio-technical constellation. This is mirrored in the notion of '**technoscience'**, which emerging technologies often are debated under ever since Bruno Latour (1987) had introduced the term to highlight the inextricable entanglement of science and society. This entanglement determines which questions get accepted as legitimate, whose statements are deemed valid or what theories are acknowledged to be guiding. Today, the term technoscience mostly indicates that technology development does not follow basic research in a linear way; rather, **principles of feasibility and marketability already influence basic research**. Fundamental decisions on applications are therefore taken early during research, possibly deciding the fate of a technology for good. Initially however, it is not clear at all whether, and which, technical applications may be realized. In regard to RRI, this means that **engagement has to set in early** in order to shape science, technology and innovation effectively. In other words, RRI pushes societal engagement to move upstream. This has become particularly evident with nanotechnology: as soon as it appeared on the agenda, scholars like Wilsdon and Willis (2004) argued for upstream engagement. The central idea was to intensify public involvement through a stimulated dialogue much earlier than previously (Gavelin et al., 2007). Following this perspective, **societal engagement is closely tied to anticipation and proactivity** in RRI. Societal actors should get the opportunity to early comment on and influence techno-social visions and directions long before they leave the laboratory. Societal engagement receives a performative function rather than a controlling or regulating one (Rask et al., 2016).

4.3   Engaging people continuously

As a second novelty, RRI explicitly considers societal engagement to be a permanent and continuous endeavour. Previously, participatory processes mostly have been one-time or single events (such as a consensus conference). While there is still much emphasis on such type of engagement activities, including the EU projects exploring societal engagement under RRI (e.g. PE2020, Engage2020, Consider), **RRI prompts to consider more continuous forms of societal engagement**. As Rask et al. (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". Obviously, to involve people continuously assigns a new task to

the organisers of engagement activities: According to the claim of RRI, they have **to build bridges between separate events and initiatives, to introduce new institutions and processes ensuring continuous engagement** and to better institutionalise engagement initiatives within existing R&I governance. Currently, there are various activities aiming at moving beyond a narrowly instrumental, methodological or event based approach and at stimulating interactions between institutions such as science centres, ministries and research institutes (Rask et al., 2016).

4.4   Too early engagement?

While **moving upstream is an important characteristic of societal engagement under RRI**, it also raises the question whether and when engagement may be too early. Early on in research and innovation processes the issues or technologies at stake are often very provisional, giving societal actors little reference points to form their opinions. **Participatory events usually are more interesting to the attendants if the issue to be debated is close to their everyday life**, or even if not, if it is being problematized in the media. In contrast, 'upstream' engagement sets in when there is yet no cause for public controversies because there are no concrete applications that could trigger citizens' concerns or stimulate public imagination (Gaskell et al., 2005). This applies, for instance, to RRI areas such as synthetic biology that currently are limited to laboratory research dealing with scientific questions which are very far from concrete applications; currently, it is hardly or even impossible to determine whether the applications envisioned by some protagonists of the research field will be realised in the foreseeable future.

Generally, the very high degree of abstraction of research practices and objectives combined with high degree of uncertainties in relation to applications and possible impacts may influence negatively the willingness of societal actors to engage with an R&I field. A paradoxical situation emerges that reminds of the so-called **Collingridge dilemma** (Collingridge, 1981): when a field of science and technology is new and decision making agendas are relatively open to influences from the public, the publics' interest in engaging with these issues is low. The consequence is that **lay people need to be actively interested and motivated to participate**.

A similar observation can be made in regard to CSOs. In the EU project NERRI (FP7), aiming at stimulating an early societal debate about neuro-enhancement, organizers found it difficult to engage with CSOs because they did not perceive the issue to be salient for their work or constituencies (Bauer et al., 2016). Activities of CSOs or concerned citizens often set in at a point of time when the research or technology is more advanced.

To sum up, in the context of RRI public dialogues and societal engagement initiatives should set in early in the innovation process. This implies a fundamental change with regard to intensity and social

dynamics of participation, with regard to the issues at stake and the willingness to engage. Formerly, participation demands accompanied the – politically reinforced – implementation of contested technologies such as nuclear energy or agri-biotechnology; these technologies gave rise to open protest and resistance. Today, engagement activities are initiated by STS or TA experts and carried out under controlled conditions, taking place for the most part without reference to public controversies since these engagement activities primarily deal with abstract issues far from the people's lifeworld, with techno-scientific visions and (non-)desirable futures embedded in policy programmes and research projects (Bogner, 2012).

5. How to engage? Tools and procedures

Which tools (or techniques) are effective and what procedures (or formats) are appropriate to engage organized and unorganized societal actors is an enduring topic. This enduring question gained renewed attention among participation scholars and practitioners with the rise of RRI. Based on insights into the variety of participatory tools we will reveal some important requirements for societal engagement in the context of RRI. At the end of the chapter we will argue in favour of connecting different forms of societal engagement: invited or top-down initiated forms and uninvited or bottom-up organized activities.

5.1   The variety of participatory tools

With regard to R&I issues, a **large repertoire of tools and procedures exists**, ranging from public outreach to dialogue events. In recent years a range of projects, notably Engage2020, PE2020 and RRITools, as well as STS scholars have explored whether the well-proven repertoire of participatory methods suits the requirements for societal engagement under RRI or whether the methods applied have to be adapted and what kind of new and innovative ways of involving societal actors are called for. In developing and critically assessing participatory tools and procedures the focus currently lies on the following areas (Mejlgaard et al., 2012, Sutcliffe, 2011, Engage2020, 2015):

- **Engagement in agenda-setting and policy formation** (addressing the European level) that includes consultation activities and dialogue procedures, including stakeholder fora, citizens' juries or focus groups (Boussaguet and Dehousse, 2009);

- **Participation in advisory boards, committees, and consultative bodies** dealing with shaping research agendas, funding decisions or evaluation of research activities (Gudowsky et al., 2012);

- **Participation in technology assessment**, foresight exercises, and other impact assessment procedures (Bogner and Torgersen, 2014);

- **Citizens' engagement in scientific knowledge** production by being involved in data collection and/or actual research mostly referred to as citizen science (Irwin, 1995);

- **CSO involvement in research** and funding of CSO activities related to research and innovation such as the publicly funded civil society platform for a turnaround in research policy in Germany (see e.g. the CONSIDER project Böschen and Pfersdorf, 2014);

- **Increased and innovative public outreach activities**, including science events, science museums, interactive science centres and mobile exhibition spaces (Gisler, 2011);

- **Grassroot approaches, including hackathons, crowdsourcing**, 'fab labs' or maker spaces, where the end user plays a role as a funder, designer, judge and/or commissioner (Andersson et al., 2015, 25).

Which tools and procedures are appropriate and effective strongly depends on the context, the issues, actors, resources and the concrete purpose of societal engagement and cannot be discussed in detail in this report (for an overview see Engage2020, 2015). In the following we shortly reflect on different typologies (or models) of participation and how societal engagement under RRI fits in. Then we highlight the call for two-way communication in societal engagement under the header of RRI and reflect upon the, so far underexplored, role of bottom-up approaches in the context of RRI.

5.2 Modes of interaction and political impact: Categorising participation

Societal engagement and participation serve as umbrella terms for a variety of ways to involve societal actors in planning, policy-making or research and innovation processes (Rowe and Frewer, 2005). Participation and engagement processes may assign different roles and agency to participants, comprise of different degrees and modes of interaction and have different functions (see also chapter 7.1). To categorize different forms of participation various typologies have been proposed. The most renowned one is the **'ladder of participation'** proposed by Arnstein (1969). Arnstein differentiates eight hierarchical levels according to the **political power** assigned to citizens: manipulation, therapy, informing (all three are summarized under non-participation), informing, consultation, placation (the three are summarized under tokenism), partnership, delegated power and citizen control (summarized under citizen power). The 'ladder of citizen participation' is **well suited for categorizing participation in policy-making** and planning processes, but less so for the involvement of citizens in research, where epistemic aspects play an important role. To maximize 'citizen power' in political decision-making may be a legitimate or even the most desired aim of participation provided that the benefits of representative democracy are largely disregarded. However, to maximize citizens' influence and control could never be a desirable purpose in the realm of science.

Rowe and Frewer (2005) present a typology of public engagement mechanisms that is based on the **nature and direction of information flow** between sponsors and participants. The authors distinguish public communication (with a uni-directional information flow from sponsor to participants) from public consultation (with a uni-directional information flow from participants to sponsors) and public participation (with a two-way information flow). In a similar way, yet confined to the field of scientific knowledge production, Jellema and Mulder (2016) distinguish, from the perspective of the researcher, discussing (science café), consulting (designing research by

stakeholders' involvement), involving (citizen science), collaborating with and supporting the public (science shop).

Categorizing different forms of science-society relations Irwin (2008) distinguishes **first from second and third order models**. The first-order model focuses on informing and educating the public by one-way communication; the second order model is based on two-way dialogue and engagement to rebuild trust and consensus. In contrast, the third order model sets science in a wider societal context, involving multiple stakeholder perspectives within the context of a reflexive, critically informed and pluralistic set of ongoing discussions and debates. By translating the terminology into that of the RRI discourse the models could roughly be subsumed under the terms of 'science *for* society', 'science *with* society' and 'science *by* society'.

With regard to the current debate on RRI, the typologies roughly outlined here serve as the main reference points for the conception of societal engagement and the respective classification of concrete engagement mechanisms and processes. The **EU projects** dedicated to conceptualizing CSO and citizen engagement (Engage2020, PE2020, RRITools, and Consider) **adapted these typologies** for their purposes accordingly. The following overview will show that across all typologies the **interaction patterns or communication flows and the degree of potential political impact on decision-making are common key parameters** to differentiate engagement types. The project Consider additionally differentiates along epistemic influence.

The **project Engage2020** a priori excluded participation formats that focus on one-way communication. It defined six levels of engagement: **dialogue** (improving the "two-way" communication between scientists, policy makers and citizens to ensure a regular exchange of views); **consulting** (obtaining public feedback for decision-makers on analyses, alternatives and/or decisions); **involving** (working directly with the public throughout the engagement process to ensure that public concerns and aspirations are consistently understood and considered in decision-making processes); **collaborating** (partnering with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution); **empowering** (the involved participants acquire certain skills/knowledge in the process of engagement), and **direct decision** (final decision-making is in the hands of the public) (Engage2020 Consortium, 2014, 6f).

In a comparable approach yet with a broader scope, the **PE2020 project** distinguished five categories of public engagement, namely **public communication** (informing and educating citizens, one-way communication from sponsors to citizens); **public activism** (informing decision-makers, creating awareness, one-way communication from citizens to sponsors, 'uninvited'); **public consultation** (informing decision-makers on public opinions, 'invited' by sponsors, one-way communication from citizens to sponsors); **public deliberation** (group deliberation on policy issues, outcome may impact

decision-making, two-way communication), and **public participation** (assign partly or full decision-making power to citizens, two-way communication) (Ravn et al., 2014, 13).

Based on Arnstein's 'ladder of participation' the **project RRITools** established four levels of engagement: **consultation** (stakeholders provide information but have little power to influence decisions); **advice** (stakeholders provide advice on decisions as members of an advisory or decision-making committee; influence in the decision-making process is not guaranteed); **collaboration/partnership** between research professionals, policy-makers and stakeholders (stakeholder inputs are included in decision-making processes) and **control** (shift in decision-making power from researchers and policy-makers to stakeholders) (Kupper et al., 2014, 13).

The **project Consider** focused on the involvement of CSOs in research projects and developed a slightly different typology based on the role of the CSO in the project and its interaction with other partners. In **projects "driven" by CSO involvement**, CSOs interact intensively with other consortium partners and, therefore, assume a dominant position (for example by leading the project, setting the agenda, defining research methods). On the opposite end of the spectrum, a **CSO's position may be "distant" from the core of the project** (for example as a member of the advisory board or a subcontractor responsible for dissemination and outreach), implying a minimum degree of social interaction. Between these extremes are **"balanced" arrangements** in which the level of social interaction among CSOs and other project partners is largely equal (for example when the CSO is project member or work package leader involved in research beyond dissemination activities). Across these three intensities of CSO involvement Consider further distinguished two roles of CSOs in knowledge production, namely a **"focused" (or limited) role** (to improve outreach or contextualize the project results with their practical experience) and a **"transformative" role** (to achieve specific research goals, identify blind spots, define the research problem or develop the methodology) (Böschen and Pfersdorf, 2014).

5.3   Towards two-way communication: RRI inspired engagement

The typologies presented serve to better understand the variety of societal engagement activities and to better distinguish societal engagement inspired by RRI from other forms of participation. The typologies illustrate, however, that it remains open whether and to what extent processes based on one-way communication only can be legitimately considered as a part of the repertoire of societal engagement under RRI. The **European Commission,** for example, proposes to explicitly include **traditional one-way information** and education procedures **along new dialogic formats** (Strand et al., 2015, 21). **Other authors** emphasize the shift away from one-way and top-down models of communication towards **'new' dialogue based approaches** to engagement that involve interactions

between a wide range of actors, including decision-makers, scientists, innovators, citizens and CSOs (Stilgoe et al., 2014, von Schomberg, 2013, Sykes and Macnaghten, 2013, 89).

Taking these different perspectives into account, we may call the former understanding as **'societal engagement under RRI in a wider sense'** and the focus on two-way or even multi-way communication as **'engagement under RRI in a strict sense'**. Overall, however, the consensus is that by and large, research and innovation governance should offer and promote engagement mechanisms providing a more active role and agency to citizens and CSOs, allowing for more dialogic interactions between all actors. Engagement should not only include the communication of activities and contents of research to the public and stakeholders but, more importantly, should allow for invited citizens, CSOs or other stakeholders to contribute their knowledge, experiences and perspectives and to raise urgent questions and concerns about the direction of research and innovation. Only if interaction occurs and communication flows in all directions actors in R&I can become mutually responsive (von Schomberg, 2013).

As an empirical example, **Research Councils UK (RCUK) aim to mainstream engagement as two-way interaction** rather than leave it at simple communication about research results. RCUK initiated training programs in engagement practices to sensitize researchers for the two-way aspect and undertook work to make the research institutions' cultures more supportive of public engagement with research[19]. However in practice, many engagement processes still "fall short in terms of true citizen participation, as an evaluation of 70 international engagement initiatives on nanotechnology found. When evaluated against the 'Ladder of Citizen Participation' most fell in the lower categories of manipulation or tokenism" (Sutcliffe, 2011, 13, for original evaluation see Laffite and Pierre-Beniot, 2008).

There are a wide range of **barriers and hurdles to non-hierarchical two-way deliberation**. The project PE2020, for example, reported institutional ambivalences, i.e. simultaneous support and resistance towards more interactive and dialogic engagement processes. Many engagement processes are perceived as being risky interventions, and in many cases policy makers make qualified statements indicating that even advisory engagement processes can be perceived as a threat to existing practices of policy making (Rask et al., 2016, 30). The authors suggest that systemic scepticism towards innovative engagement processes can easily cause them to go back to more traditional science-in-society or one-way communication models (Rask et al., 2016, 30). Similarly, in the PROSO expert workshop (see Bauer et al., 2016) one participant referred to NanOpinion (an EU funded project that organized various public communication events on nanotechnology) and found that even though some innovative forms of engagement were introduced, activities with a focus on

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[19] See http://www.rcuk.ac.uk/pe/Embedding/

one-way communication prevailed in the project. Hence, **RRI is at risk of being replaced or at least dominated by approaches aiming at educating the public**.

5.4   Appreciating 'uninvited' participation

The typologies presented further illustrate that the focus of societal engagement under the terms of RRI is on **organized, invited and top-down initiatives**, i.e. societal engagement is implicitly limited to a form of participation initiated and organized by experts 'from outside'. This participation often takes the form of a project with strong pre-determination of certain factors including the number of participants, time period, process structure and issue framing. Only the typology presented by PE2020 explicitly accounts for non-formal, 'uninvited' or bottom-up engagement (i.e. public activism).

To a certain extent, this dominance of top-down participation in the context of RRI results from the fact that engagement exercises are going 'upstream' (see chapter 4). In this phase, bottom-up initiatives such as social movements or local interest groups often do not exist yet. The **focus on 'invited' or project-shaped participation processes** is also fostered by the professionalization of public engagement along with a growing public engagement industry (Sykes and Macnaghten, 2013, 100`). The benefit of formal, organized processes is that they are more predictable and controllable, facilitate structured conversations and make it is easier to ensure particular requirements (for example balanced representation) (Bogner, 2012).

However, favouring formal engagement spaces over more spontaneous and bottom-up initiatives brings a number of **challenges for RRI processes**. First, formal deliberation processes tend to **attract certain participants;** often those with a higher education. Second, in the context of invited participation **deliberation processes are pre-determined** to a certain extent since the issue-framing and key questions have to be defined in advance (see chapter 6). Third, participants are expected to adhere to the requirements of deliberation: they have to listen to others, mobilize reasonable arguments for their opinion and be open to contextualize and relativize their opinion.

In short, **formal engagement processes expect,** to a certain extent, **'rational' participants**. There is a risk that one rationale (i.e. the scientific one) is considered the one best way of how to deliberate on the respective subject. As a consequence, bottom-up participation could be considered to be more emotional and irrational and ultimately may become delegitimized. 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 to a later point in time. Moreover, formal engagement frequently tends "to reinforce

consensus and to homogenise views" (Sykes and Macnaghten, 2013, 100). This entails the danger of **conflicts being marginalized** or even neglected and of ignoring minority perspectives.

Against this background we suggest to go beyond formal engagement processes and **to stronger include uninvited or bottom-up approaches** into the debate on societal engagement under RRI. There is a wide variety of uninvited engagement spaces including protest campaigns against technology projects, social movements, patients' initiatives for promoting research on particular diseases and more recently, crowd funding initiatives, hacker communities or fab labs. **Basic characteristics of bottom-up initiatives** include a) **self-organisation** around a common interest or aim; b) **openness in the composition** and number of people involved, and c) **no time limitation** of engagement. Bottom-up initiatives may follow different, often opposing rationales and aims, from the rejection of specific technological developments and innovations to the demand for research on specific issues or particular innovations, to alternative ways of doing research and innovation, to fun and curiosity (Torgersen and Schmidt, 2013).

In the context of RRI, bottom-up initiatives driven by critical CSOs or protest movements might offer more **'unfiltered' insights into the emotions and perspectives of people** towards STI issues. In a similar way, new emerging spaces such as fab labs or hacker communities bring together a variety of skills and abilities, encourage creativity and new ways of approaching research and innovation beyond established procedures and institutions (Delfanti, 2013). An area of concern in the context of RRI, however, relates to the requirements of inclusion and balanced representation (see chapter 3.2). Bottom-up initiatives are open and rely on self-selection, often leading to an underrepresentation of particular groups (for example women in hacker communities). Therefore, bottom-up initiatives also bear the risk to be captured by powerful groups (Andersson et al., 2015, 14).

In sum, **societal engagement under RRI** is in need of a more diverse range of ways in which scientists, policy makers and innovators can be exposed to public perspectives and concerns (Sykes and Macnaghten, 2013, 105). These include the broadening of formal deliberation mechanisms towards two-way communication as well as the consideration and potential **link with distributed and bottom-up engagement** formats. There is a need to reflect on how to link bottom-up initiatives with existing R&I governance structures and institutions without endangering their openness, self-organisation, creativity or critical potential.

6. What is at stake? Issue-framing and dissent

What kind of questions and issues about research and innovation should be addressed in engagement initiatives? The **RRI framework** does not only point to the previously discussed procedural aspects such as inclusion, upstream engagement or two-way communication, but also provides a rough guidance in terms of the **framing of engagement processes**. In the following we will address the issue of framing with a special emphasis on the controversies that might result from diverse or even contradicting framings introduced by different interest groups.

6.1   Shifting frames

Frames are **interpretive schemes that help us to come to terms with complex issues**; they help to make sense of issues that otherwise would remain too abstract, broad or diverse. This is done by emphasising or accentuating certain aspects; "by lending greater weight to certain considerations and arguments over others" (Nisbet, 2010, 44). Focusing on certain aspects of an issue, omitting others, frames offer an idea of organisation, which suggests what the debate is about. With regard to technology controversies frames serve as interpretative schemes that help to understand and problematize, respectively, the technology at stake. That said, frames are heuristic devices; they are never 'pure' but **indicate the priority of a particular perspective** without precluding other aspects. With regard to the 'classical' controversies about emerging technologies such as biotechnology, biomedicine or nuclear energy three frames turned out to be dominant in the past: **risk** (environmental and health risks), **ethics** (or moral concerns), and **economic aspects** (or interests) (Bogner and Torgersen, 2014).

RRI aims to change the way STI issues are debated. Rather than focussing on (potential or real) risks, which often tend to prevail (often resulting in a politicization of the issue at stake), **RRI puts a stronger emphasis on ethics**, including public values and EU basic rights (von Schomberg, 2013). Today, science and technology governance still is dominated by a discourse over risk, safety and precaution. This discourse translates (or frames) the ethical debate to a restricted series of topics, excluding **important moral issues such as justice**, welfare standards for marginalised groups, politics of exclusion, privacy, etc. Following Landeweerd (2015, 19), "[w]e should not merely ask 'is it (un)safe', thereby putting this up as the only possible barrier for innovation, prioritising the economic game. We should actually ask, beyond that, 'is it (un)just?'". In such a view, RRI shifts the framing towards ethical aspects while simultaneously widening the ethics frame.

Moreover, with the strong emphasis on societal needs and sustainability RRI facilitates a new frame in the debate on STI, which we might call the **societal progress frame**. Under the societal progress frame, STI issues are discussed with regard to their potential **to tackle current grand challenges**, such

as environmental problems or health. With this frame becoming dominant in the public debate, STI issues consequently convey the promise of innovation contributing to a better life. The shift in the framing of STI issues eventually bring up two questions we will discuss in the following paragraphs: a) what are the circumstances under which framing issues may turn out to be barriers for engagement initiatives? b) how can we constructively deal with fundamental dissent represented by different worldviews and framings?

6.2   Framing conflicts

Engagement processes under RRI should be open to a wide variety of perspectives and issues. Neutral moderators should ensure that deliberation processes are not skewed towards particular perspectives or interests (Kuhlmann et al., 2016). Yet as we pointed out in the previous section, putting engagement under the header of RRI already implies a particular orientation towards ethical questions and societal benefits of STI. Moreover, **sponsors and organizers of formal engagement processes command specific framing power** that has to be scrutinized in the context of RRI. Even in the case of two-way deliberation we have to be aware that there is a power imbalance between the organisers of participatory activities and those taking part in a public dialogue event. By setting the agenda and inviting participants, **organisers implicitly introduce a certain framing** that guides the deliberation and determine, to a certain extent, how to deal with the issue at stake. As a consequence, public participatory exercises are easily framed in specific ways that might be useful to specific actors (Landeweerd et al., 2015, 14), even if neutrality and balance are actively pursued. Hence, the favouring of top-down engagement processes (see chapter 5.4) increasingly bears the **risk of neglecting alternative framings** on science-related issues (Sykes and Macnaghten, 2013, 100). Such alternative framings can be observed, for example, in the debate about synthetic biology.

Upstream dialogue events on this emerging technoscience often raise questions such as "how can synthetic biology contribute to the bio-economy?" or "can synthetic biology solve the antibiotics crisis?" (Bhattachary et al., 2010). These questions clearly put forward the societal progress frame with a focus on potential values and benefits emerging from the technology. Such a framing bears the risk of a pro-technology bias and therewith limits the room for contentious issues to emerge. Other actors such as critical **CSOs often fundamentally challenge this framing,** pointing to other neglected solutions of the societal problems addressed. They strongly raise risk aspects related to human health and the environment or point to ethically controversial aspects and moral concerns (Schmidt et al., 2009). Similarly in the British nanotechnology debate, almost all of the public dialogues were set up along a scientific perspective, which massively hyped the new technoscience but were soon found to be insufficient since the invited public favoured approaches different to those of the experts (Kurath and Gisler, 2009).

Neglecting the framing power of organizers and possible framing conflicts between different actor groups also poses procedural challenges for engagement initiatives. First, if the framing established is quite narrow (e.g. on societal benefits), the engagement initiative runs the **risk of missing important perspectives and value statements of participants**. While the communication may be two-way, the initial question may already determine the direction of the whole conversation, side-lining the actual concerns and values of participants. Second, with regard to the participation of CSOs, **the framing of an event plays a pivotal role in their willingness to participate** (see also chapter 3). Critical CSOs often refrain from participating in engagement activities that are, from their perspective, too enthusiastic and uncritical towards STI issues. To avoid or at least alleviate framing conflicts societal engagement under RRI therefore requires **reflexivity and transparency** also regarding the selection of issues, questions and information raised in engagement processes and, in some instances, needs to open the framing to inputs by stakeholders or the public.

The latter aspect was also examined during our PROSO expert workshop held in Vienna in May 2016 (Bauer et al., 2016). The invited experts emphasised that transparency and reflexivity is needed in order to **make the interests involved and the framing introduced more explicit**. By unveiling and reflecting on the inherent political biases in agenda-setting and perspectives represented, engagement processes might even reach the level of a second order reflexivity, as some experts noticed.

Societal engagement initiatives referring to RRI should be extremely aware of the potential pro-technology or pro-innovation bias that results from linking debates about particular technologies (such as nanotechnology or synthetic biology) with particular societal challenges (such as environmental problems or health). Transparency and reflexivity of framing does not only refer to the organizers of engagement activities but also to participants, particularly organized ones such as CSOs: when providing inputs and perspectives to research projects, CSOs should also present their normative and political background (Rainey and Goujon, 2012). To avoid an overt asymmetry built in by pre-framed deliberation processes, it might also be helpful **to explicitly deal with the issue of framing in the deliberation process**. The starting questions in such a kind of engagement might be: How do we want to talk about new technologies? Which kind of framing or which perspective do we prefer?

6.3   Dealing with dissent

The framing conflicts between different actors point to the issue of fundamentally differing worldviews and values that participants may hold. How far can and should engagement initiatives under the terms of RRI **strive for consensus among participants?** The questions whether and to what degree consensus in societal engagement is necessary, desirable and feasible under RRI, and how to

deal with fundamental or permanent dissent on societal needs and ethical aspects are still strongly debated. On the one hand, the **notion of co-responsibility conveys the idea of mutual understanding** and rational deliberation. Actors are expected to leave their traditional (mostly antagonistic, interest or world-view driven) roles and to open up for all relevant aspects associated with the entire innovation process (e.g. companies reflecting beyond immediate market competiveness and NGOs reflecting beyond risks) (von Schomberg, 2013). In this understanding participants are expected to come up with some kind of shared vision on ethically acceptable, societally desirable and sustainable innovation. While collaboration and consensus-seeking may be a vital and a genuine element of deliberation, the legitimacy of deliberation also depends on how the collision of stakes and interests is managed (van Oudheusden, 2014, 78). Many technology issues are deeply controversial today.

Some scholars warn against a consensual closure that may iron out differences and minority perspectives. Rather, they **call for accepting disagreement and dissent** (Kuhlmann et al., 2016, 17, van Oudheusden, 2014, 80). Different worldviews and rationalities should be made explicit as an issue in deliberation rather than be broken down to the lowest common denominator. With regard to the quality of deliberation, we should not understand communication as a marketing strategy; rather, we should consider it a method to take into account diverse perspectives or as an attempt to adopt a narrative perspective to express things that are sometimes not really explicable in rational terms. Following this line of a **'dissent approach'** we should also be able to bring 'uninvited' reasons, claims and needs to the fore – all the contradictions and points of critique that are societally valuable because they contribute to a competition (or battle) of arguments and visions and, therefore, to societal change, development and progress. This might be one of the main challenges for the promotion and organisation of societal engagement under the framework of RRI: to ensure that deliberation **processes are set-up in a way that enables controversies and disagreement,** as well as free and non-hierarchical reasoning in order to arrive at solutions and recommendations a majority of participants consider to be superior. Even though there is a need for channelling controversies and antagonistic positions towards productive deliberation we definitely have to deal with fundamental dissent on societal needs and ethical aspects of R&I. However, and with a view to the societal level, it is still an open question how to transform permanent dissent into political compromises the proponents can accept.

7. Why societal engagement? Functions and impacts

The presentation of the various engagement typologies in chapter 5.2 already pointed to different ways in which engagement is expected to influence research and innovation or vice versa, ranging from informing the public, to advising decision-making, to co-decision-making. In this chapter we focus in more detail on the key question "Which functions and impacts should societal engagement fulfil in research and innovation?"

7.1   Purposes and functions of societal engagement

The literature on public participation suggests **three basic arguments** associated with societal engagement: a normative, an instrumental and a substantial one (Fiorino, 1990). The **normative argument** assumes that technocratic decisions are incompatible with democratic ideals. It emphasizes the ethical norm that citizens have the right to take part in decisions that affect them. Furthermore, participation enables political equality and the empowerment of marginalized groups. The **instrumental argument** claims that effective lay participation leads to legitimate and thus more accepted results by resolving conflicts, building trust or finding compromises. Finally, the **substantial argument** emphasizes the improvement of the quality of decisions through participation. The public may bring valuable information like local knowledge, values, a deeper understanding, or creative thinking that helps solving a particular problem (Beierle and Cayford, 2002, 64). Bauer and Pregernig (2013) add a fourth argument, the **constructive** one. Participation serves the mobilisation of relevant actors, it facilitates communication and networking. From this perspective, participation results in desirable social interaction and dynamics such as mutual understanding, changes in attitudes and ultimately actions of involved participants rather than distant decision-makers.

In the RRI discourse, however, and even more in the practice of research and innovation governance the arguments and functions invoked for societal engagement still remain ambiguous. The principle of **responsiveness**, for instance, clearly suggests a **substantial function** for societal engagement in research and innovation governance. Engagement of the public and civil society organisations serves to **inform R&I processes** with the objective of influencing the trajectory of innovation according to societal needs and values. Societal engagement in this respect is tied to the hope that research and innovation become ethically acceptable, socially responsive and sustainable. This function is strongly reflected in the engagement types (see chapter 5.2) aiming at consultation, advice or even co-decision-making. The **expectations** of what societal engagement adds specifically to research and innovation governance are divers: They range from more diverse and **better knowledge** provided by the public, industry or societal organisations to insights into the **specific values and concerns** of citizens.

The Dutch NWO-MVI programme is a striking example for this approach where the aim to innovate responsibly takes centre stage and societal engagement is perceived as one means to appropriately reach this aim (Bauer et al., 2016). This 'substantial' perspective is also applied in participatory approaches such as "user innovation" (von Hippel, 2005) aiming at involving user or consumer as co-creators in innovation; striking examples are the open source software movement or crowd-funding initiatives. With regard to **emerging technologies** such as nanotechnology or synthetic biology engagement activities serve to bring people's concerns to the fore, to jointly deliberate and to explore and recognize different perspectives. The benefit for research funders and research organisations is that they are **informed early on about the public opinion and particular concerns** or even growing resistance to emerging technologies. As a consequence, decisions such as funding priorities might be adapted to reflect a variety of concerns and perspectives.

However, even though the 'substantial' function of participation is highly appreciated there is also an **increasing unease** with regard to current activities and practice (Horst and Michael, 2011, Felt and Fochler, 2010, Irwin et al., 2013). In particular, engagement activities involving the citizenry at large are suspected to aim at informing, educating or even **persuading the public of the benefits of research and innovation** rather than actually shaping R&I processes. Following this perspective, RRI may be suspected to prepare the market for innovations rather than shaping research and innovation along societal needs and values, or in other terms: public engagement serves **to shape the needs and values of society in accordance with the requirements of research and innovation**. In this context, even bottom-up initiatives may contribute to increase the acceptance and legitimacy of R&I. Patient organisations, for example, can mobilize media attention and provide societal support for certain lines of research that may be beneficial for particular patient groups but ethically contested (see Wehling et al., 2015).

Particularly in the academic debate, societal engagement under RRI is also promoted as an **intrinsic value, a normative goal in itself.** Following this perspective, engagement becomes an indispensable part of RRI, reflecting a paradigm shift in the science-society relations. The public or civil society are not primarily engaged with because of their knowledge, perspectives or values, but because their engagement in science and technology reflects a **democratic principle**. Research institutions and governments, in this view, have a moral responsibility to give citizens a genuine say in the direction and purpose of research and innovation, particularly those that are publicly funded (Sutcliffe, 2011, 9). However, as we already mentioned elsewhere, the **normative argument is ambiguous**.

The basic idea that all people affected should have a say and be involved in decision-making may be intuitively convincing or even normatively likeable. However, the ancient Greek model of deliberative democracy cannot be applied to modern mass societies; the idea of lay people dealing with nearly all

aspects of research and innovation may overburden them; and last but not least, the basic idea of fostering deliberation and maximizing the public's political influence by several engagement activities might clash with the model of representative democracy.

When actual impacts of societal engagement processes are reported, as in the project PE2020 (Rask et al., 2016), authors frequently refer to the **constructive argument**. In these instances, the focus is less on impacting 'decision-making' in a narrower sense and more on **collaboration, learning and empowering** through societal engagement (Landeweerd et al., 2015, 17). Engagement may result in organisational improvements, e.g. patient organisations coordinating communication and cooperation between research groups from different institutions and countries. Learning outcomes include a better understanding of common or opposing values and interests among the various actors. In this context, societal engagement may also "facilitate the political empowerment of youth and development of 'scientific citizenship', i.e. new understandings of the rights, duties and responsibilities of citizens in relation to science and technology" (Rask et al., 2016, 68).

Experience with societal engagement demonstrates that **often several rationales and functions are simultaneously invoked** (de Saille, 2015, 159, Rask et al., 2016, 4). As de Saille (2015, 159) points out EU documents on RRI "show alternately a research-oriented weighting towards ideas of democratic deliberative processes, ecological stewardship and specific problem solving […], and an innovation-oriented weighting towards 'challenges' as opportunities for creating, expanding and exploiting new markets". In the context of RRI the main tension remains between the substantial and instrumental rationales for societal engagement. While the rhetoric of scientists and policy-makers may suggest a substantial function when emphasizing the principle of responsiveness, empirical studies have frequently shown that **participatory processes are used in a paternalistic manner** to educate the public (Degelsegger and Torgersen, 2011). In this context, it is suspicious that the administrative discourse on RRI largely blinds out the possibility to halt research or innovation processes when met with widespread public resistance. In this regard, the **deficit model** seems to prevail and formal societal engagement initiatives serve instrumentally to gain the public's acceptance for research and innovation.

In conclusion, if the ideal of **responsive R&I** is to be taken seriously, engagement processes should have the chance to **influence decisions on trajectories, speed and design of research and innovation** processes. This does not mean that the substantial function is the only function to be pursued and to be fulfilled with societal engagement. However, with RRI emphasising the substantial function the question is raised how to better embed societal engagement in R&I institutions and processes.

7.2   Embedding societal engagement in innovation cultures

Most impacts of societal engagement reported by EU projects (e.g. Rask et al., 2016, 58) refer to process outcomes such as capacity building, communication or learning. The tangible influence on decisions in research and innovation, however, remains marginal (Landeweerd et al., 2015, 13, van Oudheusden, 2014 #1833, 80). The reasons are found in low awareness or even scepticism of scientists and political decision-makers towards engagement processes, a lack of quality of the results of engagement processes and an insufficient linkage between engagement processes and formal decision-making structures, processes and actors (Rask et al., 2016, 66, Owen et al., 2012, Andersson et al., 2015', 27). Societal engagement processes are frequently found to be detached from decision-making in science and policy, often resembling laboratory experiments or 'intramural' exercises that are used ad hoc rather than systematically (Rip, 2003). According to this critique a **key concern** for societal engagement under the terms of RRI is the **institutionalization of societal engagement** in a continuous way and its effective embedding in institutions and cultures in a) science and b) R&I governance (von Schomberg, 2013, Sykes and Macnaghten, 2013, 101, Owen et al., 2012).

The current **science system and culture** in Europe is largely perceived as a **main barrier** for the continuous and effective implementation of societal engagement (Bauer et al., 2016, Andersson et al., 2015', 16). Scientists lack training and skills to engage with the public and frequently do not see a value in engagement beyond dissemination activities (Bauer et al., 2016, Andersson et al., 2015', 16, Kuhn et al., 2014', 45-47). In contrast, the increasing call for engagement is often perceived as a **burden and hindrance to individual careers.** The current science system evaluates and rewards scientists along purely scientific criteria such as peer reviewed publications, lowering the motivations for scientists to invest in engagement activities. In this context, the call for engagement **just adds another requirement** for individual researchers (besides e.g. breakthrough research, interdisciplinary or transdisciplinary research, publications)**.** Moreover, the **demand to engage and align with societal needs** might also interfere with the deeply held principle of **scientific autonomy**. To successfully implement and **normalize societal engagement**, a variety of changes in scientific institutions and incentives structures are proposed by scholars and engagement practitioners (Bauer et al., 2016). Proposed changes at the institutional level focus particularly on (a) funding mechanisms, (b) the peer review process and (c) the university.

Funding: Funding agencies have a key role in fostering engagement activities in research. Through specifications in funding provisions they can define the role of engagement in publicly funded research. In this way funding agencies can deliberately create spaces of freedom from regular expectations (such as publications). In the **UK**, RCUK have introduced several funding instruments specifically targeted at engagement activities. For example, RCUK allow for **follow-up funding** (to

fund additional engagement activities researchers could not have been aware of at the start of the process) and **impact acceleration** (for impact generating activities which don't have to be nailed down in the time of application).

Review: The current peer review process is widely identified as one of the main obstacles for a successful implementation and normalization of engagement. Even if funding provisions demand strong societal engagement, reviewers often evaluate grant proposals along **scientific criteria only**. Hence, experts propose that reviewers should consider the extent and quality of engagement as well as possible societal impacts of research beyond academia. In the Netherlands, the NWO recently introduced a twofold **evaluation of scientific projects** with regard to scientific excellence as well as to **societal relevance**. A remaining challenge to the proposed changes in review practices are fundamental difficulties in measuring the **impact of societal engagement**.

University: The current education and career prospects of researchers at universities are perceived as another obstacle for societal engagement. The UK is as a frontrunner in offering support for the development of a science culture that embraces societal engagement. Since 2008 the RCs along with the UK HE (Higher Education) funding bodies[20] and the Wellcome Trust[21] have funded the **National Coordinating Centre for Public Engagement** (NCCPE)[22] that provides support and advice for universities and individual researchers across sectors. Additionally, the UK's Concordat for Engaging the Public with Research[23] explicitly lists a range of requirements and measures, including a **strategic commitment** to public engagement that is reflected in the institutions' mission statements, the recognition of engagement activities as part of **criteria for recruitment and promotion** and sufficient opportunities for training and practical support for researchers.

Besides changes in scientific institutions and cultures, impactful societal engagement is in need of **changes in political culture.** Current policy-making processes are characterized by a search for "high speed, cheap solutions and quantitative data" (Andersson et al., 2015', 17). Similar to the science culture, societal engagement exercises are perceived as time-consuming and of little value for policy-makers. Public dialogues are often ad hoc, a mere add-on and quite isolated from policy processes (Sykes and Macnaghten, 2013, 104). Hence scholars frequently demand that **engagement activities** should be linked to, or even **tied into, formal policy processes and governance institutions** (van Oudheusden, 2014, 80, Rask et al., 2016, 58). In the vision of von Schomberg (2013, 71) public debate "should have a moderating impact on 'Technology Push' and 'Policy Pull' of new technologies which

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[20] Specifically the Higher Education Funding Council for England (www.hefce.ac.uk), the Science & Technology Facilities Council Scotland (www.stfc.ac.uk), the Higher Education Funding Council for Wales (www.hefcw.ac.uk) and the Department for Education Northern Ireland (https://www.education-ni.gov.uk/)
[21] See https://wellcome.ac.uk/
[22] See www.publicengagement.ac.uk
[23] See http://www.rcuk.ac.uk/pe/Concordat/

sometime unavoidably may occur". In this regard the adoption of the RRI paradigm by the European Commission and its implementation in Horizon 2020 is considered an advantage compared to previous attempts to change science-society relations (van Oudheusden, 2014, 80). Other authors go further demanding a **profound paradigm shift** "in the way European politicians think about science and social relations and about growth economics and the purpose of innovation" (de Saille, 2015, 163). Otherwise there is the **risk that RRI is reduced to a vague set of instruments and concepts** to be addressed in research proposals without influencing the administrative-political discourse on innovation.

However, calling for effectively linking societal engagement activities with decision-making processes is not enough. We have to take account of **distinct political cultures and contexts in Europe.** European member states have made different experiences with engagement in R&I so far, so they can be expected to interpret and implement RRI in distinct ways. The MASIS report (Mejlgaard et al., 2012) identified three groups of science communication cultures in Europe, a) **'consolidated'** (Scandinavian countries and the larger Western European countries), b) **'developing'** (smaller countries and Eastern European countries) and c) **'fragile'** (Eastern European countries, mostly the South East part of Eastern Europe). Among these groups the degree of public engagement and institutional support, respectively, differs significantly. It is therefore not surprising that RRI is most pronounced and developed in countries with a "consolidated" science communication culture including the UK and the Netherlands. In this regard the fate of RRI in the groups considered to be 'developing' and 'fragile' remains ambiguous. The call for RRI may facilitate a stronger engagement culture or RRI may be hindered by a lack of institutional support structure and non-inclusive political cultures (Mejlgaard et al., 2012', 82). To foster the former and avoid the latter cross-country learning and EU support is needed (Kuhn et al., 2014', 44).

7.3   The legitimacy of societal engagement

Promoting a stronger embedding of societal engagement in formal policy institutions and processes necessarily touches upon the question of legitimacy. This question has frequently been taken up by scholars from the field of deliberative democracy and participatory practice (Newig and Kvarda, 2012). In **representative democracies** parliamentarians are elected as the representatives of citizens, channelling their ideological views and values. **Participants** invited to engage in particular events, in contrast, are **neither elected** (and, therewith, accountable) **nor representative** for the whole society (even if socio-demographic representation is pursued). Therefore, participatory initiatives such consensus conferences have traditionally been assigned an advisory function with the decision-making power remaining in formal institutions that can be hold accountable. Do RRI change this understanding? Indeed, the **RRI's ambition to move towards co-decision-making**, the principle of

responsiveness and the notion of co-responsibility may contribute to a **new understanding** of how representative democracy could better meet the requirements of deliberative approaches.

With regard to different models of democracy, there is a close relationship between RRI and deliberative democracy as developed by scholars such as Dryzek, Fishkin or Habermas. Therefore, RRI invites us to scrutinise how to effectively 'democratise' innovation, i.e. **how to collectively shape innovation within the framework of representative democracy**. This is anything but an easy task and might exceed the limits of the current RRI discourse. There are many open questions associated with the legitimacy issue, and in the following we will address just a few.

The first question is related to the legitimacy of unpopular (or even irrational) decisions taken by the invited participants. What if public engagement events reveal that current trajectories of research are not in line with societal needs and values? **What if technologies** or economically promising ideas for innovation **are rejected early on?** The strong focus on responsiveness in RRI may suggest that scientific and political decision-makers should act in accordance with the participants' view and allow for "responsible stagnation" (Guston, 2015) or 'exnovation'. Against this background, RRI implicitly favours a substantial or **normative understanding of legitimacy**. In contrast, according to a **formal understanding of legitimacy** decisions could be taken against public concerns and values, although they should be openly communicated and justified. Sutcliffe (2011), for instance, argues that "sometimes difficult and unpopular decisions have to be taken" if public engagement goes against "what many other constituencies believe is vital to growth and competitiveness". While the formal approach may well fit with the previously described advisory function of participation, the question remains whether the principle of responsiveness is met in this approach and, more generally, should be included in the definition of legitimacy.

A second question immediately results from the **RRI's call for responsiveness**. If RRI requires a capacity to change direction in response to public values and concerns – **what competences and expertise on part of citizens and stakeholders are required** to legitimately challenge the innovation's shape and direction? Often, the legitimacy of societal engagement may be questioned by established actors in science and governance for epistemic or political reasons. The legitimacy of engagement in research is frequently challenged by doubts in the competences of societal actors, including citizens, to meaningfully comment on scientific debates or even contribute to research. With regards to politics, the legitimacy of engagement processes is threatened by the **suspicion** that organized societal actors such **CSOs take a 'partisan stance'** rather than representing 'the common interest'. These actors, it is sometimes assumed, are led by one-sided and irrational views on science and technology that are overly concerned with risk.

However, the notion of **'co-responsibility'** may not necessarily raise enthusiasm on part of various societal actors that are now called to formally engage with R&I. Rather, it may also provoke defensive reactions since under this notion, **societal actors automatically share responsibility** for the R&I process and related outcomes when they engage in R&I activities. However, a simple attribution of responsibility may seem inappropriate in the light of the complex actor constellations in modern science, technology development and innovation (Grunwald, 2004). Against this background, societal engagement might lose legitimacy since these **engagement events are burdened with particular obligations**, i.e. participants are expected to apply a balanced view, to accept predetermined framings or to reach consensus. In the end, with regard to its normative claim, the character of engagement might have thoroughly changed: While public engagement originally was considered to effectively contribute to encouraging a **„rights-based citizenship",** today, under the header of RRI there might be a strong emphasis on **civic responsibilities** (Eaton et al., 2014).Therefore, in a critical view, "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" (Felt and Fochler, 2008). From this perspective participation might turn out to be a **"new tyranny"** (Cooke and Kothari, 2001): Citizens are called to constructively contribute to particular research projects and debates; they are called to exchange arguments, to take on a broader and more balanced view and to reach consensus whenever possible. As a result, citizens are ubiquitously expected to be interested, to be informed, to be engaged, **to be active**. From this point of view, societal engagement turns out to be a central element of an 'activation regime' or, in other words, a pacemaker for the 'active society' (Boltanski and Chiapello, 2005).

8. Conclusion

Responsible Research and Innovation (RRI) has rapidly gained prominence as a comprehensive innovation governance approach in the European Union from 2011/12 onwards. Nevertheless, RRI remains an ill-defined and highly contested concept, at the same time considered to forcefully strengthen or to effectively problematize the 'growth-and-welfare' agenda (chapter 1.2). From a theoretical point of view, RRI is related to various governance concepts developed by STS and TA scholars. **What is new about RRI?**

First of all, general emphasis is put on **the continuous engagement of societal actors** in research and innovation. The institutionalization of societal engagement is a key concern of RRI (chapter 4.3). Participation should not rely exclusively on one-time events. Furthermore, RRI puts strong emphasis on **two-way communication** and new dialogic formats to enable deep deliberation (chapter 5.3). Otherwise, RRI may be replaced by traditional approaches aiming at exclusively educating the public. To effectively shape innovation societal engagement has to set in early-on. That means RRI pushes societal engagement **to move upstream** (chapter 4.2).

Second, RRI implies an **increasing importance of ethics** in technology issues (chapter 1.2). Ethics is referred to as a means of shaping innovation responsibly and proactively, as a pivotal **design element**; ethics is not considered anymore to be an ex post evaluation tool (chapter 1.3). Taking ethics seriously means to ensure that innovation is closely related to societal values and expectations.

Third, RRI aims to **restructure the way research and innovation is performed**. With a view to this aim, five dimensions have been identified as crucial: anticipation, societal engagement, reflexivity, responsiveness, openness & transparency (chapter 1.2).

Due to the RRI's strong emphasis on taking a broad variety of values and worldviews into account there might arise a certain **tension between the political ideals of pluralism and consensus.** First, the RRI's ideal of pluralism might pose a problem since interest groups representing such diversity do not always exist (chapter 3.2). Second, due to the heterogeneity of societal actors involved **consensus is not very likely** even though consensus still might be considered the gold standard of justification. Rather, we should expect and accept disagreement and dissent (chapter 1.3). Different worldviews and rationalities should be made explicit rather than be broken down to the lowest common denominator. Following this line of a **'dissent approach'** we should also be able to bring 'uninvited' reasons, claims and needs to the fore (chapter 6.3).

The latter aspect is even more important since the focus of RRI lies on **invited participation** (chapter 5.4). The benefit of formal, organized processes is that they are more predictable and controllable. However, invited participation brings a number of **challenges for RRI**. First, formal deliberation

processes tend to **attract certain participants,** often those with a higher education. This entails the danger of conflicts being marginalized or even neglected and of ignoring minority perspectives. Second, **deliberation processes are pre-determined** to a certain extent since the issue-framing and key questions have to be defined by the organisers in advance (chapter 6.2). This implies the risk of neglecting alternative framings on science-related issues. To avoid or at least alleviate framing conflicts societal engagement under RRI therefore requires reflexivity and transparency with regard to the selection of issues and the information provided. It might also be advisable **to explicitly deal with the issue of framing in the deliberation process**. Third, participants are expected to adhere to the requirements of deliberation: they have to listen to others, mobilize reasonable arguments for their opinion and be open to contextualize and relativize their opinion. Involved actors should not stick to their habitual roles and interests in technology assessment but should take a 'holistic' view and refer to common goods and values ('**balanced view**', chapter 3.2). In short, formal engagement processes expect, to a certain extent, **'rational' participants.** As a consequence, bottom-up participation might be considered to be rather emotional and irrational and ultimately may appear to be not justifiable. Against this background we suggest to go beyond formal engagement processes and **to stronger include uninvited or bottom-up approaches** into the debate on societal engagement under RRI (chapter 5.4).

According to the ideal of engagement moving **upstream** societal actors should be engaged as early as possible in debates about research areas and technological developments and ideally remain involved continuously throughout the whole research and innovation process. The question is whether **engagement can be too early** and what mechanisms and methods could be applied to deliberate early on **without enforcing a singular vision of a technology** upon participants that is far from being realized (chapter 4.4). The latter aspect again points to the importance of reflecting the framing issue at an early stage.

Apart from the ongoing trend towards invited participation and upstream engagement, there are several other **hurdles to the successful institutionalisation** and normalization of societal engagement. With regard to different societal subsystems, the following hurdles were identified (chapter 7.2):

- **Political system:** Hypothetically, the more a political system relies on representation and delegated power, the less inclined citizens will be to become engaged. It is characteristic for representative democracies to discharge responsibilities, implying that the delegation of responsibilities to particular actors (elected politicians) or organisations (e.g. CSOs) might be a legitimate strategy.

- **Science system:** Researches are evaluated and rewarded along purely scientific criteria such as peer reviewed publications. To normalize societal engagement institutional changes are necessary with regard to funding mechanisms, the peer review process and the university's role in promoting outreach activities.

- **CSOs:** Participation in EU policy processes and EU projects requires a high degree of professionalization by CSOs; the CSOs' willingness to participate (even if their organizational interests collide with the interest of event organizers), and a high degree of trust to avoid, from a CSO's perspective, the risk of being used as a mere source of legitimation.

- **Emerging technologies:** RRI primarily addresses new and emerging technologies laying an emphasis on engagement moving upstream. This raises the question whether and when engagement may be too early. Participatory events usually are more interesting to the attendants if the issue to be debated is close to their everyday life. From this perspective, with regard to the organization of engagement events it may be advisable to introduce a framing suitable to connect innovation issues with people's lifeworld (chapter 4.2).

Lastly, RRI strongly promotes a **substantial function** for engagement processes (chapter 7.1). If R&I are to become responsive to societal needs and values then **engagement has to get the chance to influence ongoing processes** (including the option to halt research and innovation). Currently however, societal engagement events often remain an add-on, often too far away from relevant institutions, actors and processes. Embedding societal engagement within existing science and governance structures along with a cultural shift in these systems is therefore a key demand posed by (an ambitious interpretation) of RRI. Additionally, the question of legitimacy of engagement processes and results is still to be clarified in different contexts.

Currently, RRI is one of the most visible, influential and disputed governance approaches in R&I issues. Under the header of RRI once again the old-established debate revives dealing with the question of how to foster, organize and implement societal engagement processes (chapter 2.1). The RRI discourse is at **risk of promoting ubiquitous participation**. However, the (normatively likeable) idea of lay people being involved in all stages and aspects of research and innovation might overstress the very idea and even render participation mandatory ('civic responsibility', chapter 7.3). Often enough the potential **participants may be unable to cope** with the challenge of balancing chances and risks of emerging technologies that are far from concrete applications and peoples' daily experiences. From this perspective, the RRI discourse should pay attention to the risk of an **engagement overdose**.

To conclude, this report aimed at marking out the main pillars for societal engagement under the terms of RRI. It provides key debates, positions and questions; however, it does not serve to evaluate single engagement processes in terms of organization, procedures, outcomes and impacts. Societal engagement changes according to the intended tasks at different stages of R&I processes. How engagement is effectively organized or used strongly depends on the context, i.e. the concrete issue, the purpose, the respective R&I decisions and actors as well as the institutional and political context.

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