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Multiple futures for society, research, and innovation in the European Union: jumping to 2038

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ABSTRACT

We contribute to the *Responsible Research and Innovation* (RRI) literature in two ways: (i) we consider how societal aspects are taken into account in research and innovation (R&I) activities in four fundamentally different scenarios, as opposed to analysing current practices; and (ii) put the emphasis on the political conditions of the interactions among the actors, as opposed to focussing on RRI principles and instruments. In the *Kingdom of RRI* citizens participate directly in decision-making processes; *Fortress Europe* depicts a libertarian system; *Failed Democracy* is a populist regime; while *Benevolent Green Eurocrats* describes a technocratically coordinated strong state. The scenarios offer novel insights into the nature and repercussions of possible policy problems, that is, efficacy; efficiency; legitimacy of R&I activities; societal involvement; equity; and freedom of research. Meaningful interactions between lay people and professional actors in an innovation system can be safeguarded even in the harshest ideological and political framework.

1. Introduction

The relationships between lay people and professional actors in research, technological development, and innovation (RTDI) activities are complex, given their diverse backgrounds – ways of thinking, values, norms – and aspirations. Furthermore, these interactions are strongly influenced by the external conditions for RTDI, set by other actors in a given political and economic system. How scientific results and innovations are perceived by society, and how societal aspects guide RTDI activities, are crucial properties of an innovation system. These features, together with other factors, influence the behaviour of RTDI actors, and thus the performance of the system. Hence, the interactions between lay people and professional actors have major economic, societal, and

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environmental repercussions. To foster these interactions, the EU (among other policy-makers) has launched several initiatives in the last two decades. Often, the main purpose was to anticipate the impacts of technologies on human beings and the planet, as well as to promote the societal acceptance of new technologies. This technology-centred approach has gradually been complemented by novel approaches which stress the needs and expectations of society as principal considerations guiding RTDI activities. The most important examples of this major turn include the initiatives related to *Responsible Research and Innovation* (RRI, von Schomberg 2012), introduced as a cross-cutting issue to the EU RTD Framework Programme, Horizon 2020 (2014–2020) and *Mission-Oriented Policies* (Mazzucato 2018), introduced by way of five missions into the current EU RTD Framework Programme, Horizon Europe.

Yet, RRI has almost disappeared from the policy agenda of the EU. It is no longer a cross-cutting issue in Horizon Europe, and the programme line of *Science with and for Society (SwafS),* which previously supported building a knowledge base for RRI, is not continued in Horizon Europe. The sustainability and engagement agendas of the new European Commission's Green Deal policies, together with the mission-orientation of Horizon Europe, could however open novel avenues for societally engaged RTDI activities. These, somewhat contradictory, developments strongly suggest that the ways in which societal aspects would be considered in RTDI activities in the EU is far from predictable. The trajectory can evolve in radically different directions. These possible futures, however, are not considered explicitly and systematically in the literature. Further, the various factors that are likely to shape the interactions between lay people and professional RTDI actors are not analysed, either.[1]

As a first attempt to fill these two gaps, we consider *different futures for society, research, and innovation in the EU by devising four scenarios*, focussing on the broader ideological and political framework conditions. This approach offers novel insights into the factors that influence the possibilities for, and the nature of, societally engaged RTDI. We postulate that the broad political conditions would determine to a substantial extent what type of RTDI activities are promoted, and thus what type of interactions can possibly emerge between lay people and professional RTDI actors. Our scenarios are determined by possible fundamental changes in political cultures and prevalent ideological stances that are endorsed through national and EU elections. In other words, we put the emphasis on major opportunities, threats, and challenges for democracy in the EU countries: the scenarios highlight the likely repercussions of decisions taken today and throughout the coming years. The European Research Area (ERA) of the chosen timeframe of 2038 might look very different depending on how national and EU level policies shape it, and among others, how Horizon Europe and Framework Programme (FP) 10 are devised and implemented. Hence, our scenarios reveal the crucial elements of the conditions under which lay people and professional RTDI actors can interact.

With these scenarios, we invite stakeholders – lay people, researchers, business people, and policy-makers – to 'think outside the box' when discussing the key properties of future states of affairs. The scenarios are 'pure (or: ideal) types' in the Weberian sense (Weber 1947). The actual future will undoubtedly be different, more 'colourful' than these somewhat simplified, black-and-white snapshots. None of the four scenarios describe an 'optimal' future in any sense. Further, we do not offer a so-called baseline (or reference) scenario as a basis for predicting *the* future by extrapolating the current

and likely future trends. We follow a different approach: our scenarios are snapshots of *possible futures*, without describing the path leading to them. These scenarios are driven by key factors identified in the relevant literature and at a workshop. Thus, we do not consider a number of otherwise crucial driving forces: the economic and geopolitical factors; possible major crises and natural disasters that might shape the global economy; the balance of power among the major global players, and thus the overall standing of the EU vis-à-vis the other political and economic powers. Considering these factors, in addition, would be a relevant, but different exercise. It could be combined with our efforts at a later stage: then the scenarios should be devised in a multi-level structure.[2]

Our analysis rests on *two conceptual pillars*. The first one is the systems approach to innovation, which, in turn, is derived from evolutionary economics of innovation (Fagerberg, Martin, and Andersen 2013; Fagerberg, Mowery, and Nelson 2005; Hall and Rosenberg 2010; Metcalfe 1998; Nelson 1995). Interactions among the RTDI actors is a key notion of this approach. RRI is a specific form of this key notion, i.e. a historically situated policy intervention from the EU, aimed at lowering the barriers to interaction among lay people and professional RTDI actors (Section 2). The second pillar is the idea that the future is not already given 'out there', hence it can be shaped by today's actions (Acheson et al. 2002). This principle is explicated in Section 3, where the factors considered and the steps taken when devising our scenarios are also described. Then we present our four scenarios with a time horizon of 2038 (Section 4) and discuss their implications (Section 5) by focussing on RRI as a vision of societally engaged RTDI and asking how 'meaningful' societal engagement in RTDI can be safeguarded in these radically different external conditions.

We conclude by summarising the theoretical and methodological implications of our forward-looking analysis. Most importantly, our work is aimed at contributing to a discussion about potential transformative changes. We neither intend, however, to forecast which of these changes will occur, nor to assign probabilities to these changes. Instead, our analysis sheds light on the opportunities for interactions among lay people and professional RTDI actors. Clearly, these need to be further discussed by stakeholders. Our modest aim is to highlight those issues that need the attention of actors today in order to take actions that would shape our future in a jointly accepted direction.

2. Conceptual framework

2.1. Interactions among actors in innovation systems

The systems of innovation approach identifies the main elements, structure, boundaries, and functions of an innovation system (Chaminade, Lundvall, and Haneef 2018; Edquist 1997; Freeman 1995; Lundvall 1992, 2007; Lundvall et al. 2002; Nelson 1993, 2002; Smith 2000). It stresses the role of a broad range of actors, emphasises their interactions, and the interplay of all the major components of a system. Hence, a key task for us is to consider all sorts of possible linkages and *interactions among lay people and professional RTDI actors* in an innovation system. Professional RTDI actors include researchers (working for public, private, or private non-profit research organisations), staff members of firms who can significantly shape innovation processes, as well as STI policy-makers

and funders (at regional, national or supranational levels). Their way of thinking, aspirations, ambitions, and overall approach to RTDI activities, and especially their capabilities and opportunities to steer these activities, are markedly different compared to those of lay people. These differences are crucial when analysing the interactions among the actors in an innovation system.

These interactions might have very different objectives ranging from popularisation of science and technology, to assessing emerging technologies, e.g. their likely societal, economic, and environmental impacts, to discussing or jointly setting research agendas, to conducting and/or evaluating RTDI projects in collaboration, to deliberating on policy tools aimed at promoting RTDI activities, or to deciding on public funds to support RTDI activities.

Achieving these objectives would necessitate different types and forms of interactions, including one-way communications, genuine dialogues or even collaboration among partners mobilising their respective kinds of expertise, experience, aspirations, values and norms, worldviews, and ways of thinking. Furthermore, these interactions can be regular or *ad hoc*; formal or informal; open or closed (in terms of participation); systemic or sporadic; and transparent or opaque. Finally, they can be genuine and substantive vs. tokenistic, even deceptive; inclusive and responsive vs. condescending and patronising; they might develop vs. neglect citizens' capacities; and they may rely or not on co-creation of knowledge with lay people.

The innovation systems approach does not stress the role of lay people, except for the role of users in initiating, developing, and testing innovations in certain fields. Additionally, it has not provided conceptual underpinnings as to how RTDI activities can be aligned with societal needs and concerns (Daimer, Hufnagl, and Warnke 2012; Weber and Rohracher 2012). More recent contributions, however, address how innovation systems are responding to societal challenges, developing, and adopting new research and innovation practices, and engaging new actors (Fagerberg 2018; Lindner et al. 2016; Mazzucato 2018; Schot and Edward Steinmueller 2018; Warnke et al. 2016; Weber and Truffer 2017).

The innovation systems approach stresses the diversity of types, forms, and sources of knowledge that are required for successful innovation processes, but generated and possessed by various types of actors. Collaboration among them, therefore, is key. Hence, we can also infer that more intense and deeper interactions among lay people and professional RTDI actors are likely to improve the performance of innovation systems.

2.2. Responsible Research and Innovation (RRI), its normative framework and link to democratic values

The notion of responsible research and innovation (RRI) has been introduced by von Schomberg (2012, 50):

> 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).

As van Oudheusden (2014) shows, this and other definitions of RRI have been introduced as a policy approach for addressing certain pitfalls of science-society relations. He further argues that the framing of these pitfalls depends on the values of the observers, that is, their fundamental view on the socio-technical order. Thus, we agree with him (and other authors) in his observation that RRI is a normative concept.

There are different understandings of RRI. At least two frameworks are discussed in the literature. Often, they are linked to the differentiation between RRI as a policy approach presented by the European Commission and *Responsible Innovation* (RI) as a broader concept discussed in the (mainly) academic literature.

Various authors have identified the normative framework of RRI as the pursuit of economic growth and an overall alignment to a liberal value system (Long and Blok 2017; Strand 2019; Wong 2016). In this logic, the primary purpose of fostering RRI would be to support a growing trust in scientific and technological development. The operationalisation of RRI by the European Commission using five key concepts – namely ethics assessments, gender equality aspects in team composition and research content, open access to data and results, science education activities and public engagement – has often been interpreted as a means for legitimising new technologies (and ultimately economic growth). Some authors have criticised this one-sided and potentially inappropriate use of RRI, when the concept is reduced to providing legitimacy for science programmes, instead of establishing mutual linkages and mechanisms, which would allow RTDI actors to become responsive to the needs and expectations of society (Blok and Lemmens 2015; López and Lunau 2012).

This criticism stems from a broader scholarly debate about RRI and the governance of RTDI activities in more general (Macnaghten 2020; Owen and Pansera 2019; Stilgoe, Owen, and Macnaghten 2013; van Oudheusden 2014). For example, Owen and Pansera (2019) have used the term *Responsible Innovation* to refer to the broader vision of public organisations and companies acting responsibly and citizens being critically engaged in innovation activities in a way that allows them [us] to take responsibility for our future. This vision of RI expresses a clear expectation concerning the potential benefits of RI, i.e. an anticipatory debate about societally desired directions of research and innovation, and a critical reflection on potential negative side-effects of new technologies. In this respect, RI builds on the traditions of technology assessment or anticipatory governance.

Without discussing further details of the rich analysis that exists, we conclude that these contributions aim at enacting RI as a democratic governance of innovation. They all 'rest on a vision of true democracy as a deliberative, cooperative, and broad way of dealing with social conflicts, and the conviction that social learning is morally superior to political bargaining' (van Oudheusden 2014, 72). Hence, in this vision of RI, anticipation, deliberation, conflict resolution, and inclusion are democratic qualities inherent to RI.

In their discussion of RRI in an age of strengthening populism, Long and Blok (2017) claim that the lack of an (R)RI practice based on such a vision can contribute to the rise of populism. When potential negative consequences of technological changes are not adequately addressed, they can create feelings and actual situations of being left behind in large parts of society. They claim that 'RRI needs to play a role in ensuring that dominant voices, such as the neoliberal policy agenda, do not restrict debate nor the space for alternative approaches' (68).

This is just one example where RRI proponents tend to present the approach as a politically neutral tool, while in fact, the realisation of (R)RI as a tool for the democratic governance of RTDI requires that the actors share its inherent value basis of a deliberative democracy. This observation is an important starting point for our analysis: when exploring the future potential of the RRI concept, we acknowledge that RRI is not neutral to the context in which it is being embedded. In our scenario work, we present multiple futures of research, innovation, and society as a first step before discussing how RRI might evolve in each of them.

3. Building scenarios with the ScenarioSprint approach

The underlying idea of forward-looking activities is that the future is not given 'out there', and thus, cannot be predicted, but can be shaped by today's actions. Forward-looking activities consider different futures in order to prepare for possible, feasible or desirable future developments, shape futures or strategically accomplish one of the options anticipated. Exploring different (possible) futures by building scenarios can assist actors (businesses, researchers, policy-makers, citizens) in considering the implications of different future states of affairs, and also in taking actions today in order to either increase the likelihood of a desirable future, or avoid – or at least divert, slow down – undesirable trends.

Scenarios are frequently used for describing different paths into the future or different state of affairs in the future. There is a wide variety of scenario approaches, ranging from purely intuitive to very systematic and software-based methods (Bishop, Hines, and Collins 2007; Börjeson et al. 2006; Bradfield et al. 2005; Godet 2000; Kosow and Gaßner 2008; van Notten et al. 2003). The Fraunhofer Institute for Systems and Innovation Research (ISI) has developed specific, systematic approaches based on a combination of workshops, consistency or impact matrix, and scenario writing (Bartsch 2015, 2016; Erdmann and Schirrmeister 2016; Moller et al. 2019; Opiela et al. 2018; Warnke et al. 2018) and has shortened the procedure to a 'ScenarioSprint', for scenario processes under resource (or time) constraints. The ScenarioSprint method is an abridged version of a morphological scenario approach, based on Zwicky (1969). It has been applied for various business partners and foundations (Bertelsmann Stiftung, Welthungerhilfe). Current applications include the EU projects TRIGGER (Renda 2020) or Foresight on Demand PostCovid-19 scenarios.

The scenarios presented in this article are the result of a multi-method process relying on a thorough literature review, an analysis of environmental factors, observable trends, and upcoming developments, as well as a scenario workshop. The scenarios were developed under the umbrella of the SwafS-funded project NewHoRRIzon by project partners and participants of a so-called Social Lab, that is, a social experiment format where complex societal challenges related to RRI were addressed.

Our scenarios are *environmental scenarios*, that is, future worlds we might live in. They describe potential, overall developments of political systems, the economy, society, as well as RTDI practices in the EU. We identified factors that (i) can be influenced (at least to a certain extent) by various actions taken today and (ii) frame future RTDI systems in the EU, and thus the possibilities they create for interactions among lay people and professional RTDI actors. Clearly, there are important exogenous

factors influencing our futures, such as the structure, operation and performance of the world economy, trade patterns, international relations, or crises like a pandemic or a major natural disaster. We did not consider these exogenous factors and wild cards (Markley 2011; Steinmüller and Steinmüller 2004) when devising our scenarios as these cannot be influenced by decisions and actions taken today.

The timeframe for the scenarios is 2038 because the impacts of the two forthcoming RTD FPs – Horizon Europe (2021–2027) and FP 10 (2028–2034) – will be clearly visible by then. Also, the timeframe of about 20 years allows us to explore not only incremental, but transformative changes as well. Our scenarios focus on the EU. Although there might be major shifts of power between actors around the globe, we assume that the world of 2038 is still multipolar and there is no war in Europe.

These scenarios describe possible, but not necessarily desirable futures. They are consistent in their own logic, and thus plausible. Their plausibility was checked in steps 5 and 6 of the scenario building process (see below). Scenarios are never predictions, they are hypothetical constructs, highlighting the features that are deemed relevant by the participants who have built them.

In morphological scenarios like ours, factors are identified and different assumptions about how they might unfold (projections, alternative paths to the future) are discussed in group work. The factors are then assessed in a specific impact matrix (in an abridged way in ScenarioSprint) and the 'key factor' (in our case *ideological stances and political practices*) serves as the starting point for logically combining the assumptions into different scenario paths. The raw scenarios are described during the workshop. The scenarios are consistent in themselves, irrespective of their desirability, and are built in eight steps.[3]

3.1. Step 1: Preparation: system definition, horizon scanning

As a preparation, developments were identified in a systematic but open-minded way. The so-called STEEPV structure (Loveridge 1996; http://www.foresightguide.com/horizon-scanning-frameworks/) supports a systematic search for factors that characterise the system to be analysed. It was applied to consider all relevant domains at the beginning of the process, that is, science, technology, economy, ecology, policy, and values. We screened existing databases, the internet, and the relevant literature and classified the findings according to STEEPV to be adequately comprehensive.

3.2. Step 2: Clustering of factors, first description of factors

The most important findings of step 1 were reduced to those considered most relevant for the future of RRI in the EU, and clustered at an internal workshop of the scenario preparation team. From these clusters, candidate 'factors' were summed up and briefly described by using a template. The starting list of candidate factors was as follows:

- Embeddedness of RRI in RTDI programmes and networks etc.
- RRI community
- Prevalent ideologies
- The EU's global role and competitive dynamics
- Sustainability policies

- Social movements
- Production and consumption
- Structural changes in the EU (societies and cities)
- Meaning of technological developments for human life
- Diffusion of innovations
- Political integration of the EU/ solidarity among member states
- Trust in policy and governments
- Role of researchers
- Power and control in RTDI
- Citizens' capacity to become involved in RTDI
- Facilitators of innovation

3.3. Step 3: Workshop discussion on factors

At the workshop with fifteen participants from five EU countries, held in November 2019 in Karlsruhe, the sixteen candidate factors were discussed in more detail: they were reframed, reformulated, merged or separated, and the relevant ones were selected (by giving points for relevance). This step resulted in a final list of nine factors (Table 1), that is, a reduced list for further discussions. These were used as the 'skeleton' for the scenarios. Hence, some of the original sixteen factors were not used for structuring the scenarios, but could be used at a later stage to add further elements to the scenarios.

3.4. Step 4: Assumptions about the future developments for each factor

Next, the workshop participants were split into four groups to write three to five assumptions about the future developments for each factor. The future developments were supposed to be possible, different, and plausible or consistent in themselves. It was intentionally not considered whether they would be desirable or undesirable, but importantly they needed to be substantially different from each other.

3.5. Step 5: Assessing the factors: the impact matrix

The results of each group were presented in the plenary to all participants of the workshop, who were then again split into small groups to evaluate the influence of each factor on the other nine ones by giving scores ranging from 0 (no influence) to 2 (strong influence). The evaluations of all three groups were summed up in a matrix (Table 1).

3.6. Step 6: Plenary for scenario paths

The following step began with the factor that had the highest influence score: *Ideological stances and political practices*, followed by the second: *Citizen capacity to become involved in R&I* and so on. The factors, and their three or four projections from step 4, were arranged accordingly on a wall. Starting with the first future projection of the first factor, the group systematically selected the projections and assumptions that fit to the first path. The procedure was repeated to build up the second path and so on.

Table 1. Factor influence matrix

	Factor name / Influence 0 = no, 1 = weak, 2 = strong	Citizen capacity to become involved in R&I	Role of researchers	Power and control in R&D	Ideological stances and political practices	Innovation for what	Social movements	RRI Community	Meaning of technological developments for human life	Reaction to ecological crises	Total score
1	Citizen capacity to become involved in R&I				1	2	1	2	2	2	**10**
2	Role of researchers				1	2	0	2	2	2	9
3	Power and control in R&D				1.5	2	0	2	2	2	9.5
4	Ideological stances and political practices	2	2	2				2	2	2	**12**
5	Innovation for what	2	1	2				1	1	1	8
6	Social movements	2	1	2				1	1	2	9
7	RRI Community	2	2	1	0.5	1.5	1				9
8	Meaning of technological developments for human life	1	1	2	2	2	0				8
9	Reaction to ecological crises	2	2	2	1	1.5	0.5				9

Source: Own compilation.

3.7. Step 7: Raw scenario descriptions in small groups

In two working groups, the four scenario paths were devised and described in more detail. The only instruction was to follow the path and describe it in a creative way. There was the possibility to bring back other information or even factors that were sorted out before (in step 3), but it was not allowed to include projections from the other paths. Each group had to describe two of the scenarios in a raw format using text, music or pictures. The scenarios kept their individual colour code and a fitting title was deliberated and added. The four scenarios were presented at a plenary session for discussion.

3.8. Step 8: Detailing scenario descriptions and illustration

After the workshop, the organising group transcribed the scenarios, drafted texts, and sent them to the workshop participants for further comments, which were taken into account when finalising the scenarios. A professional illustrator added pictures.[4]

4. Possible futures: four scenarios

The four scenarios – or future worlds – in which RRI might unfold or be hampered around twenty years from today, pose extreme and different developments of society and politics in the EU. In turn, these possible developments imply that the fundamental framings of what scientific results and innovation mean for society appear to be quite different. Although these are extreme developments, we consider them to be plausible and *possible*. It is up to the various observers' and actors' perspectives whether a certain development is positive or negative.

4.1. The Kingdom of RRI

EU leaders have, for a long time, failed to adequately respond to major crises such as demographic change, refugee crises, revival of populist ideology, or climate change. Chronic negligence and inefficient governments during times of hardship urged paradigmatic political change. Starting in Scandinavia and spreading to Central Europe and some other countries, established green parties or new political movements were able to present a new generation of politicians to voters. In a series of game-changing elections, the new governments pursued agendas directed towards appealing and bold societal goals (e.g. carbon-neutral mobility for all) as the key to societal wellbeing.

　　Now, response to crises (e.g. ecological crisis) is systematic and strategic, with a proactive approach. Globally, the EU is pioneering its way of responding to grand societal challenges. Yet, it does not aspire to assume global leadership. The manifold benefits of this mission- and responsibility-oriented policy approach has become the major narrative and rationale, informing many other areas of life. Putting society's wellbeing first enables the exploitation of synergies and untapped potentials. It brings healing by rescuing society, economy, and RTDI from the past 'paralysis' and develops a strong belief in a better future.

　　The positive spiral of benefits is an immense source of innovation capacity. In this sense, innovation is socially motivated and challenge-driven. Knowledge is co-created; innovation processes are co-designed.

　　Participative processes are highly prevalent. Inclusive, open structures enable not only participation, but provide empowerment and are a source of appreciation and societal satisfaction. EU societies flourish and celebrate life, strong social movements promote a shared vision with an unbreakable optimism.

　　The vision is supported by a new social contract between lay people and professional RTDI actors. Researchers follow agendas jointly set with citizens, understanding and accepting that targeting societal needs is a cornerstone of excellent research. Funding systems are arranged accordingly, having sufficient resources. Research organisations and STI policy-making bodies have opened their decision-making processes. Without doubt, all elements of the concept of Responsible Research and Innovation (RRI), invented already 25 years ago, are now blossoming and fitting together; the *Kingdom of RRI* has arrived.

4.2. Fortress Europe: Yes, EU can

Global crises have escalated. Nevertheless, *Fortress Europe* is prospering and flourishing. It is strong; stronger than ever. To withstand crises, the EU has started setting its

priorities towards sustaining a strong economy with a sovereign technological and industrial basis. The concept of an isolationist unity is key to the EU's strength, success, and perseverance in times of global difficulties. The EU has learnt from previous crises to intervene and actively address crises when they take effect.

Neoliberal governments, now in place in many EU member states, support an integration towards a single market and a strong private sector. Innovation is driven by consumer demand. Technology-based sectors, especially the new ICT- or bio- and gene tech-based companies, are growing fast, while the service economy is booming. The private sector has increased its R&D spending, while public R&D expenditures have not kept pace. Thus, private interests dominate the innovation system. High level technological advancement provides a strong basis for innovative solutions for addressing global problems, especially environmental ones.

Societies make green eco-innovations important. Society is a key driver for new demand and catalyst of technological advancement and service innovation. Strong social movements have significantly shaped and contributed to transforming the economy, for example, by hyping new entrepreneurs for their eco-innovations.

The rich EU countries have become even more attractive for economic migrants. New, big migration waves from all over the world are on the way, putting pressure on existing borders – the start of a humanitarian crisis? The EU, however, can protect its borders and prevent its social systems from collapsing. Border control is strengthened, relying on the latest technologies, a sign of the EU's remarkable technological advance and its capability to effectively tackle acute problems that could threaten its safety and integrity. Young professional, qualified migrants, who can contribute to easing a skills shortage and other negative effects of an ageing society, are welcome with a Blue Card.

Researchers are valued only if they are working for the private sector, developing applicable solutions; in this case, they are well-funded. Researchers in public research organisations are left far behind. Responsible research is ignored as it has no economic value.

4.3. Failed Democracy: Long live Populism

The original core values of the EU have been abandoned; they faded away due to the failure and systematic neglect by EU leaders to respond to global crises, especially the refugee crisis, economic inequality, and climate change. Most of the burden was imposed on a few rich EU member states, until society's dissatisfaction and frustration with politicians increased massively in these countries.

Populist reign brought 'salvation and hope': a way out of the 'paralysis'. Some populist regimes helped weakened nations to regain power and provided prosperity and security for certain privileged groups. Particular social groups felt prioritised, listened to, valued, and secure. These groups supported the regime, which, in turn, ensured stability and protection for them against 'threats and enemies', both beyond and inside the border.

Gaining approval, support, and trust from this part of the population is vital for maintaining and strengthening power and legitimacy, while polarisation and fragmentation in society are still strong features. The populist regimes have a rich toolbox to ensure this. Officially putting 'collective well-being first' is, in fact, only a synonym for instrumentalisation. The majority of citizens is convinced that the official vision of unity (as a source

of empowerment and safety) is theirs, but in reality, it is only a tokenistic, pseudo-involvement. All available knowledge of, and new ambition in, society is being controlled and manipulated by the government. Genuine, grassroot, social movements are silenced and oppressed. Dialogues do not take place; citizens are rather passive recipients of selective information. They are, and feel, under control and do not dare behave differently from others; they do what 'good, loyal citizens do'.

The same applies to RTDI: the populist regime supports activities that it considers beneficial for itself and its rule. Scientists who are in favour of democratic ideas, such as RRI, are side-lined and have neither fora to promote these ideas, nor funds to conduct research in such a way. Only a selected group of researchers obtains funds and gains status, others are oppressed and deprived of resources, whilst scientific findings are being distorted to serve the interests of the regime. Freedom of the press is largely supressed.

Innovation is purely economically driven, for the regime's benefit. Techno-fix solutions are preferred to mitigate some negative effects of global crises. However, the political system is built on fragile grounds; its economic, societal, and environmental sustainability is questionable.

4.4. Benevolent Green Eurocrats

Climate change has remained the prevailing grand challenge since the EU had launched the *Green Deal* programme almost 20 years ago and has since renewed it several times. The EU is a strong political actor, a pioneer in actively addressing climate change also at the global level. Acknowledging that green climate policy requires a 'whole-of-government' approach, there is strong political integration: the EU is organised in a top-down manner and regulates a circular economy with a strong private sector.

Governing from Brussels is a key mechanism and success factor of accomplishing the goals and inducing desired changes. Member states have transferred regulation and budgeting in all relevant policy domains to the EU level. Bundled efforts for a strong EU, however, are only aligned with the Eurocrats' agenda, which is decided by a small circle of politicians, bureaucrats, and experts, lacking broader societal debate and involvement. Innovation, serving this agenda, is highly important. There is an effective EU-wide transfer of novel solutions.

Utility and usefulness are the overarching value and credo. All good happens in the EU for the Union and for its citizens. Orchestration across all spheres of society, economy, and RTDI take place. An EU managed in a top-down manner is better equipped to tackle grand challenges. The education system is also affected: Eurocrats have pushed the value system towards the new collective values needed. A new way of political communication tries to engage people around the common narrative of collective goals. Individual goals are less important.

RTDI activities are centrally regulated: challenge-driven, mission-oriented research, supported by public investments, serves green business and social innovations. This implies, however, that blue sky research is restricted. Researchers who adhere to, and serve, the EU's missions are financially supported, gain status and power; others do not.

Social movements are perceived useful as long as they support the overall mission. Obedience, adherence and subsuming individual goals under collective goals are key

to social status. Responsibility is about what you can do for your country or the EU. Thus, the balance between personal rights and collective goals has changed towards the latter ones. Pseudo-involvement of different societal groups is organised, supporting the new values of 'green', 'circular' and 'steered economy'. These groups organise various events, which, in turn, act as a mechanism to ensure adherence and to create the appearance of having a voice and being heard.

Table 2 highlights the main differences between the four scenarios in terms of their decisive features, potential benefits, major policy rationale, and the role of actors.

5. Discussion: how RRI might unfold in the future

The four scenarios describe how political systems in the EU member states might evolve in the next 20 years and, in connection to that, sketch possible futures for society, research, and innovation. They have different implications: they do not only offer several potential benefits, but also raise a number of potential policy problems (Table 3). The *Kingdom of RRI* shows a future where responsible innovation – as discussed by current academic contributions (Macnaghten 2020; Owen and Pansera 2019; Randles et al. 2016) – has been embedded into RTDI processes in the EU to increase the potential of RTDI to address societal needs and challenges. Our discussion in this section sheds light on some aspects which require the attention of policy-makers and other professional RTDI actors, even in such a seemingly prosperous future. Likewise, while we cannot expect RRI to be embedded in a similar way in the other scenarios, the following discussion aims at making explicit some possible policy problems of science-society relations which may occur in those futures. Following the logic of prospective analysis, creating transparency about potentially undesired, but still plausible, developments can assist RTDI actors in taking strategic decisions today, as well as other actors in shaping – or making – political decisions.

5.1. Future dominant framings of RTDI in society and potential policy problems

Table 3 presents the different understandings (henceforth 'framings') of RTDI in society in the scenarios and some potential policy problems that might surface in the scenarios. By framings, we mean the fundamental normative, but often implicit, understandings and perceptions of the role that RTDI may have in a society.

Framings of RTDI in society: While in three of our scenarios these future framings are radically different from today, one scenario is based on an incremental change. This is exemplified by the *Fortress Europe* scenario, for which we assume that the growth and 'techno-fix' narratives will continue to be very strong (Strand 2019). 'Techno-fix' denotes a framing in which society strongly trusts, and believes in, technological progress, given the solutions and benefits it is assumed to bring. In this scenario, the EU is a global leader in a wide range of technologies, including green products. It thus can mitigate, at least partially, the policy problems of current techno-fix approaches, namely that new technologies have increasingly proven to be harmful to people and the planet.

In the *Kingdom of RRI* scenario, the *Co-production model* has fully manifested, which has been discussed by scholars of science and technology studies (STS) for a long time

Table 2. Comparison of the scenarios' main features

	Kingdom of RRI	Fortress Europe	Failed Democracy	Benevolent Green Eurocrats
Main features: Ideological stance & political practice	Participatory elements from local to EU level; Many green governments and new social movements in EU member states	(Neo-)Liberal with tendency to libertarian governments in many EU member states; The EU = free market & Joint border control & Immigration policy	Populist with tendency to autocratic in many EU member states; weakened EU	Top-down, technocratic co-ordination by 'enlightened' Eurocrats; significant part of member states' political power is transferred to the EU
Potential benefits	High quality of life; Society's potentials and synergies are utilised; genuine, inclusive, empowering, participation	The EU has a sovereign technological and industrial basis; strong dynamics for (green) change	Large enough groups of society feel important and listened to	Rational, evidence-informed sustainability transition; Effective orchestration across society, economy, and RTDI; The EU is a strong global actor
Major policy rationale or narrative	Mission- and responsibility-oriented policy approach brings manifold benefits	Market mechanisms are efficient; A strong private sector strengthens the EU	'Salvation and hope': promise of stability and unity, protection against external threats and enemies	Green Deal; utility and usefulness as overarching value and credo; A top-down managed EU is best equipped to tackle grand challenges
Role and relationships of the actors in RTDI processes	Society's well-being is put first: society takes part in agenda-setting (for RTDI) in a participatory manner	Focus on private sector: increased private R&D expenditures, consumer-driven innovation; Strong social movements are also present	The rulers involve the other actors in a tokenistic way, all have to serve the stability of the regime, critics are silenced	RTDI is highly valued when it delivers solutions for addressing grand challenges; Political communication engages people around a shared narrative about collective goals, the EU missions

Source: Own compilation.

and has become rather popular, inspired by the RRI debate. It means a radically new social contract, where 'the spheres of science and social order are mutually constitutive of each other' (Macnaghten 2020, 7), and where meeting societal needs is decisive in defining scientific excellence.

It differs from the *Grand Challenge model* (Macnaghten 2020, 4), where 'society can speak back to science' (Nowotny, Scott, and Gibbons 2001, 50) and there is a broad consensus that RTDI should tackle societal challenges. This model can be found currently connecting to, and refining, the techno-fix and growth narratives, for example, in Horizon 2020 and Horizon Europe, as well as in several national STI policies around the globe. The *Benevolent Green Eurocrats* scenario describes a variation of the Grand Challenge model, with room for interpretation around how well society can 'speak back to science' in this strongly top-down system.

The *Failed democracy* scenario, in contrast, does not take up any of the currently discussed models of science-society relations. In that future, populist parties won national elections in ever more countries, and thus autocratic regimes emerged all over the EU.

Table 3. Characteristics of RTDI and society and possible policy problems

	Kingdom of RRI	Fortress Europe	Failed Democracy	Benevolent Green Eurocrats
Dominant framing of RTDI in society	New social contract: science and society prosper due to a close co-operation; societal needs are decisive in defining scientific excellence	New technologies create jobs, bring prosperity and solve environmental problems	RTDI results are only endorsed if they do support the worldview and stability of the regime	RTDI is to serve the overarching goal of sustainability transition
Potential policy problems				
Efficacy of STI policies	–	Only partial solutions to societal challenges, applied only in the EU	Crises are addressed on an *ad hoc* basis, with a tendency to national solutions	Potential of place-based solutions are likely to be neglected
Efficiency in STI policy-making processes	Inclusive decision-making is hard to implement. Co-decision and co-creation slow down RTDI processes	–	–	Bureaucracy can be slow in the preparation and/or implementation phase
Legitimacy of RTDI	–	Societal scepticism regarding growth and technological progress	RTDI results are ideologically contested	–
Societal involvement in RTDI	Participatory approach might create an elitist 'bubble', favouring the rich and well-educated	–	Tokenistic, pseudo-involvement, society is controlled and manipulated, social movements are silenced	A small circle of politicians, bureaucrats, and experts takes decisions without broader societal debate and involvement
Equity (access to RTDI outcomes, e.g. innovative solutions)	–	Eco-innovations are only affordable to the rich and increase (global) imbalances, which intensifies social disparity in the EU and global poverty migration	Certain groups are favoured, whose support is crucial to maintain the regime	–
Freedom of research	Co-decision in setting research agendas is accepted by researchers, but this restricts freedom of research: blue sky research and serendipity is eclipsed	RTDI directions are set by the private sector. Narrow concept of scientific excellence and silo thinking	Limited freedom of research: the regime only supports those researchers who advance its purposes, others are oppressed and deprived of resources	Green missions imply restricted freedom of public research and strong steering of private RTDI efforts

Source: Own compilation.

The media, as well as RTDI, are directed (or controlled) by, and support, the regime. Freedom of science no longer exists, and society mainly receives controlled information. Even though all EU member states have constitutional safeguards to protect their democratic institutions, such a development is plausible when political actors start questioning the legitimacy of democratic institutions or ignoring the (implicit) norms and 'rules of the game' (Levitsky and Ziblatt 2018).

Table 3 continues with a list of *possible policy problems* that might arise in the different scenarios. They may neglect and contradict important societal aspects or simply have

unintended consequences. As the scenarios describe quite diverse frameworks, we consider a positivist and neutral approach, adequate for identifying benefits and problems, following the logic of each scenario. We identified the possible problems of efficacy of STI policies,[5] efficiency in STI policy-making processes, legitimacy of RTDI, societal involvement in RTDI, equity (understood as access to RTDI outcomes), and freedom of research. These categories are informed by policy analysis and political system analysis, and we relate them to RTDI processes and outcomes. Moreover, these categories incorporate thoughts from the literature dealing with just sustainability transitions. One of the most prominent contributions distinguishes between three concepts of environmental justice (Walker 2012): distributional justice, procedural justice and justice as recognition. The question of who is benefitting (distributional justice) is covered by the category of equity in our analysis. The question of who can influence decision-making and other processes (procedural justice) is translated into societal involvement in our scheme. Finally, the question of whose stakes or needs are recognised is related to the efficacy of policy-making, as justice as recognition does not necessarily mean to include these actors in processes but instead that their problems are recognised and addressed.

As concerns efficacy of STI policies, scenarios alert us that we should not be overly hopeful about getting rid of our current policy problems. For example, 'techno-fix' approaches are being criticised for their inadequacy in tackling challenges like the climate crisis. This problem persists, for example, in the *Failed Democracy* scenario and to a certain extent in *Fortress Europe*. Moreover, both scenarios tend to neglect the global nature of societal challenges and strive for EU-level (*Fortress Europe*) or even national (*Failed Democracy*) solutions. The other two scenarios, however, present solutions to this policy problem. Both take policy approaches, which support sustainability transitions. However, the top-down approach of *Benevolent Green Eurocrats* might neglect the potential of place-based solutions and grassroot initiatives.

Efficiency in STI policy-making processes is likely to be another pertinent issue. The *Kingdom of RRI* presents an image of a broad, if not excessive, set of participatory approaches to RTDI. The constant involvement of stakeholders, especially that of citizens in agenda-setting, conducting, and evaluating RTDI activities can become overly time- and resource-consuming. Similarly, depending on the burden imposed by the bureaucratic approaches of the *Benevolent Green Eurocrats*, policy scoping and/or the implementation of policies might become too slow.[6] The ability to react to unforeseen developments or to flexibly deal with multiple parallel solution paths when tackling major challenges, could also be impeded in these scenarios. In these cases, the problems of efficacy and efficiency become intertwined.

Legitimacy problems of RTDI might prevail, as shown in *Fortress Europe*. The potential misuse of RRI as a mere window-dressing activity to provide legitimacy for unlimited technological growth is a problem, which has been described already for the present (Section 2.2). Societal scepticism regarding growth and technological progress might persist in *Fortress Europe*. Strong social movements can be expected to give a voice to the scepticism in this scenario. Thus, we might indeed see societal engagement of RTDI in such a scenario, however rather as a cosmetic addition to RTDI processes, e.g. by way of science communication activities. Another and even more urgent policy problem related to legitimacy of RTDI are post-truth debates, as illustrated by the *Failed Democracy* scenario. Here, populist leaders contest or even neglect scientific

evidence with far-reaching consequences, as we have already seen even in a traditionally strong democratic system (Nature 2020a, 2020b).

Our scenarios highlight further policy problems, which might become more urgent in the future compared to today. The question of societal involvement, i.e. which actors can participate in shaping RTDI processes, is pertinent for each scenario. *Failed Democracy* and *Benevolent Green Eurocrats* might create a fundamental and dreadful democratic deficit, because large groups of society, for different reasons, are systematically excluded from decision-making. In the *Kingdom of RRI*, the participatory approach might prove inadequate and strengthen an already existing elitist 'bubble', favouring the participation of the rich and well-educated who have sufficient time for these activities, while others might not afford this 'luxury'.

Closely connected are the intensified or potentially emerging problems of equity, understood here as access to RTDI outcomes. *Fortress Europe* stresses the potential problems of economic (and global) inequalities, where only the rich can afford green technologies. Economic inequality is also likely to arise in the *Failed Democracy* scenario, as certain groups are favoured whose support is crucial to maintain the regime, however at the expense of others.

In the current RRI debate, freedom of science and the related excellence concept are other problems, which again might prevail in the future. Increasing specialisation in knowledge production has intensified the emergence of silo thinking and compartmentalised structures in research organisations. Hence, excellent research has become something defined inside the boundaries of separate disciplines, thus favouring mono-disciplinary advancements over collaboration among actors possessing different types and pieces of knowledge (Rafols et al. 2012; Randles et al. 2016; Stilgoe 2014). This problem is likely to persist in *Fortress Europe*. Furthermore, in that scenario it is also plausible that the business sector might have a too strong voice in determining RTDI directions, because of its increased share in total R&D expenditures. All other scenarios run a risk that the freedom of science might be restricted for different reasons: misconceived societal participation (*Kingdom of RRI*); a strict technocratic steering (*Benevolent Green Eurocrats*); or political control and suppression (*Failed democracy*).

5.2. Safeguarding meaningful approaches to societally engaged RTDI in different political framework conditions

With our scenarios, we have intentionally created provocative and extreme images of potential futures. Stressing the importance of electoral choices and the actions of politicians and policy-makers seems to take the future of societally engaged RTDI out of the hands of RTDI actors. Yet, the opposite is true. Considering these possible futures helps stakeholders recognise the issues at stake, which, in turn, can feed into today's actions in different ways, including strategy building and policy-making. We are not only citizens with the right to vote. RTDI actors and policy-makers will need to take responsibility and to collaborate in order to shape what we would call meaningful approaches to societally engaged RTDI. In the context of this paper, such a meaningful approach would be best defined by the vision of *responsible innovation* (Section 2.2): an anticipatory, reflexive, deliberative, and inclusive approach to RTDI processes, and a commitment of RTDI actors to work in a responsible way for the future of people and the planet.

Our aim is to indicate how various actors can safeguard a meaningful approach like responsible innovation while facing the challenge of being embedded in quite different normative or ideological frameworks (Wong 2016), which create partly different and partly similar policy problems, as shown in Section 5.1. We focus below on the actions, which may be taken mainly by professional RTDI actors, but to a certain extent also by lay people. Some implications for policy actions are outlined as well.

As for the *Kingdom of RRI*, we have identified several problems above. These might weaken the efficiency, the legitimacy, and the inclusiveness of RRI processes and methods, and thus conscious and orchestrated efforts would be needed to address these challenges. These would include:

• developing new methods and tools, and creating new fora to make inclusive decision-making more efficient and less time-consuming;

• developing the skills of the actors to communicate, discuss and co-operate in a respectful, but result-oriented way;

• convincingly and widely communicating the advantages of co-creating knowledge, that is, when researchers and citizens work together to solve a problem, mobilising their different types of knowledge and expertise, and approaching the problem from different angles given their different ways of thinking and framing problems;

• striking a balance between speeding up jointly conducted RTDI processes and keeping their essential inclusive character, e.g. by experimenting with new methods for collaboration;

• avoiding the trap of creating an elitist 'bubble' by involving less affluent people in important deliberation processes and providing high-quality education for all, regardless of their family background;

• rewarding service to the society, like participating in RTDI processes;

• providing adequate funding for blue sky research that does not clearly address visible societal needs when the project is proposed, but through serendipity might lead to ground-breaking new results, which later on – sometimes after a significant time lag – might be used to tackle social, economic or environmental challenges.

This list highlights why we have called this scenario also *(E)Utopia*, as it seems highly difficult to be achieved. However, the pursuit of this scenario has already started, and there are all kinds of initiatives by RTDI actors who try to implement the above ideas. There are implications for policy action as well, which we summarise at the end of this subsection.

In *Fortress Europe,* interactions between lay and professional actors in RTDI are side-lined by the strong private sector: participatory methods would not be perceived as contributing to 'value creation', moreover, they could easily interfere with profit motives. Yet, vibrant social movements could urge politicians and policy-makers to pay due attention to major problems (as identified in Table 3). Society might become so sceptical regarding the 'techno-fix' and 'Europe-first' narratives that citizens would demand changing the priorities, introducing at least some elements of participatory decision-making, and following certain RRI principles. That would lead to redefining RTDI directions to better address societal needs and reinterpret the narrow concept of scientific excellence.

In *Failed Democracy,* all possible tools and methods are used to maintain the regime, and thus participatory methods are also applied in a tokenistic way. Society is controlled and manipulated; social movements are silenced. Before a real-life case becomes as bleak as it

is described in this scenario, 'checks and balances' of democracy can counterbalance the actions of a populist leader. However, these constitutional safeguards cannot prevent the election of populist or anti-democratic leaders (Levitsky and Ziblatt 2018). The recent – not future! – case of the US illuminates the damages caused by her President and the severe threats he posed (Nature 2020a, 2020b; Tollefson 2020), as well as the opportunities for, and importance of, defending democratic principles and practices – including the autonomy of science. The US is not alone, we see similar developments in other countries, including EU member states. A crucial tool of defence is upholding the ethical and democratic norms of civil servants, politicians – by those who oppose the populist leader and serve the genuine interests of society –, and researchers. Long and Blok (2017, 64)

> propose that RRI needs to go beyond being a method for facilitating societal input into research and innovation and for highlighting desired impacts. RRI needs to evolve to provide an effective conduit for criticisms and the input of critical thinking and reflexivity into science and innovation, including in terms of economic policy and politics.

Actually, our scenario work implies that in a populist regime, we cannot expect RRI to be enacted in such a way. However, the communities of professional RTDI actors and societal actors sharing such a mindset would not disappear all at once, and would need to join forces when such developments become apparent.

In the *Benevolent Green Eurocrats* scenario, a small circle of politicians, bureaucrats and experts takes decisions without broader societal debate and involvement. That could lead to effective policy actions for tackling the challenges identified by this closed circle of decision-makers and supported by a new kind of political communication. Given that this technocratic government is benevolent, this would mean that politicians take seriously the task of explaining the selected directions and engaging people around this joint task. Yet, other issues, perceived pertinent by citizens or businesses, would receive neither adequate attention nor sufficient funding. If communication and engagement concerning these issues are neglected, citizens might not feel listened to, in particular in regard to the decision about the missions. To ease these problems, the 'excluded' stakeholders – citizens, researchers, and business people – need to apply pressure on politicians and policy-makers to use participatory methods and processes. That would broaden the perspectives considered when the missions are identified, RTDI directions are set, funding decisions are made, and regulations are devised. Social innovation and place-based solutions might become other powerful ways of societal actions in this scenario. Their effects, if communicated well, could not be ignored by the benevolent eurocrats, and the top-down approach would need to be balanced with bottom-up initiatives and solutions.

In the logic of our scenario work and the analysis presented, all of these actions by RTDI actors will require parallel policy actions. One issue, which is a recurrent one across scenarios, is education and empowerment. Two scenarios, *Failed Democracy* and *Benevolent Green Eurocrats* have shown that their stability, to a large extent, builds on an education system which 'injects' new values and orientations, while the *Kingdom of RRI* profits from educating the next generation in an integrated way that supports reflexive and anticipatory capacities of citizens. Moreover, empowerment in the *Kingdom of RRI* also has a resource component and changes the way voluntary work is valued by society.

Communication is a powerful tool in all scenarios. Political communication, which actively promotes new narratives, is a source of stability in *Failed Democracy* and *Benevolent Green Eurocrats*. In the *Kingdom of RRI*, successful communication, in the sense of a dialogue culture, seems to be a precondition and literally everybody in society needs to acquire this capability.

6. Conclusions

There is a growing consensus in the literature that it is crucial to better align RTDI activities with societal needs. Hence, in this article, we focussed on the *interactions between lay people and professional actors* in RTDI activities. These interactions can evolve by taking radically different directions, and thus we have opted for developing *scenarios to consider the possible futures of society, research, and innovation* in the EU, applying the multi-method ScenarioSprint approach. The guiding principle of devising scenarios is that the future can be shaped by today's action. By exploring different (possible) futures, various actors – researchers, lay people, policy-makers, and business people– can systematically consider the implications of different future states of affairs, and thus take more informed actions today to either increase the likelihood of a desirable future, or avoid – at least divert, or slow down – undesirable trends.

Having considered 16 major factors that are likely to shape the future of societally engaged RTDI activities, workshop participants have concluded that the most influential factors are the prevailing *ideological stances and political practices;* in brief, the future of democracy in the European Union member states. Thus, the political system, which is treated as an external condition in the innovation system heuristic, has been considered to have more impact on societally engaged RTDI than other factors considered at the workshop. From this angle, the discussion about the future of RRI or RI at an instrumental level, e.g. about developing and introducing the appropriate tools, methods, and policies to promote inclusive and transparent participation, or devising and applying the adequate evaluation instruments to measure its benefits, is certainly crucial. However, these aspects are of secondary significance compared to the external conditions, especially the dominant ideology and the concomitant political system.

With this approach we contribute to the RRI literature in two ways: on the one hand, we consider possible, fundamentally different futures of society, research, and innovation, as opposed to analysing current or recent RRI practices and STI policies, and on the other hand we put the emphasis on the political conditions, as opposed to proposing future RRI or RI principles and instruments *per se*.

Taking ideological stances and political practices to be the most influential factors provides the 'switches' where scenarios take fundamentally different directions. Our analysis has been motivated by the current observations that political debates have become ideologically extreme in recent years, including post-truth debates, where fundamental democratic principles and institutions are called into question or even ignored. Moreover, these have far-reaching implications for RTDI activities (Nature 2020a, 2020b).

We have identified four radically different types of political systems: participatory, libertarian, authoritarian/ populist, and technocratic. In the *Kingdom of RRI* citizens participate directly in decision-making processes; *Fortress Europe* depicts a liberal-with-tendency-to-libertarian system; *Failed Democracy* is a populist-with-tendency-to-

autocratic regime; while *Benevolent Green Eurocrats* describes a strong, technocratically coordinated state. At a first glance, the idea of RRI as an anticipatory, reflexive, deliberative and inclusive approach is completely ignored, manipulated, or very selectively applied in the latter three scenarios.

These scenarios depict somewhat extreme versions of distinct political regimes, relying on the dominant ideological stance, and hence they imply different framings of RTDI in society. While we painted black-and-white, somewhat simplified pictures, real life is never like this; it is always 'colourful'. Hence, there is some room for *safeguarding meaningful approaches to* societally engaged RTDI even in the harshest ideological and political conditions. The actions needed, as well as the likelihood of their success, would depend on several factors: the determination and type of 'change agents', e.g. citizens, researchers or business people, their agency, skills, motivations, and willingness to learn and apply new practices and 'unlearn' less useful ones.

More generally, the systemic approach we have taken implies that the type of actors; the processes, in which they create, exploit, and disseminate knowledge; their other interactions; as well as the institutions – that is, 'the rules of the game' – that govern their interactions, and the flow of knowledge and resources are all of crucial importance. The place of society in different political systems, on the one hand, and in the different innovation systems, on the other, makes a difference. To some extent, all the (groups of) actors have some leeway to shape the position of society in these four different scenarios. It is determined to a significant extent by the nature of government-society relationships: it would be implausible to expect societally aligned RTDI activities without political decision-makers whose main intention is to serve the well-being of society. However, the degree of autonomy available to professional RTDI or lay actors – although it might vary in the different scenarios – allows them to interact creatively and effectively in different ways.

Our work needs to be extended in three directions. First, at the ScenarioSprint workshop neither all stakeholder groups, nor all different types of EU regions, were represented. Hence, to enrich the discussion on the policy and other practical implications of these four scenarios, *a series of new workshops* needs to be organised, attended by citizens, policy-makers, business people, and a more diverse group of experts. These workshops might verify the relevance of our scenarios as a starting point for further, more in-depth dialogues, but could also identify other aspects that are also pertinent for the future of society, research, and innovation. These exchanges would lead to revised or additional scenarios.

Second, to conduct these series of workshops, most likely *methodological innovations* would also be needed, despite the novelty and proven benefits of the ScenarioSprint method. We need to experiment with techniques and approaches that would allow the involvement of a significantly larger number of stakeholders to reflect the diversity in the EU, and which is also capable of tackling cultural differences and language barriers – but in an efficient, affordable way, that is, keeping the necessary resources at an acceptable level.

Third, further work – both 'classic' academic research and participatory workshops with stakeholders – is also needed to address several issues not covered in our scenarios. That would include addressing the *complexity of the topic*: meaningful approaches to societally engaged RTDI being 'nested' in an innovation system, which, in turn, is

dependent on the overall developments of the political systems at national and EU levels, and conditioned by the economic performance, as well as global political and economic developments. That could lead to a better understanding of different innovation systems, in particular the roles and possibilities of various types of actors in guiding RTDI processes and shaping STI policies (the types of knowledge they possess; the legitimacy and validation of different types of knowledge; the power relationships among the actors; their aspirations, positions in policy discourses; as well as their possibilities and tools to initiate and influence these dialogues, etc.). Another important extension would be to focus explicitly on the 'fit' between specific policy instruments, on the one hand, and the policy governance sub-system of an actual innovation system (Havas and Weber 2017), on the other, in order to *derive tailored policy implications*.

Notes

1. van Oost et al. (2016) built scenarios for the future of RTDI to consider how to foster RRI. Yet, as they acknowledge, their scenarios do not systematically cover the external conditions for the interactions among lay people and professional RTDI actors.
2. Havas (2008) offers an example for building scenarios in a multi-level structure.
3. Further information on the scenario workshop and supporting illustrations are available at https://newhorrizon.eu/want-to-engage-for-societally-engaged-research-and-innovation/.
4. See https://newhorrizon.eu/four-scenarios-for-the-future-of-responsible-research-and-innovation-rri/.
5. This a simplification: besides STI policies, several other policies (can) also affect RTDI processes to significant extent, including investment promotion, SME development, industry, regional development, health, energy, transport, defence, and climate policies, just to name a few. For the sake of simplicity, we use STI policies as a 'shorthand' in this subsection to denote all policies that (can) shape RTDI processes.
6. Actually, discussions on the Benevolent Green Eurocrats scenario show that there is room for interpretation in this scenario. An enlightened bureaucracy can also be understood as a significantly improved system, in which processes are set up in a way that support an agile (and hence efficient) administration.

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Disclosure statement

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