DELIVERABLE 1.3

A Framework for the SocKETs toolbox

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1. Executive summary

1.1. Framework for the SocKETs toolbox

This deliverable presents a draft framework for the SocKETs toolbox, offering industry and other stakeholders a set of tools for facilitating societal engagement in Key Enabling Technologies (KETs). KETs potentially have a great impact on society; thus, they should be aligned with priorities, expectations, and concerns of citizens to enable steering innovation trajectories towards desirable and acceptable ends. We address four dimensions of the framework: 1) its content and aims (what kind of engagement do we aim at with what kind of tools), 2) communication (how do we communicate about the content), 3) function and structure (how to navigate and the toolbox) and 4) curation (how to select tools for inclusion).

1.1.1. Content

1.   Societal engagement

As a research project developed and conducted in the context of Responsible Research and Innovation (RRI), the SocKETs project aims to engage societal actors because they are a source of knowledge about societal needs and values, and about what practically works in other contexts. We identified five interdependent engagement requirements: 1) *normative (*it should be done for reasons of 'democracy, equity and justice'), 2) *substantive* (it should lead to a coproduction of decisions about STI trajectories), 3) *timely* (early enough to have significant influence), 4) *inclusive* of a broad as possible range of citizens and relevant issues and 5) *feasible* in an industry/business context.

2.   Dialogue

We presented dialogue as a suitable approach for successful societal engagement. It is seen as a communication process involving a mutual exchange of knowledge, values, needs and concerns, which can broaden (world)views, engage and enhance both cognitive and emotional capacities. This requires taking the other party seriously and being open to reshaping your own perspectives, thereby enabling *substantive* engagement.

3.   Co-creation

Co-creation is presented as a suitable approach as well. In management sciences it is adopted as a method for the "active involvement of end-users in various stages of the production process" in order to increase user loyalty and satisfaction. We propose three enrichments: 1) co-creation should not merely involve users, but rather engage citizens, 2) rather than understanding it instrumentally as a way to harvest and select creative ideas, it should aim at giving citizens a say in products that will have impact on their lives and 3) instead of selecting innovative individuals and following rational norms of organizational benefit, co-creation processes should be imbued with playfulness and experiment in order to enhance creativity and collaboration. By following these considerations, we can render co-creation a "force for participation and democratization" suitable for the SocKETs project.

1.1.2. Communicating societal engagement

1.   Views on engagement reported in scholarly literature

In presenting the toolbox and communicating about its content, we should consider how to best deal with conceptual differences in regards to societal engagement.

In regards to public engagement, five frames can be distinguished: 1) the *normative* (citizens seens as co-creators of STI in processes of mutual learning) common among RRI scholars and policy makers*,* 2) *educational* (citizens are empty vessels in need of education in a unilinear process), 3) *paternalistic* (citizens are active participants with emotions and concerns that should be taken away by addressing them, 4) *elitist* (public is heterogenous, scientific literate citizens can be actively involved, while others need to be educated), and 5) *economistic* (citizens are consumers, whose relation to technology is mediated by the market).

2.   Views of engagement in the SocKETs innovation ecosystems

To inform the communication of the toolbox, we analysed the frames of societal engagement of stakeholders from the SocKETs innovation ecosystems, interviewed for deliverable 1.1. We did four broad observations: 1) some of the interviewed stakeholders saw engagement as a promising way to integrate social values in the technologies of concern, implying a *normative* frame, 2) *elitist* and *educational* frames were apparent in the outright rejection of some of the feasibility of mutual learning for inability of citizens to contribute, 3) *educational* frames were apparent in perceptions of engagement as valuable for its educational function not primarily to enable citizens to see opportunities, but for regulators to update their knowledge, or for citizens to recognize risks and 4) in the common understanding of user consultation as societal engagement, a synthesis of two frames is implied: the normative for taking users as a valuable source of information, and the economistic for the strong instrumentalized understanding of engagement processes.

3.   Communicating through differences

On the basis of the above analysis we concluded that there are at least two important discrepancies between our framing of engagement and those of stakeholders: 1) involving users versus engaging citizens and 2) the right timing: as late as possible versus early enough to have substantial influence. Our recommendation for WP3 is to invest time and effort in identifying more crucial discrepancies and finding creative ways to deal with them.

1.1.3. Function, Structure and Curation

The function, structure and curation of the toolbox will be highly interdependent and should be approached as such when designed. We recommend to be reflective of our specific aims and requirements as presented in this deliverable, when finalizing choices in this regard.

1.2.   Concluding remarks

It is important to keep re-negotiating the nature and implications of these dimensions. The toolbox will be further developed in several stages, interacting with multiple stakeholders, feeding an iterative process in which the different dimensions will be shaped and reshaped. The toolbox itself will be co-created to align with needs and interests of actors in the innovation ecosystems, including citizens.

2.   Introduction

This deliverable presents a draft framework for the SocKETs toolbox, offering industry a set of tools for facilitating dialogue and co-creation for societal engagement in Key Enabling Technologies (KETs). It is part of the SocKETs project, which aims to contribute to opening up innovation processes of KETs to a broad range of social actors. Examples of KETs are nano- and biotechnologies, the Internet of Things (IoT), blockchain technology, and artificial intelligence. These technologies potentially have a great impact on society and on the relations between humans and technology. Engagement tools, such as tools for facilitating dialogue and co-creation, can be used to make these technologies more aligned with societal values, needs and interests. This has been increasingly encouraged in academic, policy as well as public spheres (Ribeiro, Smith & Millar, 2017; Wickson, Fern & Carew, 2014).

Societal engagement is seen as a way to keep science and innovation open to continuous social monitoring taking the priorities, expectations, and concerns of citizens in account, making it more 'socially robust' (Nowotny, 2003). Socially robust knowledge requires to acknowledge the normative within the technical and to place 'expertise' within a societal context. It has three complementary components: 1) its validity is tested both inside and outside the laboratory, 2) it is established by involving an extended group of experts and 3) it involves an iterative process in which it is repeatedly tested, broadend and adjusted. Nowotny (2003) calls for this creation of 'socially robust' knowledge as scientific facts are more often scrutinized and contested by an increasingly educated public. She argues that reliable knowledge is not only created by the scientific method but is highly dependent on their 'reliability' in their societal context. Therefore, to navigate the complexities between knowledge, decision-making, expertise and action in science and innovation it is of importance to not only take knowledge required through the scientific method into account, but also the experiences, attitudes, perceptions and vulnerabilities of participants and relevant groups in order to steer innovation trajectories towards desirable and acceptable ends (Nowotny, 2003).

In the past decade, a number of EU projects have developed, tested and evaluated frameworks, methods and resources for engagement in science and technology. For many projects, these efforts resulted in the development of a toolbox. These toolboxes differ in what they offer its users: sets of tools for co-creation, broadly defined by drawing from several disciplinary angles (SCALINGS; GoNano), 'methods' for research driven by involvement and inclusion (ActionCatalogue), tools that serve as a guide to incorporate RRI principles (Societal Readiness Thinking Tool; RRI tools; ROSIE project) or co-creation toolboxes to stimulate RRI in policy design (SISCODE). In addition, the application area of toolboxes differs. Some focus on specific sectors such as robotics, autonomous driving, urban energy (SCALINGS) or nano-technology (GoNano), while other toolboxes do not have a specific focus but are rather generic (Societal Readiness Thinking Tool; ROSIE project).

Furthermore, toolboxes are created for different kinds of users. Some are targeted specifically to Small-Medium enterprises (RRI PRISMA; COMPASS) or to policy makers (SISCODE), while others to a wide range of users such as industry, business, universities and policy makers (SCALINGS; RRI tools). Among these toolboxes, some function as online crash courses (COMPASS), step by step manuals (GoNano), roadmaps (SISCODE, ROSIE project), online decision support tools (ActionCatalogue) or thinking tools (Societal Readiness Thinking Tool). Additionally, the toolboxes are presented in different ways: some are online documents, others entail websites with click-through menus. The way they address the user also differs: some give the opportunity to select your own stakeholder group from a range of options (RRI tools), while others ask you where you are in the process of engagement (SR thinking tool).

For the establishment of our toolbox for successful engagement several choices have thus to be made. The toolbox is conceived as a digital platform, developed in several stages with input from multiple stakeholders. The toolbox can be freely used. It should cover practical steps to enable industry and other stakeholders to work with citizens to enhance their societal responsibility in future projects and partnerships. But, what kinds of tools will the toolbox entail? What do these tools specifically aim at? What is the target group of our toolbox; what are the intended participants of the engagement activities? How will we present the toolbox to its intended users; how will we communicate about its content? These questions are addressed in the deliverable.

The deliverable is part of WP1 that entails the preparatory work for WP2 en WP3. In WP1 we will gather best practices, which will be further developed, tested and evaluated in WP2. This deliverable presents the draft framework for the toolbox, which will inform the process of building the toolbox in WP3. As such, it is a living document that will be further adjusted throughout the project.

3.   Framework

In this section we present four dimensions of the toolbox framework. First of all, the content: what kinds of tools should be included in the box? The second dimension concerns the communication of the content. How should the targeted users be taken into account in how we communicate about the content. The function and structure of the toolbox is the third dimension addressed. How should the toolbox function for its users, i.e. how do we intend users to navigate the box? What kind of structure fits such a function? The fourth dimension is the curation of the box. How will we select tools for inclusion in the toolbox?

3.1.   Content of the SocKETs toolbox

The first dimension of the toolbox addressed in this section is the content of the toolbox. What kind of tools will the box provide and why? The aim of the project is to support a wide range of industry actors, procurers and science and technology organizations involved in the development of KETs technologies and applications (hereafter 'stakeholders') to organize societal engagement activities aimed at including a broad range of societal needs and concerns early in the innovation process. We intend to do this by offering a set of tested and approved dialogue and co-creation tools. In this subsection we will thus explain in more detail what, according to us, early societal engagement, as well as dialogue and co-creation, entails, and how these understandings are embedded in existing literature and policy practices.

3.1.1.   Societal engagement

Since the 1990s, the call for engagement of societal actors in Science, Technology and Innovation (STI) has gained momentum (Stilgoe, Lock & Wilsdon, 2014). STIs are playing an increasingly central role in modern society. While STIs have caused profound changes in how we live our daily lives, it has also radically changed the quality of the environment we live in. STIs are currently the primary cause of societal problems, but also the primary means for making these problems visible and solving them. Due to its centrality in our everyday lives, scholars and policy makers have called for a democratization of STI. They emphasize the importance of including societal actors in science and technology processes and as such, engaging with societal concerns, controversies and needs (Koster & Kupper, 2020).

Another factor in the rise of public engagement practices since the 1990s is the perceived need to continuously negotiate the legitimacy of science and technology practice, particularly in response to a series of badly managed public controversies. Yet, public engagement is also perceived as a way to provide opportunities for developing both better and more acceptable technologies (Irwin, 2001, Wilson et al., 2005). Especially in the context of emerging technologies such as nanotechnologies and biotechnologies, public consultations and dialogues are increasingly common (Krabbenborg & Mulder, 2015; Shelly-Egan, Bowman & Robinson, 2017).

Against the backdrop of the above developments, Responsible Research and Innovation (RRI) has been introduced as a new governance framework to integrate anticipation of the future, ethical reflection, public engagement and responsive change (Stilgoe, Owen & MacNaughten, 2013). SocKETs' notion of societal engagement is mainly based on this framework, as based on an understanding of the relation between science and society as one between equals. Societal actors should be engaged not because they lack knowledge or understanding, but because they are a source of knowledge about societal needs, about what is considered valuable in our present and future ways of living and about what works in other contexts.

For the aim of building a toolbox framework, we draw five interdependent requirements for engagement from recent literature and research aimed at societal engagement in STI. First of all, societal engagement

should be *normative*. As noted by Stilgoe et al (2014, p.11), engagement activities seldom move beyond 'procedural response(s)', in which public opinion is used in convenient ways. Engagement then becomes a "one-off hurdle" taken whenever convenient for a government or STI developer (Hagendijk & Irwin, 2006, p. 174). From this we can conclude that an important pitfall of societal engagement is that it is used instrumentally to quickly gain superficial legitimacy or to be able to mark an institutional check box. Stronger even, Chilvers (2010) notes that public engagement is in a process of professionalization yielding an engagement industry whose commercial motives might jeopardize the broader democratic ideals central in approaches such as RRI. Important for the framework of the SocKETs toolbox is what Syckes and Macnaughten (2014, p. 95) formulate as the importance of engagement to be done for *normative* reasons of 'democracy, equity and justice'*.*

Another important requirement for engagement is to be *substantive* (Sykes & Macnaghten, 2014; Stilgoe et al, 2014). This means that the diverse social knowledge, values, and meanings that result from an engagement activity should be taken up in a process of co-creating decisions about STI trajectories. A problem in this regard is the extent to which societal actors are given space to actually discuss a new STI, noting that often the issues are framed before the engagement initiatives have even started. Drawing on twenty-six case studies, Hagendijk & Irwin (2006) conclude that often such framing is done in a top-down fashion by a limited number of policy officials and 'experts' on the issue. Such framing compromises the substantiveness of engagement. Even stronger, it potentially reinforces existing relations among policy makers and STI developers at the expense of citizens who are relative outsiders of the process. Another danger is that it reinforces the image of the public as lacking knowledge, understanding and skills needed to substantially participate (Wynne, 2006; Kerr et al, 2007). A typical pitfall of engagement of concern for the SocKETs toolbox is thus that citizens are merely superficially engaged in a discussion of which the problem has been defined beforehand. Thus, tools of engagement should allow for facilitating engagement not merely in preselected sets of solutions, but also in the process of defining the problem at stake.

The third requirement, largely related to its substantiveness, concerns the *timing* of engagement. The issue of timing has been been widely discussed in RRI literature and in literature about anticipatory governance (Guston, 2014 & Barben, Fisher, Selin & Guston, 2007) and about the diverse forms of technology assessment (Schot & Rip, 1997) on which RRI is built (Owen, Bessant & Heintz, 2014). As part of a tendency to instrumentalize engagement, it is convenient to engage citizens (users) at the end of the trajectory, when their input can be used for merely assessing for example a new device's user friendliness. The SocKETs engagement tools should thus facilitate "upstream engagement" (Joly & Kaufmann, 2008; Macnaghten, 2009; Pidgeon & Rogers-Hayden, 2007; Tait, 2009; Wilsdon & Willis, 2004) or "early engagement" (Doorn, Schuurbiers, Van de Poel & Gorman, 2013), which is organized in a timely manner, when its output can still have substantial impact on the content and direction of the STI trajectory. Note that upstream engagement has been criticized for bringing about other challenges: societal consequences of technologies in the early stages of development are often hard to predict (Schuurbiers et al., 2013). This problem is known as the Collingridge dilemma (Collingridge, 1980). Finding the right timing of engagement is thus a balancing act, a matter of finding a window of opportunity when enough is known to explore possible futures, while there is still a possibility to significantly change the trajectory.

The fourth requirement for engagement is to be *inclusive* to a diverse group of participants (Kupper, Klaassen, Rijnen, Vermeulen, & Broerse, 2015). A pitfall noted in the literature is that engagement practices often merely engage certain groups of people, such as patients, end-users or consumers, instead of a range of citizens as broad as possible (Stilgoe et al., 2014). Yet, while engaging future users is insufficient, inclusivity is also not a matter of ensuring demographic representativeness (age, gender, education and ethnicity). Boulianne (2018) notes the importance of balancing out the diversity of demographic backgrounds with a diversity of attitudes towards STIs. Deliberating issues is not a matter of weighing preferences, but of

addressing and discussing the broadest range of relevant issues among a broad group of participants. In order to enable this, it may be important to oversample minority groups. Making a similar point, Kupper et al (2015) point out that in order to reach sufficient inclusivity it is crucial for organizers to engage 'silent voices' of vulnerable groups such as ethnic minorities and citizens that are not employed, educated or in training (NEETs). However, such new groups are typically harder to reach, precisely because they are not as highly educated and not as interested in STI developments as the citizen groups that tend to be overrepresented (Ellard-Gray, Jeffrey, Choubak & Crann, 2015; Powell, Colin, Kleinman, Delborne & Anderson, 2011; Sturgis 2014). The insight that it is often necessary to adopt design or recruitment strategies aimed at reaching these groups is of particular importance for the SocKETs toolbox. In the literature, it is suggested that art might be of help in this regard (Salter, 2017; Fraaije, Van der Meij, Kupper & Broerse, forthcoming).

A fifth requirement concerns the feasibility of societal engagement in an industry or business context. The RRI approach, on which we based the content of our notion of societal engagement, has mainly been adopted, conceptualised and assessed in academic and policy contexts (Gurzawska, Mäkinen, Brey, 2017). Some exceptions aside (Flipse, 2013; Lubbering, Blok, Van Ophem, Omta 2015; Iatridis & Schroeder, 2016; Van de Poel, Asveld, Flipse, Klaassen, Scholten & Yaghmaei, 2017), it is still underexplored for the more commercial settings (Blok & Lemmens, 2015; Gurzawska et al., 2017) of the targeted users of the SocKETs toolbox. In business contexts other related approaches to innovating in a more responsible way are more widely established, such as Corporate Social Responsibility (CSR), sustainable innovation, participatory design and stakeholder dialogues. Among these approaches, CSR is the most recognized approach (Van de Poel et al, 2017). CSR encourages corporations to prioritize social goods over their own (financial) gains, yet, the approach does not aim to open up the innovation process to societal engagement as RRI does. In developing the SocKETs toolbox, we aim to strengthen the CSR movement by including dialogical citizen engagement to their approach while also seeking inspiration for improving RRI ability to relate to the more business-oriented industry innovation ecosystems.

3.1.2. Dialogue

Successful societal engagement needs approaches that facilitate open exchange with citizens in which they can express their priorities, needs and concerns while at the same time taking the earlier mentioned requirements into account. One of such approaches is the 'dialogue' approach.

Dialogue is often used to describe any form of spoken interaction and it is used interchangeably with conversation, consultation, participation, dissemination etc. Escobar (2011) warns that by approaching dialogue in this way, it loses its meaning and might end up meaning nothing at all. In the SocKETs project, dialogue is seen as a specific communication process involving a two-way exchange of knowledge, needs and concerns. A well-working dialogue can broaden worldviews, reshape perspectives and engage and enhance both cognitive and emotional capacities (Escobar, 2011). Dialogue is defined as 'meaning flowing through' in which the relational conditions are of importance. It requires collaboration of the dialogue partners to work towards a shared understanding of issues and perspectives with the goal to delve into common ground and differences. Dialogue enables mutual understanding and learning of each other's viewpoints (Escobar, 2011).

During dialogue, several dynamics are present, such as building a safe space, openness, respect, storytelling, listening, suspending automatic response, judgement, and certainty, collaborative inquiry, finding common ground and exploring differences, balancing advocacy and inquiry. It can lead to several changes, such as discovering crucial differences between people taking the 'same side', finding ways to work together despite differences and learn more about our experiences and our beliefs. It can potentially establish learning, finding alternative pathways, co-create meaning, defuse polarisation and build a common language (Escobar, 2011).

This approach of dialogue fits the SocKETs view on societal engagement. With a dialogue, in Escobar's meaning of the word, the aim is to facilitate an open conversation in which mutual learning can take place. Such interactions are normative and substantial, rather than merely instrumental. With a dialogue, participants and organizers alike are required to take the other party seriously and to be open to changing their own perspectives, thereby consequently going beyond engagement as a mere 'procedural response'.

3.1.3. Co-creation

Another approach that will be included in the SocKETs toolbox as a societal engagement tool is co-creation. Co-creation has a rich history that goes back well into the 20th century, with roots in a diversity of fields such as psychotherapy, open innovation, design and literary theory (Ind & Coates, 2013). However, the recent increase of interest in co-creation methods has emerged from its adoption in management science (Prahalad, Ramaswamy, 2002; Stroh, 2020). In the context of business management, co-creation is understood as the "active involvement of end-users in various stages of the production process" (Stroh, 2020, p.11). By involving future users, customers are expected to become more satisfied and more loyal, thus providing corporations a means to increase their competitive edge (Stroh, 2020; Voorberg, Bekkers & Tummers, 2015). Recently, co-creation has been adopted in other contexts as well, such as the public sector. This has enriched its meaning, but also has rendered it less well defined. According to Voorberg et al, co-creation still remains 'weakly conceptualized' for the public-sector context (Voorberg, Bekkers & Tummers, 2015).

In the context of the SocKETs toolbox, it is important to find a fitting understanding for using it as a tool for societal engagement. In this regard, we propose to take into account three considerations.

First of all, while in the business context co-creation is seen as a way to *involve users,* in the SocKETs toolbox we aim to *engage citizens.* Even though our targeted toolbox users are mostly from business contexts, we nevertheless thus intend to borrow from the public sector context for further developing co-creation tools, in which it is intended "mobilize (...) citizens to become an active part of the innovation process" (European Commission 2011, 30).

Secondly, businesses tend to use the method of co-creation in a *hierarchical* and *instrumentalized* manner. When understanding co-creation in the above management sciences definition, co-creation is conducted from the perspective of the organization, mainly interested in harvesting and selecting ideas they consider suitable for their product, while attempting to control the meanings associated with their brand. Users are then involved as workers, offering their creativity to firms, merely getting the 'intrinsic benefit of participation' in return (Ind & Coates, 2013, 88). It is not surprising then, that such a use of co-creation has been criticized for exploiting involved users "who gift their time and intellect for the benefit of organizations" (Ind & Coates, 2013, p. 86). This interpretation can be countered by adopting elements from the 'participatory design' approach (Bodker & Grondbaek, 1990) whose main goal is to *empower* workers and to *democratize* the developmental process by giving users a say in the development of the products that will impact their lives in the future.

By placing the values of creativity and collaboration center stage, Ind and Coates (2013) further counter the instrumental use of co-creation. Often co-creation has aimed to involve what businesses perceive to be the "lead user", selecting users on the basis of their creative skills. With such an approach it is assumed that creative processes are most successful when conducted by innovative individuals. Ind and Coates (2013), however, argue that creativity often occurs from collaborative efforts, undertaken in groups of people that trust each other: "breakthroughs come from 'group genius' not lone epiphanies'' (Ind & Coates, 2013, 91). Similarly, a core value of co-creation should be creativity, best stimulated in an environment in which there is no preconceived end point. In order to foster creativity as a core element of co-creation processes space for experiment is crucial, and relatedly space to play. This however, is often absent from processes of co-

creation organized in business contexts (Ind & Coates, 2013), because the instrumentalized use most common in such settings comes with placing rationality and organizational benefits center stage.

Aligning our position on these three considerations with the aim of societal engagement as described in the first subsection of this chapter will make co-creation a "force for participation and democratisation that (…) creates meaning for all, rather than simply an alternative research technique or a way of creating value through co-opting the skills and creativity of individuals" (Ind & Coates, 2013, 92). As such it will be a fitting tool for facilitating normative, substantive, timely and inclusive engagement.

3.2. Communicating societal engagement

With the SocKETs toolbox we intend to encourage a broad group of stakeholders involved in developing and applying KETs to use the provided engagement tools. This is a diverse group, consisting of stakeholders directly involved in the trajectories of KETs development or application, but also of policy makers involved in KETs regulation, procurers, or science and technology agencies that support secondary tasks of STI development. In this section we will present the diversity of understandings of societal engagement found in the six innovation ecosystem mappings conducted for deliverable 1.1. of the project. The section will be concluded with some reflections and suggestions on how to deal with these differences in the toolbox communication.

3.2.1. Views of engagement reported on in scholarly literature

In presenting the toolbox and communicating about its content, we should consider how to best deal with conceptual differences, and the related differences in motivation and rationales for engagement, between the toolbox designers (us) and the intended target group. Scholars (Hartley, Pearce & Taylor, 2016; Burri, 2017; Heltzel, Schuijer, Willems, Broerse & Kupper, forthcoming; Van Hove, Wickson, 2017) who have tracked the practical implementation of RRI ideals, have noted that the diverse ways in which stakeholders understand the relation between science and society profoundly shape how RRI ideals are enacted in practice. In task 1.1. of the SocKETs project we interviewed innovation ecosystem stakeholders of six different KETs case studies in six different European countries: three concerned with health care technologies, two cases with circular economy and new technologies for sustainable manufacturing and one case study with artificial intelligence (AI) for industrial automation. During the interviews among other topics, we addressed their experience with and interest in societal engagement activities. In this subsection we will closely compare the differing views of engagement that inform the SocKETs project and that are assumed among the ecosystem stakeholders.

For this purpose, we will use Burri (2017) who analysed how nanoscientists imagine interactions between science and society in early public engagement as a framework for exploring frames of the ecosystem stakeholders. Burri (2017) identifies five frames: the *normative, educational*, *paternalistic*, *elitist* and *economistic*.

The *normative* frame is common among RRI scholars and policy makers, and as such has informed the SocKETs project and will inform the content of the toolbox. In this frame, science-society interactions are considered to be complex. In the relation between scientific actors and societal actors, the counterparts shape each other. Citizens are seen as active co-creators in the process of determining the direction of science and society. Engagement with citizens is perceived to yield mutual learning and understanding.

In the *educational* frame identified by Burri (2018) engagement is seen as a way to educate the public. It is a unilinear process between unequal partners in which the public is the passive recipient of information. This frame considers two-way engagement with lay people unattainable.

The *paternalistic* frame shares many similarities with the *educational* frame. For example, they both consider it unfeasible for interactive engagement with citizens to have a substantive contribution to STI development processes. They differ, however, in how citizens are conceived within their frames. Whereas in the educational frame, citizens are imagined as "passive empty containers'' (p. 88) in need to be filled with scientific facts, in the paternalistic frame they are rather imagined as active participants, who have emotions, concerns and hopes. In the latter frame, engagement with science is seen as a process in which citizen concerns and fears should be taken away by addressing them. This can be done, for example, by giving space for asking questions.

Another alternative implicit model is represented by the *elitist* frame. The *elitist* model views science-society relations as complex and heterogeneous. The public consists of at least two different groups: ignorant lay-people without scientific knowledge and an educated *elitist* group with an interest in science and an ability to actively take part in gathering knowledge and informing themselves. According to the *elitist* view, engagement with the latter group would be feasible, but not with the former.

In the *economistic* frame lay people are framed not as citizens, but first and for all as consumers of new technologies. In such a frame the market thus plays a mediating role in the relation between science and society. This also shapes how possible engagement is perceived. As consumers, the main way to engage lay people in the process of STI development is through their economic activities, which is by definition late in the development trajectory.

In the SocKETs project, we need to be reflective of these different views of engagement in order to communicate effectively and mobilise industry actors and other stakeholders to start making efforts to engage citizens by using the toolbox. In the next subsections, we will first present the views of engagement found in the d1.1 deliverable as a sample of our future users, to subsequently reflect the differences and suggest some options for dealing with the differences.

3.2.2. Views of engagement in the SocKETs innovation eco-systems

In the interviews for deliverable 1.1. we found a subtle variety of frames and combinations thereof. First of all, some of the input from interviewees were aligned with the normative frame of engagement. For example, in the innovation ecosystem of the use of AI for manufacturing, interviewees noted to be "attracted by the possibility of having tools or methodologies that can help to integrate social values in their technological development or modifying biases derived from databases that can exacerbate algorithms". In the circular economy for the building sector case, an interviewee believed that sharing data early in the project with stakeholders and citizens, would enhance collaboration.

A second observation is that the elitist and educational frames were apparent in the outright rejection of co-creation as a suitable approach in the context of some of the case studies. Interviewees noted the absence of incentives and the inability of citizens to contribute to the process or to have a meaningful discussion about the technology.

In other interviews, thirdly, the educational frame was implied not in a rejection of engagement, but by perceiving it as having an educational function. This however was often conceived slightly differently from Burri's

(2018) educational frame. For example, Interviewees saw the educational value not only for citizens, but rather for public authorities involved as regulators in the building sector. In the AI for manufacturing case, another interviewee valued engagement as a way to increase technological literacy, not to enable seeing the opportunities of these technologies, but rather to see the risks and implications: "*AI is not neutral, and I think a debate is needed on its potential and associated risks that may arise if adequate governance mechanisms are not established".* Some snippets of the educational frame were found in how interviewees perceived engagement as user consultation. One of the interviewees believed that users do not know what they want or need. Engaging users is better used at the end of the development trajectory to explain how to properly use it.

The fourth observation is that the second most commonly adopted type of framing of engagement, as user consultation, seemed to be a synthesis of Burri's normative and economistic frames. Engagement as user consultation implies a normative frame because the citizens, understood as (near) future users of the technology, such as professionals in the building or health care sectors, and patients or workers that will use medical or manufacturing technologies in their daily lives, are seen as valuable sources of (practical and/or medical) information that is of substantial importance to the development process. As such, many of the interviewees had experience with forms of societal engagement as a non-hierarchical two-way communication process in which the goal is to gather information that developers lack (*normative frame)*. However, deviating from the normative frame, because such consultation is aimed at product improvement, interviewees indicated that it is only useful at the end of the trajectory, when there is a clear idea about how the product will work, or what it will look like. Engagement as user consultation also implies the economistic framing. Engaging users is not done for normative reasons, but for instrumental ones, since only citizens that will use or buy the product in the future are relevant. This resembles understanding lay people as consumers in Burri's (2018) economistic frame. In the context of the case studies, engagement as user consultation was done instrumentally to obtain information about the willingness of professionals or patients to use it in the future. Other instrumental reasons were brought up as well in the interviews. Engagement as user consultation was done to start new collaborations through presenting know-how, to anticipate possible practical and medical obstacles for the implementation process, to obtain co-creation testimonials or a 'hallmark' useful for marketing or funding purposes or in more general to "smooth the way to the market".

3.2.3. Communicating through differences

For the communication of the toolbox, it is important to be reflective of the likely discrepancy between the framing of societal engagement implied in the toolbox, and the kinds that intended users hold. As explained in the first section of the report, in which we addressed the content of the framework, as an RRI project, we aim to select tools that facilitate normative and substantive engagement. Substantive engagement is engagement of citizens as citizens, not merely as users, at a time when co-creation of decision making is still possible. This is important for reasons of democracy, equity and justice. We found that the innovation ecosystem stakeholders, as a sample of the potential future users of our toolbox, framed engagement differently.

One of the most important discrepancies that became evident in the above comparison of frames concerns the intended participants of engagement activities. Who should STI stakeholders engage? There is a widespread practice of engaging future users, for example in user consultations, yet, the normative reasons to also engage citizens in a broader sense of the word is often missing in how stakeholder imagined or experienced science-society interactions. The implied normativity and inclusivity of the engagement tools might thus be lost in the communication process.

The difference in intended participants in engagement activities (users vs broad range of citizens) can possibly be overcome by mobilizing the resemblance that we also noted in the above. In the health care innovation ecosystems, and to a lesser extent in the building sector, some awareness can be found that citizens (as

users) are an invaluable source of information, because developers are lacking it. This has prompted the interest in and appreciation of two-way engagement processes of innovation ecosystem stakeholders. Using conversation starters that draw on this resemblance can possibly create a bridge to the conflicting under-standings. For example, techno-moral vignettes (Rathenau, 2019) can be written that convince the reader that is it not only necessary to anticipate on the direct problems come up in use or implementation of the product but also on the broader, often more indirect impacts of technologies that concern broader groups of citizens, such as secondary environmental impacts, or radical changes in aspects of our daily, social and work life.

Another important difference concerns the appropriate timing of engagement. Finding the right window of opportunity is crucial in both the normative frame as the economistic frame, yet, what is considered "right" differs. In the normative frame it is a balancing act, finding a moment that is not too early, but certainly not too late; in the user-oriented frames it is crucial to engage participants late in the trajectory instead. The approach of Design for Values (Van den Hoven, Vermaas, Van de Poel, 2015) might be a source of inspiration for overcoming this problem. On the one hand it has many concerns in common with approaches such as technology assessment (Grunwald, 2015) and RRI, such as the importance for intervening early in the pro-cess. On the other hand, it shares a strong focus on products with the interviewed stakeholder. Adopting such an approach in for example a co-creation tool allows for finding a shared focus point - a bridge - while moving the engagement moment upstream.

These are two suggestions for finding ways to address and bridge differences with (elements) of the toolbox, without going against them or leaving the differences unaddressed. A more general recommendation for WP3 is to invest time and effort in finding creative ways to deal with likely differences between engagement frames of the toolbox designers and its intended users.

3.3.   Function, structure and curation

When building a toolbox there are many possibilities for organizing the presented tools and knowledge. As we described in the above, the RRI toolboxes that have been published online in the past years vary in how they intend its users to navigate the box. A toolbox can be a crash course (COMPASS), step-by-step manual (GoNano), roadmap (SISCODE, ROSIE project), decision support tool (ActionCatalogue) or thinking tool (Soci-etal Readiness Thinking Tool), an inventory of collected tools (RRI Tools) or of best tools.

When choosing a function for the toolbox, it is important to define our aim in as concrete terms as possible. For example, if we decide that it is crucial for engagement to be organized early, creating a decision support tool which asks users to indicate the phase of development is not a fitting function. The more specific we determine our engagement, target and participant group to be, the more static function we should choose.

A clear function and concretely formulated aim will also help to design a structure for the toolbox, and a method of curation. A click-through menu will suit a toolbox facilitating tools for a variety of phases of en-gagement, and diverse approaches to selecting citizen-participants. A static document will fit a more specific idea of what engagement entails, how and when it should be done. Similarly, the curation method is depend-ent on the formulated aim as well. The more specific our engagement requirements are, the more selective our curation should be. Do we intend to include any tool available, whether or not it enables facilitating normative, substantive, timely and inclusive engagement or not? Or do we want to include only approved tools? Or the ones that proved to be scalable? What should our selection threshold be?

We thus recommend to be reflective of our specific aims for and requirements of engagement, and in more specific, of the dialogue and co-creation tools included in the box, when making a final decision on the func-tion, structure and curation of the toolbox.

4.   Concluding remarks

We have set out to present a draft framework for the SocKETs toolbox, offering industry a set of tools for facilitating dialogue and co-creation for societal engagement in Key Enabling Technologies (KETs) consisting of four dimensions: content, communication, function/structure and curation.

Basing our notion of societal engagement on the RRI framework, we identified five important requirements: engagement needs to be done for normative reasons of justice, equity and democracy; it should be substantive, timely and inclusive. Furthermore, it needs to be feasible not only for policy or academic but commercial contexts as well. We noted several aspects of dialogue and co-creation that make such tools fitting for facilitating such engagement.

Comparing different frames of societal engagement in the SocKETs project itself on the one hand and in the innovation ecosystems of the six SocKETs case studies on the other, brought profoundly different notions of engagement to the surface. For the communication of the toolbox, it is crucial to be reflective of these differences and to find creative ways to deal with them.

For the last two dimensions, function/structure and curation, we called for formulating a concrete aim on the basis of the first two dimensions. Determining how strict we want to focus on the formulated requirements is important first, for deciding on the function of the toolbox, and relatedly its structure; secondly, its curation method.

As I final remark, we want to stress that it is important to keep re-negotiating the nature and implications of these dimensions. The toolbox will be further developed in several stages, interacting with multiple stakeholders, feeding an iterative process in which the different dimensions will be shaped and reshaped. The toolbox itself will be co-created to align with needs and interests of actors in the innovation ecosystems, including citizens.

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