SOCIETAL ENGAGEMENT
WITH KEY ENABLING TECHNOLOGIES

DELIVERABLE 1.2

Cultural conditions for public engagement in Key Enabling Technologies in industry

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1. Executive summary

Cultural conditions for public engagement in Key Enabling Technologies

This deliverable explores the cultural conditions for co-creation and public engagement with Key Enabling Technologies in industry in six European countries. It is part of the SocKETs project, which aims to contribute to opening up innovation processes in KETs innovation to a broad range of social actors, such as citizens, by creating a toolbox with dialogue and co-creation tools. Key enabling technologies are defined as knowledge and capital-intensive technologies, pervasive and with a systemic relevance for all industrial and economic sectors. Examples of KETs are advanced manufacturing systems, advanced materials, nanotechnologies, biotechnologies, the Internet of Things (IoT), blockchain technology, and artificial intelligence. These technologies potentially have a great impact on society and relations between humans and technology. Therefore, industry needs to consider priorities, expectations, and concerns of citizens in innovation processes by engaging citizens. At the core of the research work are six case studies in six European countries. Three case studies are concerned with health care technologies, two case studies deal with circular economy and new technologies for sustainable manufacturing and one case study deals with Artificial Intelligence (AI) for industrial automation. This deliverable is complementary to D1.1- mapping the innovation eco-system of the case studies.

1.1.1. Mapping the cultural conditions for engagement

The different relationships between science, innovation, technology and the public, influence how people view innovations and technology, but also influence their views on co-creation. These views are shaped by the historical context and dynamics present in different cultural settings. It is thus crucial for the quality of engagement to take the cultural factors into account. Mapping the cultural conditions enables adjusting and aligning engagement practices to them, contributing to the overall success of the project.

1.1.2. Sociotechnical imaginaries

For a holistic approach to explore cultural conditions of engagement, we have used Jasanoff's (2015) concept of sociotechnical imaginaries, which is based on the idea that the technical and moral-cultural world are deeply entwined. A sociotechnical imaginary is a collective vision of the future built on a shared understanding of the good life, and the role of science and technology therein. They give insight into the country-specific socio-technical conditions for engaging citizens in the development of technologies. In most societies several sociotechnical imaginaries co-exist. Identifying them will not only give insight into cultural aspects of a country, but more importantly, they give insight into how moral, social and cultural aspects are entwined with understandings of science and technology performed and expressed in policies and public opinion. From exploring the diverse insights into how governmental and industrial actors, and citizens understand their country's future and identity, themselves as a population and the role of science and technology therein, we can carefully draw recommendations on who to engage with what means, and how to take pitfalls and opportunities into account. The sociotechnical imaginaries are based on expert interviews in each of the countries and additional literature. The study does not give a complete analysis of all the sociotechnical imaginaries in these countries as the interviews and document review were limited. They do indicate the main tendencies and elements to take into account when organising engagement in these specific contexts.

1.1.3. Key observations

1. Bulgaria

In the Bulgarian sociotechnical imaginary technological advancement is depicted as a promising engine for accelerating the economic growth of a country lagging behind the others. Due to unstable governments, polarized politics and failed reforms of the past decades Bulgaria economic development has stagnated and the country is now in a demographic crisis.

The sociotechnical imaginaries of STI in general and eHealth in particular are offering both opportunities and difficulties. First of all, in the dominant sociotechnical imaginary expectations of the economic advantages of STI are rather large, possibly leaving little room for critical concerns of citizens. It is important in developing engagement events to make space for addressing possible negative impacts.

Secondly, while an attempt to engage citizens in science and technology that are not health related might be met with disinterest, in the specific case of eHealth there seems to be more at stake. By addressing issues such as accessibility and equity currently of concern in the context of the Bulgarian health care system might be a way of making the activities urgent.

Thirdly, a difficulty that might arise during the engagement activities is to overcome a disbalance between technology owner/developer on the one hand and citizen on the other. Another recommendation is thus, to carefully consider in the design and the processes of engagement how to create and maintain a balanced relationship between participating industrial actors and citizens, and to make sure that citizens engage even when they feel incapable for a lack of knowledge.

2. Denmark

In the Danish political and public sociotechnical imaginaries, the positive role of science and technology for prosperity of the country go hand in hand with an citizenry optimistic about the benefits of science and technology for the future. In the dominant sociotechnical imaginary, cultivated by the government, citizens are seen as important stakeholders in the country's development, who should be involved through culturally embedded and institutionalized two-way deliberation and participation practices. Even though the participation and deliberation practices seem to have been losing ground since around twenty years ago, currently they seem to be making a comeback. In the alternative industrial sociotechnical imaginary in contrast, the prominent role of science and technologies is accompanied by a much weaker sense of needed participation.

Based on the sociotechnical imaginaries in Denmark there are several issues of importance for successful engagement in eHealth. Firstly, Denmark has a strong culture of deliberation and participation, which results in the willingness of citizens to participate and speak up to authorities and experts. This indicates that engagement and co-creation practices for eHealth will not be hindered by a lack of interest or willingness to participate.

Secondly, although the Danish industry is quite open to customer consultation for enhancement of products, the wider notion of participation in which citizens become co-developer in the innovation process is less accepted. The industry is, therefore, more characterized by deficit thinking. This issue should be addressed when organizing engagement activities for citizens with eHealth in an industrial context.

Furthermore, Denmark is highly advanced in regards to digitalization and eHealth initiatives, but there seems to be a divide between higher educated citizens and lower socio-economic groups. This should be taken into consideration when organizing engagement practices by making sure that views of minority groups are sufficiently presented and addressed.

3. Estonia

The key storyline of Estonia's sociotechnical imaginary is that of a small (less than 1,5 million), relatively young (1991) but tech-savvy country that has managed to make a worldwide impression with its ICT-related policy achievements. Since the early 90s, when the country became independent and started its transition to democracy and a market economy, the Estonian government has been boosting the economy and its position as forerunner in the region by making deliberate STI-policy choices.

From Estonia's sociotechnical imaginaries a set of recommendations for public engagement in the circular economy innovation can be drawn. First of all, the positive role of science and technology can and should be taken as an opportunity. Most Estonians appear to have a positive attitude, and will probably not be averse to taking part in a project about technology, and in a process of collaboration with actors invested in innovating current practices.

A second recommendation is to be wary of the the dominant sociotechnical imaginary, cultivated by the government, being a double-edged sword. The populist sentiments and the quickly erupted discontent might indicate that the optimistic attitude towards technologies and the growing environmental awareness might be loud and dominant, but not as widely held as suggested. Estonians living in rural areas, and those from older generations, might subscribe to an alternative sociotechnical imaginary, making it harder to reach include them. It will probably require tailor-made efforts to motivate people from such groups to participate in events.

A third recommendation is to design engagement processes that give space to discontent without disregarding them as emotional or irrational. It should facilitate engagement without requiring specific engagement skills. Engagement tools should be adopted that are designed to map the concerns at the basis of strong polarized positions such as outright rejection of technological innovation, or of sustainability measures. The above gives reason to recommend investing in the activities to be as inclusive as possible, not only in terms of recruiting a diversity of participants but also in their design.

4. Italy

Italy's sociotechnical imaginaries have diverse and often conflicting characters. In highly industrialized areas, for example, with well-structured research and innovation systems, Science, Technology and Innovation (STI) is seen as playing a crucial role in producing and maintaining wealth, while in rural areas a more traditional and conservative economic system and culture can be found, in which the role of STI is seen as much less prominent. Another important division can be seen in the sociotechnical imaginaries played out by the media. On the one hand, a strong sense of distrust of the government and a gloomy image of the country's economic development is reproduced. On the other hand, in a contrasting sociotechnical imaginary a positive expectation of the future is depicted, presenting Italy as a country full of potential with several regions performing within or above the EU average in terms of both economic and science and technology development.

Based on the different sociotechnical imaginaries in Italy there are several issues of importance for successful public engagement within the case study new technologies for sustainable building construction. Firstly, engagement activities should leave room for multiple contesting sociotechnical imaginaries to emerge in order to address the underlying values, concerns and needs.

Secondly, Italy has strong regional differences both cultural and regarding policies. For successful engagement, the organizers should be aware of the region-specific policies and regional attitudes of citizens regarding engagement.

The third issue of importance is the industry (historically) playing an important role in the development of science and technology and often are initiators of Responsible Research and innovation initiatives. This finding indicates that certain industries in Italy are open for co-creation and participation methods, although this cannot be generalized to all industry sectors.

A fourth issue is the absence of a strong cultural tradition of deliberation and participation, although this is not the case for all regions. In addition, people can often be found to be sceptical towards motives and intentions for engagement practices for science but for industry as well. Therefore, it is of high importance to be transparent about the motives behind engagement and what will be done with the outcomes.

A fifth observation is that even though the Italian media refers to Italy 'lagging behind' in comparison to other European countries, the general public seems to view technology as a way to move out of this competitive lag. This suggests that there is a general interest in technologies to enhance the position of Italy, which also implies that there would be interest in co-creation and participation on these topics.

Specific attitudes or relevance for the case study are a sixth concluding remark. The differences between attitudes towards innovation between generations and a hesitancy and critical stance towards recycled materials should be taken into account when organizing engagement for sustainable building construction.

5. Serbia

In the nationally dominant sociotechnical imaginary in Serbia, also cultivated by the government, the assumption is present that technological development is inherently positive. It seems this imaginary roots in the past communist times, when technological development was a prestige project needed to prove communism as a successful socio-economic alternative. In this imaginary, technological progress is equated with economic growth. The Serbian public discourse seems to comprise a strong alternative imaginary in which science is distrusted because of its affiliation with the government, by many viewed as corrupt and hardly transparent.

Based on the sociotechnical imaginaries in Serbia there are several issues of importance for successful engagement in innovation processes of advanced technologies for health system improvement. Firstly, Serbia is a post socialist country, where many governmental processes are non-transparent and corruption is present. This has influenced the public perception of the government and affiliated organizations. Mistrust is expressed and this can potentially influence engagement practices if motives and intentions are non-transparent.

Secondly, in Serbia's healthcare system the doctor-patient relationship is hierarchical with the knowledgeable doctor seen as the educator of ignorant patients, or citizens. It is of importance to take this into account when organizing engagement activities with the industry. Using co-creation tools that put emphasis on reflexivity and equality will help make the process as inclusive as possible.

Thirdly, due to Serbia's history knowing both relative wealth and extreme poverty, a generational gap appears to be present. Namely, while elder Serbs still have lived experiences from these times, younger Serbs do not have this experience and therefore hold other views. Elder generations are more concerned about falling behind and experiencing poverty, while younger generations are more optimistic about the future. A similar division can be found among businesses, where start-ups are expected to be more more interested to engage the public for the greater good, in contrast to larger, older and more established companies, which focus mainly on profit and competitiveness. For

successful engagement it is important to take these generational differences into account and make sure that generations are sufficiently represented.

6. Spain

Spain's great regional diversity comes with a variety of regional sociotechnical imaginaries. For the Spanish case the imaginary of Basque country as the place where the research will be conducted is most relevant. The Basque sociotechnical imaginary is reflected in its identity as a forerunner in matters of technological innovation and industry, which is depicted as the main cause for the region being one of the wealthiest regions of Spain. However, this stands in stark contrast with the imaginaries co-existing in society, which can be characterized by distrust towards national and regional politicians, and possibly in technology and industry perceived as part of the same establishment.

Based on the Basque country's sociotechnical imaginary, we give three recommendations for successful engagement in AI development processe.

The first recommendation is to make the best possible use of Basque's orientation towards technology and industry when approaching citizens for engagement.

A second recommendation is to be aware of and anticipate the high levels of distrust of citizens and their governments. Rather than circumventing these issues, public engagement initiatives should aim to actively search for and explore these attitudes and identify underlying root causes.

The third recommendation is to be aware that only a moderate public engagement culture exists in Spain, and probably Basque Country. Thus, explicitly stating the incentives for and aims of the project, and issues at stake to different stakeholders can be important for successful engagement. Finding civil society organisations (CSOs) that may have something to win from their engagement may greatly benefit recruitment as well as the quality of the engagement process.

1.1.4. Conclusion: cultural conditions shaping engagement

In this deliverable we have explored a variety of sociotechnical imaginaries and the dynamics between them in the six different case study countries. Setting aside the nuances that come up with a more detailed view, four categories can be distinguished. First of all, in countries such as Bulgaria and Estonia we found a dominant imaginary in which technology has been attributed such an important role, respectively in establishing the new found identity, and for making a better future possible, that the inclusion of other imaginaries in engagement activities might require an especially targeted approach. In Serbia we found a dominant sociotechnical imaginary with a strong alternative imaginary. The dominant sociotechnical imaginary assumes that technological development is inherently positive, but the Serbian public discourse seems to comprise a strong alternative in which science is distrusted due to affiliation with the government. In our explorations of Spain and Italy another image emerged. Due to the strong regional differences in these countries it seems impossible to pinpoint a nationally dominant imaginary. The understanding of science and technologies' role in imaginaries of the future and identity and the space for more critical voices seem to differ among regions. The Danish case seems to represent a category by itself. In this case, including critical voices in the debate seems to be an inherent part of good STI policy in the nationally dominant view. The imaginaries that came up with the growing populist discontent in the beginning of the century seems to have been going against the embedded deliberation practices.

In order to successfully engage the public and meet the objectives for engagement which include considering priorities and concerns of the broadest range of actors, we have formulated a set of recommendations based on the dynamics of the sociotechnical imaginaries per country. When taking stock of the recommendations the following themes stand out: 1) the expected readiness of citizens to participate in co-creation activities, 2) industry attitudes, and 3) diversity of voices.

In regards to the first theme, in Denmark, deliberation is culturally embedded and therefore citizens can be anticipated be more willing to participate in engagement activities than citizens of Italy, Spain, Bulgaria, Estonia and Serbia. In the other countries, it might be required to develop other ways to motivate citizens to participate. Furthermore, mistrust might be an obstacle for finding citizens willing to participate in countries such as Italy, Spain and Serbia, where we found a certain degree of mistrust in government and industry. In these countries, sufficient attention needs to be paid to accommodating such mistrust in engagement activities as an important source of information about fears and concerns.

The different industry attitudes also play an important role in the formulated recommendations. In several countries, namely Denmark, Serbia and Bulgaria, industry displays one-way communication and participation attitudes. Lastly, to accommodate priorities and concerns of the broadest range of actors it is of high importance to include a diversity of voices. In several countries, such as Italy, Estonia and Bulgaria, dominant sociotechnical imaginaries or the presence of multiple contesting sociotechnical imaginaries call for the need to leave room for these to emerge during engagement activities. Furthermore, in several countries great differences are seen between generations or socio-economic groups. These differences are country specific but play an important role in inclusive deliberation and is an important theme that should be addressed.

Understanding the dynamics between sociotechnical imaginaries seems an important preparatory step for organizing engagement in science and technology. Digging into the imaginaries helps bring excluded voices into view and emerging discontent. These insights can feed into the process of designing the engagement activities, pinpointing where extra attention is required to enable engagement that is inclusive to the broadest range of social actors, priorities and concerns.

Contents

2. Introduction

This deliverable explores the cultural conditions for co-creation and public engagement with Key Enabling Technologies in industry. It is part of the SocKETs project, which aims to contribute to opening up innovation processes in KETs innovation to a broad range of social actors, such as citizens, by creating a toolbox with dialogue and co-creation tools. Examples of KETs are nanotechnology, biotech, 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. Therefore, industry needs to consider priorities, expectations, and concerns of citizens in innovation processes by engaging citizens.

Due to the importance of aligning innovative processes to societal values, needs and interests, many European projects have focussed on opening up science and innovation under the names of Responsible Research and Innovation (RRI) and Corporate Social Responsibility (CSR) and creating toolboxes for engagement activities. RRI is a concept mainly used by academics and policy-makers to introduce a framework to steer research and innovation activities towards socially responsible and ethically acceptable ends (Gurzawska, Mäkinen, Brey, 2017). Although many scholars and policy-makers have pushed the importance of RRI, it often remains a concept not widely integrated into the industry (Gurzawska et al., 2017). CSR is more widely accepted within industry. It deals with the prioritization of social goods beyond industries own interests, but often lacks measurable criteria (GA). To address the issue of co-creation uptake in industry, many EU-projects have focussed on engagement for one specific technology, such as nanotechnology (GOnano), biotechnology (PRISMA) or information technology (RRI Industry). In contrast to these initiatives, the SocKETs project focuses on co-creation in industry for a range of technologies, together categorized as Key Enabling Technologies (KETs). Hence this project focuses on co-creation activities in the innovation process of KETs.

In order to open up the process of scientific and technological innovation to a broader range of social actors, public participation methods, such as co-creation and dialogue between society and technology innovators have been developed (Llorente, Revuelta & Carrió, 2020). Co-creation is understood in a wide variety of ways in industry. On the one end of the spectrum, it is described as a process of consulting end-users about their opinions, ideas, and improvements of certain products and technologies. This might increase competitive advantage, yet it does not always lead to the actual incorporation of societal values and concerns in the innovation processes (Belal, 2002; Foster & Jonker, 2005). On the other end of the continuum, co-creation is seen as a way to actively and substantially involve citizens in the innovation process. In this way, citizens become co-developers, and as such their priorities, expectations, and concerns have an impact on the outcome of innovation process. As such co-creation can be used to align innovation processes to societal values, concerns, hopes and fears of the future (Salvioni & Almici 2020). In this report, co-creation is approached from the latter definition, thus as a two-way perspective, where successful engagement entails a process ofco-shaping the innovation process.

For successful co-creation it is of importance to take country and case-specific cultural conditions into account, as the cultural context is of great importance for the quality of engagement. What is the general attitude of citizens towards science and technology? How is their understanding of science perceived, both in terms of the processes and outcomes of research and innovation trajectories, and how do they perceive their own? How common are co-creation processes, or similar processes of

engaging citizens in science and technology? How can we anticipate the opportunities and benefits for organizing successful engagement that come with the specificities of such cultural conditions. For example, according to one of our interviewees, there is a strong cultural tradition of deliberation in Denmark, which is seen as an important part of general education. In contrast, the public engagement experts we interviewed about the cultural conditions in Italy indicate such a tradition is lacking in many Italian regions; people tend to question the purpose of engagement, especially if it is organized by industry or government, suggesting a different approach might be needed to engage the public. By exploring the relevant cultural conditions, public engagement practices can be adjusted and aligned according to these conditions, thereby contributing to the overall success of engagement practices.

Furthermore, until now most EU projects aimed at engagement in science and technology have taken cultural aspects into account, such as gender, religion etc. In the Gonano project, for example, countries were clustered in certain cultural groups, associated with specific sets of cultural values and prioritizations. Approaching the cultural aspects in such a way, runs the risk of reducing culture to a check-list of aspects. The cultural context of engagement is then made explicit, but a view on how such a context shapes and is shaped by science and technology is lacking.

In this deliverable we adopt a more holistic approach by not focusing on cultural conditions and technological development as two separate entities, but instead, by foregrounding how they are entwined in the different national contexts of the case studies. For this purpose, we use Jasanoff's (2015) concept of sociotechnical imaginary. In order to enable anticipation of opportunities and challenges for the public engagement activities of the project, we aim to sketch the contours of how in the six different participating countries cultural, social and historical conditions shape how technology is viewed and governed, and vice versa.

SocKETs project

The SocKETs project is carried out by several partners within the EU and will be executed over 3 years. SocKETs has four overall objectives: firstly, to develop a freely-available and easy-to-use toolbox for the industry to develop corporate social responsibility by working co-creatively with citizens on priorities, expectations, and concerns related to KETs. The second object is to test activities and tools for dynamic and co-creative citizen engagement in industrial technologies useful for industry and procurers. This will be done through a multi-stakeholder engagement process involving social sciences and humanities (SSH), research, industry, manufacturers, and professional users. Thirdly, to increase understanding among publics, innovators, and innovation networks on the challenges and opportunities of KETs for contributing solutions to societal challenges, and the priorities, expectations, and concerns of citizens. Fourthly, to stimulate commitment of industry actors and networks, procurers (e.g. cities, regions) to include two-way citizen engagement in their strategies for developing KETs solutions in the future.

At the core of the research work are six case studies in six European countries, each conducted by one of the partners or linked third parties. Three case studies are concerned with health care technologies, two case studies deal with circular economy and new technologies for sustainable manufacturing and one case study deals with Artificial Intelligence (AI) for industrial automation. Table 1 displays the topics per country and main technologies used in the case study. This deliverable is complementary to D1.1-mapping the innovation eco-system of the case studies.

By exploring the cultural conditions of the case studies, that is, the cases in which the engagement tools and activities will be tested, this deliverable is aligned with the first as well as the second objective. It will contribute to the development of successful co-creation practices for the toolbox, by focussing on the cultural conditions in which public engagement tools and activities will be tested.

COUNTRY	TOPIC	TECHNOLOGIES
Bulgaria	eHealth	ICT, IoT, Big data analytics, AI
Denmark	eHeath for monitoring and diagnostic solutions	ICT, IoT, AI
Estonia	Cicular economy	AM, AMS, LST
Italy	Circular economy in the building sector	AM, AMS, IoT, AI
Serbia	Advanced technologies for health care system improvement	AMS, Robotics, AI, Advanced Computing
Spain	AI for the future of work	IoT, AI, AMS, Robotics

Table 1: An overview of case-study countries, topics and technologies. (AM=Advanced Materials, AMS=Advanced Manufacturing Systems, IoT=Internet of Things, AI=Artificial Intelligence, LST=Life Science Technologies)

Covid-19

A year into the Covid-19 pandemic and governmental measures worldwide to contain it, its huge impacts on our daily research practices are becoming clear. Of special concern for this deliverable is how the pandemic will affect cultural conditions of public engagement. Even though it is too early to address this question in detail, we would like to make some general remarks on its possible effects.

In general, it seems likely that the ongoing and direct interaction between researchers, media and citizens in regards to Covid-19 measures will have an impact on the relation between science and society. How these impacts play out probably depends on a wide variety of factors. For example, it might depend on what role national governments have attributed and are still attributing to scientists in developing Covid-19 policies, how they were perceived and portrayed in the media, whether citizens (felt that they) were taken into account and the already existing levels of trust and distrust in authorities. The often-far-reaching measures, and the role of science and technology in informing such policies and implementing them, are met with approval by citizens who feel a need for protection and control of how the pandemic further unfolds. For other groups, these same measures have the opposite effect. They fuel the already existing distrust of the government and science and technology alike. Effects will thus be diverse, and currently hard to predict in much detail.

Reading guide

The deliverable first introduces the theoretical approach and methodology adopted for the research. In the results section, secondly, we explore the cultural conditions per country, and conclude each section with a recommendation for how to take our findings into account when organizing engagement activities. The concluding remarks will relate back to the theoretical approach, making a case for the importance of a sensitivity to the diverse socio-technical conditions, and the dynamics between them, for organizing effective public engagement.

3. Theoretical approach and methodology

Theoretical approach

In order to substantialize the above-mentioned holistic approach to explore cultural conditions of engagement, we have used Jasanoff's (2015) concept of sociotechnical imaginary. With the concept Jasanoff has shown that the technical and moral-cultural world are deeply entwined. A sociotechnical imaginary is a collective vision of the future built on a shared understanding of the good life, and the role of science and technology therein. As such, sociotechnical imaginaries play an important role in how national policies are shaped, but also how politicians and policy makers (publicly) legitimize policy choices. Sociotechnical imaginaries can thus be an interesting point of access to understand the differences and commonalities between Science, Technology and Innovation (STI) policies of different nations and to understand how countries are viewed internationally. More important for this deliverable, however, is that sociotechnical imaginaries, constructed and implemented by governments, have a significant impact on the views within a society about the role of technologies in the country's future and identity. As such, they give insight into the country-specific socio-technical conditions for engaging citizens in the development of technologies.

The concept of national sociotechnical imaginaries explains the endurance of how the entwined cultural and technical world are constructed and perceived on the level of national governments. Yet, in most societies other sociotechnical imaginaries exist as well. Nationally dominant imaginaries are often confronted with alternative imaginaries that contain a different and often clashing conception of what a good future entails and what role science and technologies (should) play in achieving it. Smallman (2020, p. 589) for example distinguishes between the "elite sociotechnical imaginary of 'science to the rescue'" that shape policies and the governmental machinery on the one hand and public imaginaries on the other in which fears and dystopian futures often play a more dominant role. In Smallman's (2020) research of UK public engagement activities organized by the government, the identified elite imaginary left little room for public imaginaries in which science and technology are typically seen as inherently problematic.

Exploring national sociotechnical imaginaries can thus be an important first step in preparing for the design, execution and evaluation of the public engagement activities in the countries of the SocKETs partners for two reasons. First of all, national governmental and public sociotechnical imaginaries give us not only insight into cultural aspects of a country, but more importantly, they give insight into how moral, social and cultural aspects are entwined with understandings of science and technology performed and expressed in policies and public opinion. As such, using the concept to direct our explorations of the cultural conditions of public engagement did not give a more in-depth or complete view of the cultural conditions but a more relevant one when aiming to identify opportunities and problems for societal engagement in science and technology. Secondly, the first sketch of the dominant and public imaginaries enables anticipating opportunities and challenges in the country-specific contexts for organizing processes of engagement. Smallman's (2020) research, showing that the elite imaginary-imposed limitations on substantially engaging with fears and concerns of citizens is just one example of this. From exploring the diverse insights into how governmental and industrial actors, and citizens understand their country's future and identity, themselves as a population and the role of science and technology therein, we can carefully draw recommendations on whom to engage how, and what the pitfalls and opportunities might be.

Methodology

As described in the above, the SocKETs project is aimed at engagement with a wide variety of Key Enabling Technologies (KETs) in different countries. The SocKETs partners, located in six European countries, each have taken on a different case study to identify similarities and discrepancies in co-creative practices. The following paragraphs describe the methodology that was used for exploring the cultural conditions that give shape to public engagement with KETs in these countries.

3.1.1. Data collection

First, a series of expert interviews were conducted to get an expert view on the public perception of science, public engagement and the perspective of industry in each of the countries. Interviewees were firstly selected on the basis of advice from consortium members, through our own network and by scanning relevant articles published on the topic. The final selection was made taking the content of the specific case studies into account. In two countries we conducted one expert interview (Serbia, Bulgaria); in the four other countries two (Spain, Denmark, Italy, and Estonia). Interviews were semi-structured. The topics addressed in the interview guide were drawn from Jasanoff's concept of the sociotechnical imaginary (2015). In addition to the interviews, a document analysis was carried out. Through desk research and snowballing, peer reviewed scientific papers were collected and included in the analysis. Recommended papers by interviewees were also included. Finally, cultural documents such as newspapers were analysed too. As becomes clear from this description, the interviews and document analysis informed each other in an iterative document collection process.

3.1.2. Data analysis

A coding scheme was designed for the analysis of the summarized interviews, peer reviewed scientific articles and policy reports. The coding scheme was constructed by departing from the notion of socio-technical imaginaries as introduced by Jasanoff (2015) and used by Whittrock et al. (2020) who have researched the uptake of RRI in different countries based on the identified sociotechnical imaginaries. The final coding scheme consisted of four pillars: images, stories of the past and the future, policy structures and goods and values. With these codes we captured how the interviewees of different countries make sense of the past and future of their country by relating events, views of science, technology and innovation, citizens and goods and values. The coding process and data analysis were iterative processes in which we strived to remain flexible and responsive to the insights we gained about each country and its cultural conditions as these required different emphases and nuances in their documentation. Finally, the upcoming results section touches upon the four pillars from our coding scheme throughout the description of the role of technology development and public engagement in each country.

3.1.3. Limitations

With the deliverable we offer a first sketch of the interacting sociotechnical imaginaries in the countries of the case studies. These studies do not give a complete picture given the limited time and resources to conduct the research. In order to get a more comprehensive view on this matter more interviews and a more extensive document analysis is required.

4. Results

Introduction

To adjust public engagement practises to cultural conditions we describe the sociotechnical imaginaries identified in each country with special emphasis on the case study subjects. To understand these imaginaries, they are placed in a historical context, while exploring the specific cultural conditions and how these are shaped through history. A first glimpse is offered of how current STI policies and national industries are shaped in a historical development, and of views and perceptions of citizens regarding public engagement practises and new technologies. In the concluding subsections of each of the country sections, recommendations for successful engagement are suggested as related to the key elements of the sketched sociotechnical imaginaries.

Figure 1: countries of the six SocKETs case studies

4.1.1. Bulgaria

In the dominant sociotechnical imaginary of Bulgaria, technological advancement is depicted as a promising engine for accelerating the economic growth of a country lagging behind the others. Due to unstable governments, polarized politics and failed reforms of the past decades Bulgaria economic development has stagnated and the country is now in a demographic crisis. The Bulgarian case study is focused on eHealth, more in particular on KETs such as the Internet of Medical Things, Telemedicine and mobile devices for health indicators that are developed by private companies (SocKETs, 2021). In order to anticipate opportunities and difficulties in organizing public engagement in the development of such eHealth applications, this chapter we will explore the dominant sociotechnical imaginary and emerging alternatives.

1. Engine to prosperity

In many regards, Bulgaria had a good starting position in the early 90s at the beginning of its transition to democracy. Yet, this beneficial starting position has not resulted in a frontrunner position in the process of transition. In EU lists, whether they concern the economy, STI, health or health care, the country often finds itself (among the members) at the bottom. Many have blamed Bulgaria's slow transition, and technological and economic development, to the country's political instability and its economic and demographic difficulties. In the first decade of the new century, no party was able to win two consecutive elections (Karasimeonov & Lyubenov, 2013), and in the short period from 2013 to 2017 there were two changes of government (Dimova, Rohova, Koeva, Atanasova, Koeva-Dimitrova, Kostadinova & Spranger, 2018, p. xvi).

The transition to a market economy was difficult for Bulgaria. During this period, which included a negotiation process with the EU, coherent legislation was installed forming an adequate base for scientific and technological development. The problem, however, was a lack of human resources due to emigration, which started after the transition. This resulted in a significant decline of Bulgaria's population. In 1989, when its transition to democracy started, Bulgaria was inhabited by 9 million people; in 2018 by 7 million. The past thirty years, Bulgaria went from the lowest unemployment rate among EU countries to a peak in 2001 when 19.3% of the population was unemployed. In 2018, after a period of decline, it was 6.8%. Bulgarian wages are now among the lowest in the EU (Damianova, Hajdinjak, Evgeniev, Ivanov, Shentov, 2018, p.14), with an exception of IT, financial and pharmaceutical sectors (personal communication with project linked third party). But the ongoing emigration of young Bulgarians, the "brain-drain" as denoted by an interviewee, has been damaging for a number of professional sectors. For example, in combination with the decreasing numbers of Bulgarians enrolling in a university program, it has caused the STI-sector now "lacking human resource capacity" (Damianova et al., 2018 p.14). A report notes that Bulgarian research institutes have been ranked as one of the least competitive in the EU; partnerships between business and science are scarce (Damianova et al., 2018). This is due among other reasons to a lack of interest in applied technical sciences caused by an underperforming industry and of links between research and industry (personal communication with linked third party).

The slow and for some disappointing transition has fed into the dominant sociotechnical imaginary that poses science and technology as the much-needed means to overcome the position lagging behind. The fact that Bulgaria in one way or the other is lagging behind the (other new) EU member states is mobilized as an important argument for making the knowledge economy top priority. For example, The National Strategy of Scientific Research to 2020 notes that of all EU member states, "Bulgaria had the lowest GDP per capita" when "the financial crisis broke out", and it has one of the

"slowest growing economies". Relating this to another contrast, the low share of "high technology manufacturing exports" (only 3.57 % in contrast to the new EU members average of 6.5% and the EU of 15%), forms a solid ground for a call to stimulate STI as important drivers for a flourishing economy (Ministry of Education and Science, Republic of Bulgaria, 2017). In a report about the uptake of Responsible Research and Innovation in a range of countries worldwide the STI policy of the Bulgarian government is emphasized to be not an attempt to improve or maintain their competitive position, but to build it up (Wittrock, Forsberg, Pols, Macnaghten & Ludwig, 2020). In a paper on e-health and e-government in Bulgaria (Hadjitchoneva, Ivanov & Hadzhiev, 2020, p.3) the current phase of the Bulgarian economy is characterized as one of "'catching up' economic development and market economy". What this shows is that for Bulgaria, a country that since the financial crisis has been struggling to keep up with the other EU member states, stimulating STI development has become an important and promising means to recover from the setbacks.

In the above sources, forms of STI are mobilized for gaining public goods such as competitiveness, wealth and economic growth. The relation implied between STI on the one hand, and wealth on the other hand is linear. If only the government manages to boost the STI development, the backward position of Bulgaria in regards to its economy will be overcome. The subtitle of the latest national strategy document (Ministry of Education and Science, Republic of Bulgaria, 2017) for Bulgarian science policy is telling in this regard: "Better Science for Better Bulgaria". This shows how in policy Bulgaria is focused on STI as having the potential to become a strong and successful solution to the country's problems; it is seen as the "engine" of the economy. As soon as the government gets the engine running, the processes needed to build competitiveness, maintain it, and excel in it, will be accelerated; further economic development will follow.

2. Health care

The above-sketched Bulgarian sociotechnical imaginary cannot be directly translated to the eHealth context. The sociotechnical imaginaries that play out in eHealth contexts are most likely also shaped by how Bulgarian policy makers and politicians on the one hand and citizens on the other perceive (the state of) healthcare and is thus, of importance for anticipating on opportunities and pitfalls for public engagement.

Since 1998 the health care system in Bulgaria is in transition from a universal health care system funded and owned by the state to a hybrid system with both public and private funding (Varnai, Nausedaite, Beckers, Madubuko, Terrier, Zoboli & Eljas-Taal, 2019). Primary, dental and pharmaceutical care, some outpatient and hospital care are privatized. The academic hospitals and other national care centers, however, are still owned by the state (Dimova et al, 2018). In this system, health care costs are paid by the compulsory health insurance, voluntary insurance or directly by the patient (out-of-the-pocket payments) (Dimova et al, 2018).

With 8.1% of the GDP, health care spending is well under the EU average. Yet, the past 15 years has shown a steady growth that outpaces the growth rates elsewhere in Europe except for Romania. What stands out in this growth is that an important share consists of out-of-pocket payments, which poses a burden on household expenditures, thus, creating a strain on the accessibility of care. For example, there is a maximum of patients that a general practitioner can refer to the hospital paid by the SHI, but for wealthy patients who can pay out of pocket, there is a way around it through private clinics or the

emergency room. This is reflected in the large discrepancy between unmet medical needs between high- and low-income groups (OECD, 2018). While on average the unmet needs have decreased considerably in the past years, there is still a large group of Bulgarians that reported to have refrained from getting medical care because of the costs.

An important problem of the Bulgarian health care system is that it is hospital-centred: while there are many hospital beds and a high number of hospitalizations in comparison to other countries, the primary and preventive care sector is relatively weak. This is reflected in the Bulgarian life expectancy. Even though it has gone up considerably since 2000, Bulgaria still has the lowest of EU member states. The cause of the lower life expectancy can be related to the prevalence of risk behaviours, such as smoking, poor diet and alcohol consumption, but the high mortality rate from treatable diseases is an indicator of the relatively weak primary care sector: they fail to diagnose and treat patients in time. Another indicator is that a fifth of the hospital procedures could have been conducted in an outpatient facility, while one tenth could have been prevented by timely outpatient care. In 2016 reforms that addressed these inefficiencies were stopped by the courts after they were resisted by important stakeholders (Dimonova et al, 2018).

The health care sector suffers from the consequences of the high emigration numbers as well. Bulgaria has high quality medical schools, but many of the graduates emigrate after (interview). In a report about the Bulgarian health care system, it is noted that while there are relatively many health professionals in Bulgaria, there is a shortage of nurses and general practitioners, which is especially problematic because of their uneven distribution throughout the country. As a consequence, in the rural, less affluent, parts, general practitioners serve longer lists of patients. The government has taken measures to make both professions more attractive. This resulted in an increase of the number of graduates in nursing and general practice care, but the effects are diminished by emigration and urbanization (OECD, 2019).

Ehealth has been a topic in strategic reports and in government policies since 2006 when a national strategy for eHealth was developed and approved by the government (Dimonova, Rohova, Koeva, Atanasova, Koeva, Pantelli & Van Ginniken, 2012). Some initiatives were taken to encourage the digitalization of work processes and infrastructures, but in a 2018 report it was noted that by now achievements are only partial (Dimonova, 2018); few concrete steps were taken to actually implement the plans. In 2018 information systems operated by professionals were still fragmented, information from different health care providers was being collected and consolidated by national organizations, but there was no unified system. By now, more policy documents have appeared that announced scaled down ambitions, but in an EU-report comparing Bulgaria to Finland, Estonia and Slovenia from 2019, the country is still noted to be lagging behind considerably.

In the meantime, the slow pace of the public initiatives has caused private providers and health care businesses to jump in the void, developing and implementing their own small-scale solutions. Even though these initiatives have value locally, they cause the field of eHealth to be rather fragmented. Future integration efforts will probably be hampered by the incompatibility of data formats and information standards (Varnis, 2019).

3. Engaging in eHealth development

In the above identified dominant sociotechnical imaginary, STI is seen as an engine for creating wealth and prosperity, for bringing a better future. This is reflected in how public participation in science is widely understood in Bulgaria. The importance of encouraging and facilitating public participation is broadly agreed upon, but mainly to "secure public trust in science and to generate legitimacy for STI policy" (Wittrock et al, 2020, p.82). Another important motivation is to stimulate public participation according to an interviewee is the earlier mentioned brain-drain. Awareness and understanding of science that comes with such participation might encourage young Bulgarians to choose a scientific career, improving both their own life and the state of Bulgarian knowledge economy. However, despite the above agreement on the importance of participation, there is also scepticism about the knowledgeability of the general public to meaningfully engage in dialogue with policy makers and scientists about science (Damianova et al., 2018).

Views of science and technology in general cannot be translated directly to the context of the case study, eHealth, due to problems in Bulgarian health care. As mentioned in the above, for many Bulgarians health care is not always accessible because of the costs, or the uneven distribution of doctors over the country, which has become even clearer during the Covid-19 pandemic (interview). Thus, the quality and accessibility of care is not the same for everyone with considerably large differences between high-and-low-income patients and between patients living in rural areas versus patients that live in cities. While most reports (et al, 2019) hold the unstable government responsible for the current health care problems and the failures of the health care system – one report, for example, mentions that the Ministers of Health are often in office for not more than two years, which makes them focus on quick wins instead of long and complicated reform processes - according to an interviewee the media have a tendency to focus on the failures of individual doctors. This has been detrimental for citizens' appreciation of doctors. Citizens tend to see them as profiteers that are motivated to make money more than to care for people. Besides this more general view of health care, there is a small group of Bulgarians who chose to be uninsured not because they cannot pay the monthly costs, but because they do not trust the insurance system (OECD, 2019, p.16).

The discontent about the current state of health care might be feeding into alternative sociotechnical imaginaries revolving around eHealth. As one report (Varnai et al, 2019) states, the patient perspective on eHealth technologies determines whether it will be adopted and used effectively. Varnai et al (2019, p. 49) refer to a recent study, which showed a "distinct dissatisfaction" with eHealth applications in Bulgaria, resulting in a low usage of services. The study also reported low familiarity with the term "electronic health care" (56%), and as much as 94% responded to not having been informed about its benefits. However, these negative views about eHealth care mostly about the applications introduced by the state, e-prescriptions, e-dossier, and others, because they are informed about those in the media. The eHealth applications of concerns in the case study, such as Internet of Medical Things, Telemedicine, and mobile devices for health indicators developed by other players, are quite unfamiliar, except for the telemedicine platforms that became popular during the Covid crisis.

To conclude this section, the analyzed reports are unanimous in calling for reforms of the Bulgarian health system in general, and the eHealth initiatives in particular. Two of these reports also emphasize the need of public support. Dimonova et al (2018) calls for a "dialogue with citizens and professionals" as an important condition for reforms to be successful. The required reforms are substantial, and thus require not only "political will" but also "public support" (Dimonova, 2018, p. xxiv). Similarly, Varnai et al (2019, p. 21) refer to an eHealth monitor that encourages the involvement of patients and professionals in the "design, development and testing phases" of new eHealth technologies.

4. Recommendations

The sociotechnical imaginaries of STI in general and eHealth in particular are offering both opportunities and difficulties. First of all, in the dominant sociotechnical imaginary expectations of the economic advantages of STI are rather large, possibly leaving little room for critical concerns of citizens. It is important in developing engagement events to make space for addressing possible negative impacts.

Secondly, while an attempt to engage citizens in science and technology that are not health related might be met with disinterest, in the specific case of eHealth there seems to be more at stake. Bulgarians are rather strongly concerned with health care and possibly also with technologies aimed at improving their personal everyday experience of it. A mixture of concerns with the current state of the health care systems, daily nuisance for people in need of receiving it, and the prevalent optimistic view of science and technology might be a stimulation for citizens to participate. From this opportunity we can draw the recommendation to specifically address the current issues of concern in the context of the Bulgarian health care system. For example, the events could focus on issues of health care accessibility and equity. Or they could take a more practical focus, such as exploring the value of eHealth for the underdeveloped parts of the health care system, such as preventative and primary care. Another issue of Bulgarian health care, especially of the past eHealth initiatives, is its fragmented character. To prevent further reproducing this fragmentation, an interesting option would be to take a more holistic approach: rather than focusing on individual technologies it might be worthwhile to consider the effects of larger interventions, or on the impacts of a set of eHealth technologies together on the future of Bulgarian health care.

Thirdly, a difficulty that might arise during the engagement activities is to overcome a disbalance between technology owner/developer on the one hand and citizen on the other. During engagement events, the knowledgeability of citizens might be downplayed by industrial participants *and* notably the citizens themselves. Another recommendation is thus, to carefully consider in the design and the processes of engagement how to create and maintain a balanced relationship between participating industrial actors and citizens, and to make sure that citizens engage even when they feel incapable for their supposed lack of knowledge. Importantly, the aim of engagement should go beyond encouraging eHealth use and raising interest for an eHealth career, towards substantial engagement in the development process.

4.1.2. Denmark

In the Danish political and public sociotechnical imaginaries, the positive role of science and technology for prosperity of the country go hand in hand with an optimistic citizenry. In the dominant sociotechnical imaginary citizens are involved in the country's development through culturally embedded and institutionalized two-way deliberation and participation practices and trust in the government. Even though the participation and deliberation practices seem to have been losing ground since around twenty years ago, currently they seem to be making their comeback. In the alternative industrial sociotechnical imaginary in contrast, the prominent role of science and technologies is accompanied by a much weaker sense of needed participation.

In this section, the different Danish sociotechnical imaginaries are related to the Danish case study which deals with eHealth for monitoring and diagnostic solutions. These new technologies can reduce healthcare costs and overall increase healthcare quality. eHealth is currently having significant technological, economic, cultural and ethical impact on the Danish society. There is an increase of digitalization and new technologies being developed, and we see this continuing in the years to come. Implementation of eHealth into society has implications that need to be addressed with the development of new technologies.

1. Danish cultural heritage

Horst (2012) traces Denmark's tradition of deliberation back through history to the cultural heritage of priest, poet, and politician Grundtvig (1783- 1872). He advocated an educational philosophy based on the idea that knowledge comes from the ordinary life of the common man, encouraging lay-people not to take the advice of authorities for granted and to formulate their viewpoint by deliberation among themselves. Embedding these concepts in the folk high schools, Grundtvig's ideas became part of the Danish educational system. In 1844 the first folk high school was established. It was common for young Danes to attend these for one year in addition to the regular curriculum, being educated in science and technology, 'active humanism' and 'life-long learning'. In the current Danish education people are still encouraged to collaborate and deliberate. Although many Danes are not actively aware of this cultural history in current times, Danes in general do not seem to hesitate to formulate their opinions or speak-up to experts or educated people and often seem willing to participate in engagement activities. This suggests that the heritage of Grundtvig might be deeply embedded in the cultural landscape of Denmark and still influences engagement practices to date (Horst, 2012; Horst, 2014; interview).

2. Institutionalization of deliberation practices

In line with the tradition of Grundtvig, in the Danish governmental sociotechnical imaginary there seems to be considerable space for dialogue and collaboration between parliament and stakeholders, civil society organisations with a culture of public hearings (internal communication with project partners). This is also illustrated by the establishment of two institutes that safeguard the public goods of deliberation and participation (Hetland, Kasperowski & Nielsen, 2020). In the 1980s, the Council of Ethics was established, to address ethical considerations for science and technology. Its establishment was triggered by controversies around medical technology, such as the first Danish in-vitro fertilization (IVF) baby in 1983, which gave rise to controversies regarding medical authority, access to reproductive biomedicine, and the changes it might bring in individual and social identity (Horst, 2012; Mohr & Koch, 2016). And in 1985, the Danish Board of Technology (DBT) was established, with the aim 'to follow and initiate comprehensive assessments of the possibilities and consequences of technological

development for society and citizens and to support and encourage a public debate on technology' (Klüwer, 1995). Over the years, the DBT is internationally recognized for the format of participatory consensus conferences, where citizens take the centre stage in deciding which arguments hold important information for a shared understanding of the technology. These citizens do not have expert knowledge on the topic or other interests involved (Horst, 2012).

According to Horst (2014) at the beginning of the 21st century a decline in interest in deliberation and a move to more one-way communication of science and technology was observed throughout the country. There seemed to be a decline and ignorance of the long-standing cultural embedded deliberation and participation (Rask et al., 2012). Science communication became less connected to institutions of democratic participation and more to the branding of organizations and research groups (Horst, 2012). Although according to one interviewee a rise in deliberation and participation has again been observed in the past five years. Horst (2014) warns that the institutionalization of deliberation practices in Denmark and the decline in interest and funding for such institutions indicates that although engagement is deeply embedded, it is not always a priority in society and might even be taken for 'granted', resulting in a decline of engagement practices. Therefore, it should be taken into consideration that even though engagement is culturally embedded, this does not necessarily mean that it receives much attention or appreciation. Efforts to organize, motivate and show the wider benefit of engagement are therefore still of importance and should be taken into account when organizing engagement activities.

3. ICT and eHealth industry

The wider trend starting around 2001, of less attention to deliberation and a move to more one-way communication and participation, is also seen in industry perspectives. One-way communication is based on the underlying idea that the public mainly lacks explanation or education on certain topics. A lack of understanding is used as an explanation for controversies or contesting beliefs in the public debate. According to two interviewees these views are observed in industry's arguments, stating that the public lacks knowledge and understanding, which in their view should be addressed by informing and explaining to the public. Despite the long-standing cultural tradition of deliberation and participation, industry seems to mainly focus on consumer consultation but not on involving the 'wider' public. Participation in which citizens become co-developer in the innovation process appears to be less accepted in industry.

Regarding eHealth, Denmark has an international reputation of being a fast adopter (Bertelsen & Tornbjerg, 2015). Denmark is one of the countries with the most advanced ICT development. Much personal data is stored online, such as digital signatures, Electronic Health Record (EHR), and national ID systems, which are all introduced by the government while benefiting the industry as well (Igari, 2014). Although ICT is widely used, it is not without controversies. In 2015 medical and personal sensitive information was collected and stored on the database of a private company, which was used for public research and research funded by private medical companies. This scandal gave rise to public debates on privacy and data sharing (Deget, 2015).

4. Danish views on eHealth and public engagement

Even though the controversy regarding sensitive medical data used by private companies has put larger themes regarding citizenship and attitudes toward technology and engagement on the agenda, Danes still have rather positive attitudes towards eHealth. Most people indicate to be in favour of the use of eHealth and regard this technology as a potential opportunity to enhance the quality of care (Bertelsen & Tornbjerg, 2015). In Denmark, a range of personal data is gathered by the government and

often shared between governmental bodies and private institutions. Trust in the government is high, with a low perception of government corruption. Therefore, trust seems to be an essential feature in the sociotechnical imaginary of Denmark for engagement in eHealth, which also explains the advanced user-centred ICT developments in Denmark (Igari, 2014).

Among groups of citizens from lower socio-economic backgrounds however, greater distrust in government and eHealth can be found. These citizens are often not using eHealth, but have the least resources and the largest health problems. This shows the emergence of an alternative sociotechnical imaginary in which science and technology are perceived with inherent and recurring problems. The contrasts between the two sociotechnical imaginaries raise the question which groups are empowered by the use of eHealth and which are not, and calls for an inclusive approach when organising engagement practices (Bertelsen & Tornbjerg, 2015).

Regarding the attitudes towards engagement and participation, it stands out that most Danish citizens seem willing to participate and give their opinions, which is in line with the cultural tradition of Grundtvig. One interviewee mentioned that people appear not to be afraid to challenge or disagree with professors or other experts. Furthermore, a central idea of deliberation is in place, where the focus is on finding a solution that works for everyone instead of trying to reach a consensus (Horst, 2012). Therefore, the Danish public socio-technical imaginary is characterized by open attitudes of citizens and high trust in government and technology.

5. Recommendations

Based on the sociotechnical imaginaries outlined in this chapter, there are several issues of importance for successful engagement in eHealth in Denmark. Firstly, Denmark has a strong culture in deliberation and participation, which results in the willingness of citizens to participate and speak up to authorities and experts. This finding suggests that engagement and co-creation practices for eHealth will not be hindered by the lack of interest or willingness to participate of citizens.

Secondly, although the Danish industry is quite open to customer consultation for enhancement of products, the wider notion of participation in which citizens become co-developer in the innovation process is less accepted. The industry is, therefore, more characterized by one-way communication. This issue should be addressed when organizing engagement activities for eHealth in the industry and poses difficulties regarding the motivations and intentions of the industry to engage in co-creation and participative methods.

Furthermore, Denmark is regarded as highly advanced concerning digitalization and eHealth initiatives, but there seems to be a divide between higher educated citizens and lower socio-economic groups. This finding should be taken into consideration when organizing engagement practices in which the views of minority groups should be sufficiently presented and addressed.

4.1.3. Estonia

The key storyline of Estonia's socio-technical imaginary is that of a small (less than 1,5 million) tech-savvy country that has managed to make a worldwide impression with its ICT-related policy achievements. Since the early 90s, when the country regained its independence and started its transition to democracy and a market economy, the Estonian government has been boosting the economy and its position as forerunner in the region by making deliberate STI-policy choices. The Estonian case study in the SocKETs project is focused on KETs for circular economy, such as advanced materials, for example plastics made from fishing industry waste and new materials made from wood, and produced by advanced manufacturing technologies (SocKETs, 2021). In order to anticipate opportunities and difficulties in organizing public engagement in the development of such technologies, we explore the broader national governmental sociotechnical imaginary mostly built around the ICT accomplishments and its resonance in the technology for sustainability sector. In the course of the chapter alternative imaginaries present in Estonia will be addressed, as well as its dynamics with the dominant imaginary produced by the government.

1. Estonian Tiger Leap

In "the tiny post-Soviet nation" that "found the way of the future" (Heller, 2017), citizens can vote online and on the same platform challenge a parking ticket. The ICT developments of the Estonian government, which started in the early 90s and has now resulted in most governmental services being offered online, did not stay unnoticed. In academic literature (Kattel & Mergel, 2019; Runnel, Pruulmann-Vengerfeldt, & Reinsalu, 2009) and international media (Crouch, 2015; Gaskell, 2017; Heller, 2017; Scott, 2014) the Estonian digital achievements were heralded as a great success story (interview). In the New Yorker the development was denoted the "Estonian Tiger Leap" referring to the governmental program with that name implemented in the 90s aimed at ensuring all schools in the country getting internet access. The Estonian ICT achievements are of importance for understanding the governmental sociotechnical imaginary, because they have had a significant impact on the nation's current identity.

Focusing on the digitization of the public sector was a deliberate plan of the post-Soviet era governments. After the most significant disruptions of the democratization and transition to capitalism had settled, the upcoming ICTs became a key issue for Estonian policymakers. ICTs were seen as an important driver of economic success (Runnel et al., 2009). In policy documents ICTs were presented as crucial for boosting Estonia's "competitiveness, democracy and educational system" (Olesk, 2020, p. 287). The numbers from the late 90s about computer usage already show how quickly the policies had effect. Before the end of the 90s, Estonia was ahead of other Baltic countries in terms of "internet use" among the population, "the use of internet for communication" and "the use of internet for banking", etc. Ten years after ICTs policies were launched, the Lisbon Review positioned Estonia as the 12th most competitive state of the European Union, the highest among countries that became member states in 2014 (Runnel et al., 2009). The economic success of Estonia is widely attributed to a competitive edge related to its leading position in regards to ICTs (Runnel et al., 2009, p. 31).

Importantly, the successful ICT policies enabled a thriving ICT industry (Kattel & Mergel, 2019). According to one of our interviewees, there is not much research and development in Estonian industry, mostly because the country is too small for such investments, yet the sector providing ICT for digital public sector services, such as blockchain, encryption technologies and digital infrastructures is

an exception. Estonia has a young and vibrant start-up community involved in developing these digital tools for the Estonian e-democracy (interview).

As part of this socio-technical imaginary, the Estonian reputation for quickly becoming a significant player in a technology field is resonating in expectations about other technology sectors, such as in the eco-innovation sector relevant for the Estonian case study. The country does not "capitalise on its full potential, which particularly lies in digital readiness and associated skills" (Beckers, 2020, p. 5), according to a country profile of Estonia's position on the European eco-innovation index. Estonia improved its position in comparison to the previous year, and it has outpaced other new member states, but the fact that the country is falling behind the EU average is taken as a disappointment because of its leading position in digitization.

2. Views of science and society

Of importance for further understanding the socio-technical imaginary dominant in Estonia, and thus how Estonians view innovation, is the disruptive 20th century development of the Estonian sciences and its relation to society. The Estonian scientific community first took shape during the country's first period of independence, in the interbellum. Then, the focus was on the so-called national sciences, such as Estonian history, culture, nature and applied sciences such as agriculture. Aiming to do significant work in the fundamental sciences, such as physics, was seen as unfeasible because of Estonia's small size (Olesk, 2020). When the country was occupied by the Soviet Union after the second World War, not much was left of the scientific community. Many elites who had been working in science had fled, were persecuted or died. Part of the larger Soviet Union, science was built up again following Soviet standards. Being part of the larger Soviet science community, there was much more emphasis on fundamental sciences. Scientific and technological development became an important governmental concern for geopolitical reasons, and were centrally led and controlled by the Soviet government with little space for the Estonian scientific societies that were initiated in the first period of independence. The transition to a market economy in the early 90s was another disruptive change for the sciences. They had to be rebuilt again, now according to the Western model structured around publications in international peer reviewed journals and competition for funding (Olesk, 2020).

The disruptive development of Estonian sciences went hand in hand with an evolving societal view of science and technology. In the first period of independence, science popularization was seen as an important task for scientists. Popular science books and magazines written in the Estonian language by Estonian science societies appeared, of which some survived the Soviet era science reformations. Later, in this same spirit, the science centers of AHHAA were established in both Tallinn and Tartu. Even though of a different character, during the Soviet era the societal promotion of science and technology was important as well. Huge prestige projects, with great visibility, were set up not only to make science "popular" but also to convince the world of the success of the Soviet socio-economic system, pervading society with an idealized view of science and technology as the way to progress (Runnel, 2019). While the events of the 20th century were disruptive for the sciences itself, in terms of views of science, they seemed to have accumulated into a rather optimistic attitude which fed into the sociotechnical imaginary described in the first section. The digitization efforts of the government for example were met with surprisingly few concerns from the public. Privacy has not been debated; anything is possible in Estonia. An interviewee noted that a high level of trust in science and new technologies "is still lingering from the Soviet era".

Note that the described historical and existing science communication efforts mostly consist of transferring knowledge from scientists to the public. It does not entail engaging citizens in determining the direction of scientific research. Even today, the science communication activities that engage the public are aimed at educating citizens not at democratizing science (Olesk, 2020, p. 291). For example, one of our interviewees pointed out that there is no mention at all of public engagement in the official document of the national science communication strategy.

3. Engaging in science and technology

Views of science and technology as independent sources of progress, popular among and adopted by many Estonians, proved to be a fertile soil for instigating the quick and successful process of digitization. In turn, the digitization process fed back into the existing views as well. As part of the national pride, being technical savvy has become part of how Estonians understand themselves. Stronger even, the digitization developments took off parallel with Estonian transition to democracy, making Estonia a unique case of a young democracy, in which e-participation is an integral part of the new democratic culture (Reinsalu & Winsvold, 2008). For Estonian citizens, e-participation is not an alternative form of democratic participation that exists alongside others, but it is the form of participation through which they first experienced it, and through which they developed citizen skills. Because of its central position in the process of democratization, the digital participation forms gained more (media) attention in Estonia than elsewhere, possibly shaping how public engagement in science and technology will be received.

The rather dominant sociotechnical imaginary finding its roots in the ICT policies of the 90s, tends to overshadow alternative sociotechnical imaginaries in Estonian society that convey a more critical stance toward new technologies. The Estonian elections of 2020, for example, brought one of these imaginaries to the surface. With these elections the support for far-right parties doubled to 17,8 % of the votes, among other issues because of its critical stance toward using ICTs for government purposes. It seems that the Estonian enthusiasm about the promises of technology as part of the national sociotechnical imaginary is mainly representative of the inhabitants of Tallinn and other Estonian cities; the far-right electorate is predominantly rural, older as younger generations have moved to the cities, and significantly less well off. The trust and optimism concerning technology is typical especially for the first group, but not so much for others. During the elections, e-voting for example, was contested by the far-right parties for contributing to a digital divide between the rich well-connected city people and the inhabitants of rural areas who are less skilled in using such services. This divide is somewhat aligned with the divide among Estonians in regards to environmental issues. While Estonians are found to be in a process of becoming increasingly aware of environmental issues such as recycling and sorting waste (SocKETs, 2021), the issue of restricting or abandoning the Estonian shale oil industry is highly controversial. Besides oil shale being a fossil fuel, this sector of the industry produces 80% of Estonian waste (Beckers, 2020, p.4), yet abandoning it has the potential of leaving thousands of people living in the rural areas of Eastern Estonia unemployed, creating desolated towns, and thus, threatening the traditional ways of living of the rural mainly Russian speaking minorities (SocKETs, 2021).

When looking more closely to different generations of Estonian inhabitants, more diverse sociotechnical imaginaries can be found as well. People from different generations grew up in very different circumstances, which has had an important effect on their ideas of citizenship and attitudes towards science and technology, and their expectations and willingness to engage in its development. According to our interviewees, the generation of Estonians born in the Soviet Era going through the

harsh economic circumstances of the "wild capitalism" of the early 90s became rather individualistic and materialistic lacking the skills for effective engagement. This is not surprising. Many Estonians of this older generation lived in absolute poverty in the early 90s, and even now, with many females reaching an older age as widows without proper pension they still or again have to live with a very low income, leaving a generation to have "lost out [in the transition to market economy]." Estonians from later generations, born after the 80s, who came of age after the transition to democracy, and thus enjoyed more freedom and financial security, clearly have a different attitude towards engagement with science and technology. After the period of transition, postmaterialist values have been coming up, which are crucial for developing engagement activities. Another important difference is directly related to the case study. Reports about eco-innovation (Beckers, 2020) and circular economy (SocKETs, 2021) note that among people from the older generation there is resistance against reusing materials and repairing objects, as a common and necessary practice in the Soviet era that they had hoped to leave behind with the transition to a market economy.

Another element in the alternative imaginaries is the "ever growing 'not in my backyard' attitude" (SocKETs, 2021) that interviewees noted, and according to some are making it hard to even create space for meaningful engagement. An example is a recent public debate that occurred after a company had initiated to build a cellulose factory in the forest areas of Estonia. The company promised to invest one billion into the Estonian economy by producing cellulose from wood, much more profitable than the timber exporting that is currently done, which generated a great deal of media attention. The company that initiated the plans presenting an ambition to engage the rural community, especially in deciding the site of the factory. As soon as the company presented a list of potential sites, before being able to even initiate the actual engagement activities, the plans became hugely controversial evoked among others by grassroots activities. The Estonian media, depending on its position, depicted the proponents as fearless and egocentric profit-oriented industrial parties or the opponents as a needlessly irrational and emotional public. The plans to build the factory were soon abandoned. These events show a familiar pattern of activists fighting what they see as destructive developments disrespectful of local communities, and investors depicting the activists as too emotional that according to the interviewees is detrimental to substantial and constructive engagement processes. One mentioned it to be evidence of a lack of societal skills that can possibly be solved over time with better education.

4. Recommendations

From the above-identified national socio-technical imaginaries a set of recommendations for public engagement in the circular economy innovation can be drawn. First of all, the positive role of science and technology in Estonian past and its current economic progress, and the growing awareness of environmental issues can be taken as an opportunity. Most Estonians appear to have a positive attitude, and will probably not be averse to taking part in a project about technology, and in the process collaborate with actors invested in innovating current practices, especially if it is concerned with the societal goal of protecting the environment.

A second recommendation is to be wary of the dominant sociotechnical imaginary being a double-edged sword. The alternative imaginaries, reflected in populist sentiments and the quickly erupted discontent, might indicate that the optimistic attitude is not as widely held as suggested. A sociotechnical imaginary produced and reproduced by the government, in which national pride is somehow intertwined with a leading position in technology, possibly renders other imaginaries,

containing societal concerns about these technologies, invisible. Estonians living in rural areas, and those from older generations, might be harder to reach and might be found to be less motivated in engagement in the specific issues of the case studies. It will probably require tailor-made efforts to motivate people from such groups to participate in events.

A third recommendation can be drawn from the observation that there is not much experience in Estonia with public engagement in science and technology and that there is a tendency, especially in the media, to write off critical voices as overly emotional and activist. When designing engagement processes it is important to give space to discontent as an important source of information about fears and concerns rather than disregarding it for being emotional. The processes should be designed in such a way that they can include voices expressed without "postmaterialist" engagement skills. Some engagement tools are designed with the intention to map the concerns that lie at the basis of strong polarized positions such as outright rejection of technological innovation, or sustainability measures. The above gives reason to recommend investing in the activities to be as inclusive as possible, not only in terms of recruiting a diversity of participants but also in the design of the activities.

4.1.4. Italy

Italy's sociotechnical imaginaries have diverse and often conflicting characters. In highly industrialized areas, for example, with well-structured research and innovation systems, STI is seen as playing a crucial role in producing and maintaining wealth, while in rural areas a more traditional and conservative economic system and culture can be found, in which the role of STI is seen as being much less prominent. Another important division can be seen in the sociotechnical imaginaries played out by the media. On the one hand, a strong sense of distrust of the government and a gloomy image of the country's economic development is reproduced. On the other, a public sociotechnical imaginary in which a more positive expectation of the future is depicted, presenting Italy as a country full of potential with several regions performing within or above the EU average in terms of both economic and science and technology development.

In this section, these diverse sociotechnical imaginaries are related to the Italian case study about the circular economy, with a focus on new technologies for sustainable building construction. It concerns technologies such as advanced materials; advanced manufacturing technologies; IoT (Internet of Things), AI (Artificial Intelligence) and blockchain technology. These technologies can be used for circular and efficient use of resources throughout the value chain of products and services in the materials, buildings, and construction sectors. Towards the end of the section, recommendations for public engagement in the circular economy innovations will be drawn from the depicted sociotechnical imaginaries.

1. Regional differences

The diverse character of Italy's sociotechnical imaginaries can be related to the great regional differences that can be traced back to the relatively recent establishment of Italy as a nation-state. Italy is a relatively young country, as it was only established in unity in 1870-71 (Black, 2002) after it had remained divided since the decline of the Roman Empire around 500 AD (Killinger, 2002). Therefore, each region has its own rich history and cultural differences. This is also displayed in the diversity of languages that were present before the political union of Italy, making it linguistically the most diverse region of Europe. Despite the unity of Italy and their nowadays shared language, great diversity is still to be found. Due to these differences, it is often remarked that Italy seems to lack 'one' national Italian feeling throughout the country (Black, 2002).

This history of regional differences seems to still have its influences on the current cultural landscape and public engagement practices. For example, in research conducted on public engagement around geothermal energy in Southern-Italy, it was observed that participants held a strong Sicilian identity, in which participants discussed local interest as opposed to national interests (Pellizzone, Allansdottir, De Franco, Muttoni & Manzella, 2015). This is of importance for engagement as co-creation activities might have different outcomes depending on the region in which it is organized. Furthermore, the dynamics among regions themselves and between regions and the state, also influence engagement outcomes. Therefore, the regional differences should be taken into account when organizing engagement activities.

2. Decentralization and regional autonomy

The regional differences have also had an impact on how the country is governed. Since the establishment of Italy, governance has been centralized, but since the 1990's a move to decentralization has been observed (Palermo & Wilson, 2013). This trend has taken place to overcome the general inertia of legislative decision-making which is imminent in a country with a strong regional interest and a considerable economic gap between North and South according to Palermo and Wilson (2013).

This decentralization is also reflected in STI policy. From the second World War Italy has slowly reorganized and modernized the STI system, a development that simultaneously took place in many other Western countries (Wittrock et al., 2021). During the 1950s and 1960s no public policy for supporting technological innovation was in place, but the support of high-tech technology sectors emerged in the 1970s and late 1980s, mainly established by lobbying from the scientific community, electronics industry, and biotechnology industry (Malerba, 1993). Therefore, throughout history, the industry has played an important role in Italy's science and innovation. In a part of the sociotechnical imaginary it is seen as an important driving force of STI development. From then onwards, a movement toward 'science for society' and a 'systems of innovation' model has taken place. This was followed by decentralization in the past decades. In 2001, legislative power was redistributed and decentralized between government and regions, including legislative power concerning scientific and technological research and innovation policy (Arnaldi & Neresini, 2018). Italian regions also have legislative power regarding 'international and EU-relations'. They are involved in the decision-making process regarding EU legislative acts and accountable for the implementation of EU agreements (Arnaldi & Neresini, 2018). Due to this decentralization and partial autonomy, great differences in STI policy are observed between regions, also affecting the type of support and incentives for engagement practices. The regional policies should therefore be taken into account when organizing engagement activities.

3. Italian industry and building sector

According to Arnaldi & Federico, Italy's research and innovation landscape has regional underfunding as R&D expenditure per inhabitant is significantly lower than the EU average (Arnaldi & Federico). It is also argued by Malerba (1993), that Italy has two innovation systems: one defined by collaboration on a national level, including universities, research institutes, industrial laboratories and the national government, while the other system is defined by small-firm networks consisting of many small and medium sized enterprises (Malerba, 1993). While the majority of Italian industrial companies are small and medium enterprises (SME's) and according to Neresini and Arnaldi (2019), SMEs often struggle to find enough resources to successfully engage the public, due to the low funding of R&D.

In contrast to the difficulties of SMEs to find proper funding, many new collaborations on Responsible Research and Innovation (RRI), in which engagement activities are common, are seen between private-public enterprises. One example of this is the RRI initiatives in Lombardy that bring both public and private partners together. Furthermore, a remarkable characteristic of the Italian sociotechnical imaginary is the promotion of RRI by the industry itself. The industrial sectors in Italy were one of the first to introduce RRI practices (Arnaldi & Neresini, 2019). Here again, the emphasis has to be laid upon the regional differences, as these initiatives are supported by Lombardias regional policy. Due to the great regional differences and decentralization of governance, industry landscapes and initiatives look inherently different in all regions of Italy. This has to be taken into account when organizing

engagement activities: in some regions more supportive policies are in place and funding is available, than in other regions, where policy and funding are lacking.

When we specifically look at the building sector in Italy it is seen that the landscape is characterized by small and micro businesses, which just as the SMEs, often have limited access to funds and advanced technologies. Furthermore, despite several initiatives regarding RRI and the opening up of science in certain regions, the building sector in Italy over-all seems quite conservative and often regards circularity and sustainability as a barrier rather than an opportunity for competitive advantages (Sockets, 2021). These characteristics should be taken into account for engagement, as building sectors might have a conservative stance toward the engagement of citizens. Despite the more conservative stance of the building sector Italy is among the five best performers when looking at the circularity index, it hosts one of the largest exhibitions on sustainability and circular economy in the world and the chemical industrial sectors have a longstanding tradition and performs well in terms of sustainability indicators (Enea, 2020; Federchimica, 2020). This indicates that these initiatives could potentially cross over to the more conservative building sector and much could be learned from initiatives in other industry areas.

4. Italian views on public engagement and technology

For successful engagement, it is important to understand the views and attitudes of citizens regarding public engagement and technology. This section first describes how the public has been engaged in the past and the general attitudes towards this engagement. Followed by a description of the general views towards technology and specifically the building sector.

Historically, the Italian state and government have not been concerned about involving or consulting the public. According to one of the interviewees, in general, a cultural tradition of participation and engagement is lacking. This said, it must be noted that again, great differences between regions and their traditions of engagement can be observed. For example, the story goes that in Bologna there is a tradition of meeting on squares to discuss political matters, or in Tuscany where regional laws on public participation necessitate public engagement processes and also allocates resources for doing so (Rask, Maciukaite-Zviniene & Petrauskiene, 2012). On a national level, consultation of the public has only taken place by national referendums. For example, in 1987 and 2011 two referendums on nuclear plants were held soon after Chernobyl and Fukushima, in which a majority voted against nuclear energy (personal communication). In 2011 another referendum was held on the privatization of water resources and privatization of public television (Pellizzone et al., 2015; Neresini, Giardullo, Di Buccio & Cammozzo, 2020; interview). Even though the majority voted in favor of the privatization of television, it is still mostly owned by the state.

This example touches upon the place of trust in the public sociotechnical imaginary of Italy: according to one interviewee it has fed the lack of trust in the government and, to a certain extent, to larger companies, because even though they gave their opinion, politicians still acted according to their own interests. Sources of distrust seem to vary regionally. A study around geothermal energy in Southern-Italy, for example, observed the entanglement between public institutions and organized crime (Pellizzone et al., 2015) to create distrust among participants. The widespread mistrust of the 2017 compulsory vaccination policy was related to a more general mistrust in science, medical research, the pharmaceutical industry, and regulators (Arnaldi & Neresini, 2018).

These examples, from referenda that were not honoured, the entanglement of the government with criminal organizations, and the rise of mistrust in the vaccination debate, show that mistrust in the government and industry seems to be an important theme in the public sociotechnical imaginary. It not only influences how Italian's view technologies but also influences engagement practices. When organizing engagement in Italy these sources of distrust should be addressed and taken into account. For successful engagement, trust is an important factor, without trust a meaningful two-way dialogue is impeded. The mistrust in government, industry, and available information in Italy calls for transparency about the goals of engagement and available information. In much engagement literature emphasis has been put on the importance of showing how participants contributed to the process they were engaged in (Wynne, 2006). In the case of Italy this is of extra importance.

In contrast to the public sociotechnical imaginary addressing mistrust to the government, companies and technology there is another contesting sociotechnical imaginary present, showing once again that attitudes and trust regarding science and technology is multi-faced. Data from a well-known survey on science and society in Italy (Pellegrini & Saracino, 2019), shows that trust in science and technology has grown in the last five years. Over 80% of the respondents think that benefits of science and technology outweigh possible negative impacts. This is particularly true for young people, of whom a large majority has a positive attitude, and for whom science and technologies are a part of daily life. On the other hand, about 70% of respondents think that science and technologies are changing too rapidly our habits and lifestyle; more than one third thinks that scientific developments could threaten fundamental values such as family and human life.

However, the Italian political sociotechnical imaginary shows another side: in debates attention has been put on the possible negative impacts of technology and innovation. For example, the fact that innovation processes are not positive by default was articulated by the former Economic Development minister, Carlo Calenda (Arnaldi & Neresini, 2018). In addition, policymakers often addressed the technical details of innovation and technology but more often ignore the social components, such as societal values and community lifestyle (Pellizzone et al., 2015). In addition, the Italian media often depict a 'gloomy' future, in which emphasis is placed on negative views and consequences. Furthermore, according to Neresini (2020) an often-heard narrative is the one of a 'competitive lag' in which Italy falls behind compared to other European countries (Neresini et al., 2020). This represents a more pessimistic sociotechnical imaginary that is present in the public debate, in which the future is depicted rather pessimistic and technology is not seen as something positive per definition. Although this sociotechnical imaginary again is contested by the view that Italians generally view technology and innovations as ways to move forward and decrease this competitive lack (Neresini et al., 2020). These dynamics between different sociotechnical imaginaries in the societal debate including different actors such as politicians, media and citizens should be taken into account when organising engagement activities. Attitudes are multi-faced and engagement should leave room for all these imaginaries to emerge and address the underlying values, concerns and needs.

Concerning the case study: circularity and efficient use of resources in the building sector, several views of citizens regarding these specific technologies are of importance for public engagement activities. Firstly, in recent years more attention is paid by citizens to circularity and environmental issues, making them possibly more willing to participate in co-creation on the circular economy. Secondly, a generational difference seems to be present regarding the openness to innovation for both the use of

materials as well as attitudes regarding the change processes and approaches. Older generations seem to be more reluctant to change while younger generations and professionals are more open to innovation. Thirdly, Italian citizens and companies are often sceptical about the introduction of innovative materials (e.g., nanomaterials) or materials made from recycled parts and in some cases about the introduction of advanced materials (e.g. nanomaterials) in buildings. These materials raise questions regarding the quality and toxicity and long-term negative effects on health. (Sockets, 2021) Fourthly, according to one interviewee Italy is a country with the highest number of 'house owners' which might make people more interested in participating on this topic as it can be of relevance for their own housing.

5. Recommendations

Based on the different sociotechnical imaginaries that are present in Italy, there are several issues of importance for successful public engagement on new technologies for sustainable building construction in Italy. Firstly, engagement activities should be aware of the multiple contesting sociotechnical imaginaries present in Italy. It is of importance to leave room for different sociotechnical imaginaries to emerge in engagement activities in order to address the underlying values, concerns and needs.

Secondly, Italy has strong regional differences both cultural and regarding policies. In some regions, policy supports open innovation and engagement practices while in other regions such policies are lacking. This influences engagement activities depending on the region in which engagement is taking place. For successful engagement, the organizers should be aware of the region-specific policies and regional attitudes of citizens regarding engagement.

Thirdly, the industry has played an important role in science and technology development and continues to be one of the main actors implementing corporate social responsibility and open innovation initiatives. This finding suggests that certain industries in Italy are open for co-creation and participation methods, although this cannot be generalized to all industry sectors.

Fourthly, there seems to be a lack of cultural tradition of deliberation and participation, although there are some regional exceptions. Furthermore, mistrust in government due to mismanagement and corruption plays an important role in the public perception of technology and engagement. People are sceptical towards motives and intentions for engagement practices for science but industry as well. Therefore, it is of high importance to be transparent about the motives behind engagement and what will be done with the outcomes. In this way, a trustful relationship can be fostered.

A fifth observation is that even though the Italian media sociotechnical imaginary refers to Italy 'lagging behind' in comparison to other European countries and often sketches a gloomy future, the general public seems to view technology as a way to move out of this competitive lag. This suggests that there is a general interest in technologies to enhance the position of Italy, which also implies that there would be interest in co-creation and participation on these topics.

Specific attitudes or relevance for the case study are a sixth concluding remark. The differences between attitudes towards innovation between generations and the hesitancy and questioning of recycled materials should be taken into account when organizing engagement for sustainable building construction.

4.1.5. Serbia

In the nationally dominant sociotechnical imaginary in Serbia, also cultivated by the government, the assumption is present that technological development is inherently positive. It seems this imaginary roots in the past communist times, when technological development was a prestige project needed to prove communism as a successful alternative. In this imaginary, technological progress is equated with economic growth. The Serbian public discourse seems to comprise a strong alternative imaginary in which science is distrusted because of its affiliation with the government, by many viewed as corrupt and hardly transparent.

In this section, the two different sociotechnical imaginaries are related to the Serbian case study, which deals with innovation processes of advanced technologies for health system improvement. It concerns technologies such as bioinformatics, biotechnology, artificial intelligence, and advanced materials for the improvement of public healthcare. These technologies could for example contribute to the prevention of health problems related to an aging population, digitalization of the healthcare system, and enabling personalized treatment. In the course of the chapter, the implications of the sociotechnical imaginaries and the dynamics between them will be explored in order to draw recommendations for organizing public engagement.

1. Serbia and former Yugoslavia

Important fuel for the latter sociotechnical imaginary is Serbia's turbulent history. Serbia was part of former Yugoslavia, founded in 1918 after World War I and collapsed in 1991-1999. After World War II, when Germany occupied the area, Yugoslavia came under the communist leadership of Tito. Many Serbians remember this period as rather properous and stable. With his death in 1980, the communist legitimacy eroded due to economic setbacks and political paralysis (Finlan, 2014). The disintegration of former Yugoslavia did not take place right after Tito's death but was set into motion after communism began to fall in other parts of the world. While communism eroded, democracy was regarded as 'nothing more than the expression of freedom of individual ethnic groups' (Pavlowitch, 1999). Several wars between different ethnic groups resulted in the violent disintegration of Yugoslavia. Its profound social and economic impacts left the region unstable (Finlan, 2014). These social and economic impacts are still visible today, for example by the 'brain drain' that is taking place.

After the turbulent conflicts in the region, Serbia has made a move towards a more genuinely democratic climate. But this has not been without its upheaval. In 2003 a criminal attack in collaboration with members of special security forces assassinated prime Minister Zoran Ĉinÿiü. Liebert, Condrey & Goncharov (2013) speculated that this attack was motivated by obstructing democratic reforms. In the same article, they characterize the current political climate as polarised, fragmented and volatile, which is further fed by scandals regarding financial mismanagement, disregard for democratic rules, political rights, and civil liberties. According to one interviewee this has highly affected the public perception of the government and enforced mistrust. In 2009 Serbia officially applied to join the European Union. Serbia currently is a parliamentary democracy, and despite eroding political rights and civil liberties, it is continuing to move toward membership of the European Union (Freedom house, 2020).

2. Institutionalization of non-transparency

Kobal & Radosevic (2005) characterize the Science and Technology sector of Serbia by the low level of state investments in research, the many bureaucratic regulations, and a 'brain drain' due to underfunding and unfavourable conditions. This was confirmed in one of our interviews. The sector has gone through six different phases. During Tito's rule, it slowly expanded until 1987 (I), after which it stagnated in 1987-89 (II), further regressed until 1995 (III), with a stop of regression in 1995-1998 (IV), after which it was falling behind in 1999-2000 (V) and starting the transition phase in 2001 (Kobal, 2005). Serbia's science and technology system has been highly influenced by the unstable environment and dissolution of former Yugoslavia. While it has known steady economic growth under Tito, it has been in decline during the civil wars. Currently it is slowly recovering (interview).

The European Commission's report on research and innovation in Serbia for 2016 stated that: "Although the country has a relatively good scientific base, the level of investment in research is less than 1% of GDP and cooperation between the public and private sector is weak and not systematically supported" (cited from Bieber, Bino, Kmezic, Myzeqari, Pavlovic & Tepavac 2017). This has also instigated a 'brain drain', as the absence of financial and material support has led people to look abroad (Kobal, 2005). In recent years Serbia has been actively participating in EU research and funding programs and has improved innovation policies (European commission, 2020). For example, in 2019 a satellite institution of the ministry, the 'science fund' was established, giving Serbian universities and institutes opportunities to apply for projects in research and technological development projects. Previously, this task was carried out by the ministry itself and was bureaucratic and slow. Another example of efforts to improve innovation is the establishment of the Serbian Center for the Promotion of Science in 2010 by the ministry of education. This center is specialized in science communication and promotes public engagement activities (Rask er al., 2012, Interview). Despite these improvements, it is stated by an interviewee and Bieber et al., (2017) that many institutions such as universities lack transparency for efficient functioning and bureaucratic regulations and rules are in place. For example, there is no transparent register of all Serbian scientists including affiliations and scientific results, making it difficult to measure scientific progress (Bieber et al., 2017). Furthermore, bureaucratic processes make it increasingly difficult for researchers to attend international conferences or go on fellowships abroad (Bieber et al., 2017). The lack of transparency and scandals over plagiarism and diplomas and the absence of serious consequences, all further contribute to the mistrust of the public in the government and closely affiliated organizations such as universities (Bieber et al., 2017). These bureaucratic processes and the 'brain-drain' all influence innovation and the possibilities for companies to innovate in the health-care sector. This in turn can influence public engagement as policies and funding to support engagement activities are scarce.

3. Serbian health care system and industry of advanced medical technologies

A similar sociotechnical imaginary revolving around distrust, might be prevalent in the context of health care. Corruption and bureaucracy observed in the government and affiliated institutions, are also leading problems of the healthcare system according to Stamenović (2019). There is inadequate implementation of the law on public procurement, misuse of funds within institutions, forms of employee manipulation, in the state as well as in the private health care sector. Also, there seems to be a lack of optimization in organizational and economic terms (Stamenović, 2019). The introduction of advanced technologies in the Serbian state healthcare system is often a long and slow bureaucratic process. Once services are in place, they are only affordable for wealthy citizens (SocKETs, 2021). One of the top priorities of the government currently is the digitalization of the healthcare system (SocKETs, 2021).

Despite problems of implementation of new technologies in the rather slow and bureaucratic system, one of the main growing industries is the biomedical industry (Stamenović, 2019), possibly indicating innovation and progress. Important for this industry is the flourishing of start-ups and medical companies, which however, might be hampered by the lack of the supportive public regulations and laws (Stamenović, 2019). An interviewee mentioned that in contrast to larger companies that mainly aim for profit, among the start-ups there is more interest in societal values. When approaching industrial actors for participation in engagement activities it is important to take these possible differences in attitudes and industrial cultures into account.

4. Serbian views on technology and public engagement

Another important factor that possibly shapes the dynamic between sociotechnical imaginaries in the health care sector is the doctor-patient relationship, which is rather hierarchical. Doctors are often perceived as knowledgeable in contrast with the "uneducated" patients, or in more general, with the public lacking medical knowledge and understanding. The way in which the vaccination debate unfolded is a typical example. Vaccinations are mandatory in Serbia. Medical professionals regard hesitations to be merely caused by a lack of knowledge, seeing the provision of statistics and probabilities as a sufficient means to take such hesitation away. However, as Trifunovic (2019) pointed out, when looking closely at the vaccination debate the socio-cultural context plays an important role. In the Yugoslavic era, the paternalistic state played the role of provider, in medical as well as other issues. As long as this was carried out effectively, no controversies or debates arose. As the disintegration of Yugoslavia and the move from communism did not provide the hoped economic and social changes, but instead resulted in lower living standards and a sense of insecurity and general public disappointment, more critical voices were raised (Trifunović, 2019). Within the new individualistic culture, arguments built on the importance of collective immunization became much less convincing. A profound mismatch emerged between public and medical professional views on the need of vaccination. This case illustrates the societal context to be of great importance for understanding how debates about science and technology unfold. It also shows that the dynamic between 'experts' and the general public in the healthcare sector can become unproductive when arguments that were effective in one societal context, obtain a different meaning in the other. To enable meaningful engagement in the context of the case study, it needs to be ensured that activities provide space for a broad range of understandings of the issues, enabling collaboration not through providing more information but by explicating and exploring the differences.

Taking the above depicted distrust of the state, and the transition from a more collective towards a more individualistic society, in which some citizens feel increasingly vulnerable, while others have high hopes for the future, has given rise to a variety of sociotechnical imaginaries. According to an interviewee, there is a gap between younger and older generations in this regard. While the elder generations have lived through the different phases of economic growth, decline and restoration, younger generations do not have these experiences and tend to be less afraid of the future, and thus to the implications of emerging science and technologies. Against the backdrop of this diversity, the challenge of organizing inclusive public engagement can be met by giving space to people from all generations and a diversity of sociotechnical imaginaries.

5. Recommendations

Based on the sociotechnical imaginaries outlined in this chapter, there are several issues of importance for successful engagement in innovation processes of advanced technologies for health system improvement in Serbia. Firstly, Serbia went through a transition from being part of a communist state to an independent post socialist country, where many governmental processes are non-transparent and corruption is present. This has influenced the public perception of the government and affiliated organizations. Mistrust is expressed and this can potentially influence engagement practices. When organizing engagement practices in Serbia it is important to take these trust issues and the dynamic it might create with already present distrust into account.

Secondly, in Serbia's healthcare the doctor-patient relationship is hierarchical, in which the knowledgeable doctor is seen as the educator of ignorant patients, or citizens. Although it is unclear whether these views are also held in other sectors of the medical technology innovation industry, it is of importance to take this into account when organizing engagement activities with the industry. Using co-creation tools that put emphasis on reflexivity and equality will help make the process as inclusive as possible.

Thirdly, due to Serbia's relative wealth and extreme poverty throughout history, a generational gap appears to be present. Elder generations are more concerned about falling behind and experiencing poverty, while younger generations are more optimistic about the future. This trend also appears to play a role in start-ups, who are more interested in engaging the public for the greater good, in contrast to larger companies who focus mainly on profit and competitiveness. For successful engagement it is important to take these generational differences into account and make sure that generations are sufficiently represented.

4.1.6. Spain

Spain's great regional diversity, comes with a variety of regional sociotechnical imaginaries. For the Spanish SocKETs case the imaginary of Basque country is most important. This imaginary is especially visible in the regional identity, Basque country as a forerunner in matters of technological innovation and industry, which is seen as the main cause for being one of the wealthiest regions of Spain. However, this stands in stark contrast with the imaginaries co-existing in society, which can be characterized by distrust amongst citizens of national and regional politicians, and possibly of technology and industry perceived as part of the same establishment.

The Spanish case explores the potential of societal engagement for the responsible development of AI for the future of work. The convergence of AI technology with robotics, Internet of Things (IoT) and 3D printing give shape to the 'Factory of the Future' (Sockets, 2021). However, AI can be seen as an especially disruptive technology, raising issues of employment rates, professional skills and capabilities (Sockets, 2021). Furthermore, it is part of a long development of ongoing factory automation, which has in the past raised considerable anxieties (SocKETs, 2021). Through exploring the sociotechnical imaginaries in Spain, with an emphasis on Basque country, we foreground the cultural context of concern for organizing inclusive societal engagement.

1. The build-up of the Spanish scientific community

Of importance for understanding Spain's sociotechnical imaginaries is understanding the history of its scientific community shaped by the turbulent politics of 20th century Spain. The country went through a civil war between 1936-1939, after which General Franco's authoritarian regime came into power until 1975 (Mele, 2004). Franco's dictatorship had a devastating impact on the country's scientific community for inhibiting the development of a scientific tradition and associated funding structures. During this period many scientists emigrated to France and Latin America. Revuelta et al. (2020) note five important events in the second half of the 21st century that enabled the Spanish scientific community to move forward : (1) Franco's death in 1975 ended the nearly 40-years autocratic dictatorship, (2) the transfer of some powers of the national government to the regional communities, (3) the country became a member of the European Union in 1986, (4) a 'Law on Science' was introduced that regulated scientific activities and careers, (5) a National Research and Innovation Plan was created in 1988 (Revuelta, 2020).

After the transition to democracy Spain entered the European Union and the European scientific community, enabling applying for European funding (Revuelta, 2020). The research and innovation community flourished in the 1990s and beginning of the 2000s, with large infrastructures and funding possibilities attracting important scientists back to the country. However, the economic crisis of 2007 hit the country hard and its consequences can still be seen today in an economically weakened scientific community (Revuelta, 2020).

On a national level, these setbacks have undermined the build-up of a solid scientific community and tradition throughout history. As a result, there is a limited number of national policy structures and funding opportunities in place to stimulate scientific research. In addition, high bureaucratic burdens in the form of complicated and highly regulated procedures for research and innovation further hinder scientific advances (personal communication). However, one of the interviewees mentioned that the memory of the dictatorship and the reconstruction of the country has been fuelling the motivation

among Spanish scientists to show the international community their scientific achievements as a demonstration of having overcome the oppression.

2. The Basque imaginary of STI as engine for growth

The Basque government seems to mainly have had a stimulating role on STI development, in specific on the innovation created by industry. Most of Spain's industry is located in the northern regions, which has made these regions relatively prosperous compared to the rest of the country. This has fed into a regional sociotechnical imaginary, reproduced in regional innovation policies, revolving around a strong orientation towards the industry as an important engine of technological development and economic growth (Navarro, Valdaliso, Aranguren & Magro, 2014). The historical support of Basque government of innovation has brought forth a dynamic business environment (Ahedo Santisteban, 2003), making the region a forerunner in the country in regards to digital transformation and industry 4.0. According to one of our interviewees, the region's industry and accompanying prosperity has been one of the sources of Basque Country's desire to become independent. Additionally, Basque country has its own language, not rooted in Spanish, adding to the idea of a unique Basque identity (interview), further feeding into the identity as a region with an exceptional position in Spain.

3. Government and citizens' distrust

Basque and national imaginaries are confronted with alternative ones in society, which are possibly shaped by the high level of distrust amongst citizens of the government. Multiple political events and views are seen to have fuelled this distrust. First, Spain has an elaborate history of corruption by both national and regional politicians. A well-known network of corruption scandals brought to light between 2007 - 2016, negatively affected how the public viewed the politicians running the country (the Guardian, 2019). Hundreds of politicians and businessmen throughout Spain were accused of large-scale corruption schemes and a government was brought down. These corruption scandals reveal and emphasize the tensions between Spanish and other layers of society.

Spain's political arena is described as toxic and chaotic with regular occurrences of confrontation between different political parties (personal communication project partner). Meesterburrie (2021) notes that the recent demonstrations in Barcelona and other cities in Catalonia illustrate the political tensions between left and right wing and the associated discontent of citizens with the Spanish government. Several factors contribute to these tensions. Firstly, the contrast between the rich and poor is starkest in all of Western Europe. This is one of the reasons mentioned for the existence of an 'extreme left wing' unfamiliar to most other European countries. Supporters typically are in favour of Marxism and stand against banks and the rich elite. Meanwhile the discrediting of politics seems to have provided excellent conditions for the rise of extreme right-wing party 'Vox' (Caparrós, 2019). Vox, claiming monopoly on nationhood and making a distinction between true Spanish citizens and those who are not, became the third biggest party in Spain's national elections in 2019.

Extreme left- and right-wing parties have gained popularity in a country that has been confronted with serious economic setbacks in recent years. The crisis in 2008 caused the Spanish economy to shrink 8,6 % and unemployment rates to increase to 28%. One interviewee noted that the Covid crisis has decreased the number of tourists visiting the country, heavily impacting the country's economy. The national government's inability to organise reliable retirement plans, reduce unemployment rates and increase public debt further feeds into this growing dissatisfaction by citizens (Meesterburrie, 2021).

The current generation faces temporary and unstable working contracts, low wages and poor perspectives of the future (Meesterburrie, 2021). The hostile national and regional political arena and instances of large-scale fraud make that 'disappointment and detachment' are key for describing the 'relation between citizens and politicians in Spain' (personal communication with partner).

For the SocKETs case, the disappointment and detachment of Spanish citizens in their regional government may have fuelled an alternative imaginary, possibly present in Basque country as well, in which technological innovation might be viewed with a more negative outlook. To enable engagement of the broadest groups of citizens and concerns, it is important to acknowledge these issues of distrust, and possible effects on the perceived role of science and technology in the future and identity of Basque Country. It is advised to explore such discontent in collaboration with citizens as an important source of information about concerns and fears in regards to scientific and technological development. This is especially important, because the topics raised by AI, such as the effects of robotisation on employment might hit a sensitive nerve in a country battling with high unemployment rates. In this context being wary that the regionally dominant social technical imaginary revolving around industrial innovation as an engine to prosperity will not take alternative imaginaries out of view is of utmost concern.

4. Public engagement and science communication

Rask et al. (2012) evaluated Spain's participatory performance as moderate compared to other European countries, based on the availability of funding, participatory skills and procedures and the existence of a culture of public debate. Instead, public involvement with science seems to focus on educating the public about science through initiatives that follow a deficit model. Revuelta (2020) describes the development of the field of science communication in Spain as reflecting developments of the scientific community itself. In the '60 and '70 only a handful of journalists and communicators devoted their time to scientific topics and concepts of 'science communication' and 'public communication of science' were unknown. The government did not show much interest in promoting science communication until 2001 when a national program was established; the Spanish Foundation for Science and Technology (FECYT) (Revuelta, 2020). The institute aims to stimulate Spanish research and its communication. In 2004, the Spanish government issued a call for science communication and dissemination for the first time, in a national program comparable to other scientific disciplines. In 2007 a national yearlong celebration of Spanish science was organized by the government 'Año de la Ciencia'. The celebrations led to the Spanish Network of Science Museums as well as local administries concerning science communication. The national celebration is considered a turning point in the attitude towards the field of science communication and dissemination. In addition to these developments in the '00, an interviewee highlighted science communication received considerable attention in previous years despite declining governmental science and technology funding budgets. Universities find it important to share their achievements in order to attract new students. The following paragraphs will elaborate on the views and attitudes of citizens, researchers and industry towards public engagement.

One interviewee mentioned that research into citizens' attitudes towards science has shown there is little interest to participate among citizens. The disinterest might be related to the absence of science culture and low levels of scientific education. This attitude would thus be directly related to disruptive development of the scientific community and the cutbacks in scientific budgets the last decade. In order to involve the broadest range of citizens' perspectives in the SocKETs case interviewees provided several recommendations. First, as Spain does not have an elaborate participatory culture be aware

that citizens may not know about public engagement. In engaging them it is important to explain why their input is valued, how their input will be used in order for them to follow through, leave satisfied and be a part of any other follow-up activities. Second, citizens' unfamiliarity with public engagement initiatives may require organisers to think through and communicate the personal benefit for participation to citizens. For example, when engaging citizens communicate the ways in which their input will be used to emphasize the impact of participating (Rask et al., 2012).

In line with the survey on citizens' attitudes about science, researchers experience a discrepancy between their desire to disseminate findings and the perceived interest in science by society at large (Llorente (2019); Torres-Albero et al. (2011) observe researchers to be "trapped between the need to engage in dissemination activities from a moral standpoint and a social and professional environment (lack of time and of academic recognition) that is hardly conducive to these activities". Researchers in fields of engineering and technology were less confident in public interest in science than were fields such as the humanities and applied sciences (Llorente, 2019).

While science communication and education have gained traction, concepts of responsible research and innovation (RRI) remain relatively unknown in the Spanish scientific community (interview). Besides being unfamiliar with the RRI concept, Llorente's (2019) survey revealed a third of Spanish researchers believed that society should not have a say in scientific practice because: '... despite being interested in this field, the public has a lack of understanding of science and technology'. To enable inclusive engagement, it is thus crucial to make sure that the perceived lack of knowledge among citizens is mobilized to bypass groups of possible participants. Inclusive and successful engagement does not require the participants to have detailed or in-depth scientific knowledge. As citizens and workers, they will have unique experiential knowledge which should be enough to have a constructive dialogue about the future of the factory/work.

5. Industry

In the SocKETs case industry partners have an important role in the engagement of citizens. However, the concept of responsible research and innovation (RRI) is not widespread amongst industry stakeholders in Spain (interview). The related phenomenon of corporate social responsibility (CSR) has received increasing attention by Spanish industry (Mele, 2004). Initiatives by the EU and other international companies have boosted industry to implement CSR. Research projects facilitating RRI such as SoCKETs should make use of the movement of associations and forums bringing together the heads of leading corporations, business schools and other academic institutions, NGOs and the media to promote CSR in Spain. The idea that industry can be held accountable by society and that ethics should be an integral part of industry's practice is gaining more and more traction.

However, as addressed by multiple interviewees in the SoCKETs project so far, a Spanish science communication expert emphasized in our interview there should be a clear advantage for industry to participate in public engagement activities. According to Melé (2004) the nine most important reasons for corporates to invest in CSR and RRI are: (1) improve reputation, (2) competitive advantage, (3) industry trends, (4) consumer pressure, (5) employee demands, (6) stockholder demands, (7) capital market pressure, (8) pressure from NGOs, (9) cost cutting. In line with Melé (2004), one interviewee believed industry partners are interested to engage a wider audience to develop products and services that meet societal needs. However, industry partners may also be wary of engaging a wider public due

to patents or knowledge that should remain confidential (interview). While not all motives for public engagement may apply to (potential) SocKETs partners, keeping them in mind will inform collaborations and help steer intended outcomes.

6. Recommendations

Based on the sociotechnical imaginaries outlined in this chapter, three recommendations have been formulated for successful engagement in AI development processes in Spain. The first recommendation is to use the drive to put Spain on the international science community map and the Basque Country's tradition of technological innovation to engage citizens. Address this drive by contextualizing the project in an international setting and by highlighting the opportunity of a Spanish contribution to innovative technology developments. The Basque Country's tradition of industry would make such a contribution particularly valuable.

The second recommendation is to be aware of and anticipate the high levels of distrust of citizens and their governments. Rather than circumventing these issues, public engagement initiatives should aim to actively search for and explore these attitudes and identify underlying causes. Organisers are advised to be aware of the potentially negative consequences of these feelings of distrust on the participatory culture in Spanish society.

The third recommendation is to be aware that only a moderate public engagement culture exists in Spain. As a result, industry partners, research bodies and citizens may be unfamiliar with RRI and public engagement concepts and underlying ideas. Thus, when persuading parties to engage as well as throughout the execution of the case it is necessary to make explicit the incentives for and aims of the project to different stakeholders. As one interviewee emphasized when engaging citizens, organisers should make clear why their input is needed and how it will be used. Finding civil society organisations (CSOs) that may have something to win from their engagement may greatly benefit recruitment as well as the quality of the engagement process.

5. Concluding remarks

In this deliverable we have explored the cultural conditions for successful engagement by investigating a variety of sociotechnical imaginaries and the dynamics between them. We have given a first sketch of the ways in which groups of people in the six case study countries collectively view development and embedding of research and innovation in relation to their perception of the nation's identity and future, and especially the role of science and technology therein. Foregrounding the dynamics between dominant and alternative sociotechnical imaginaries enabled us to anticipate opportunities and pitfalls of engagement and formulate recommendations for the engagement activities of the SocKETs project.

That the sociotechnical imaginary of a nation has consequences for the democratic accountability of STI policies has been shown by Jasanoff and Kim's (2013) research into the national energy imaginaries of South Korea, the US and Germany. Different energy imaginaries come with different distributions of risk and benefit, but also with different degrees of openness to public scrutiny. Smallman (2021), who has conducted research into public engagement in science and technology organized by the UK government, further builds on this insight. On the basis of her findings, she argues that in the UK, the nationally dominant sociotechnical imaginary of 'science to the rescue' leaves little to no space for alternative sociotechnical imaginaries, in which science and technology are viewed as inherently problematic.

Departing from the above observations in the literature, we have done a first attempt to bring such dynamics to the foreground of the six different case study countries. We found the first contours of similar but slightly different dynamics between nationally dominant and alternative sociotechnical imaginaries. Setting aside the nuances that come up with a more detailed view, four categories can be distinguished.

First of all, in countries such as Bulgaria and Estonia we found similarities to Smallman's UK case and Jasanoff's insights in the energy policies of the US and South Korea. A dominant imaginary strongly pushing technology for gaining wealth, or as a solution to societal problems, leaves littles space for engaging with more critical imaginaries, or for debates about the responsibilities of the state. In the nationally dominant imaginaries of Estonia and Bulgaria, technology has been attributed such an important role, respectively in establishing the new found identity, and for providing a better future, that the inclusion of other imaginaries in engagement activities might require an especially targeted approach. In Serbia we found a different dynamic in which the dominant sociotechnical imaginary is opposed by a strong alternative imaginary. In the dominant sociotechnical imaginary technological development is seen as inherently positive, but the Serbian public discourse seems to comprise a strong alternative in which science is distrusted due to affiliation with the government, which is considered corrupt and hardly transparent. In our explorations of Spain and Italy another image emerged. Due to the strong regional differences in these countries, it seems impossible to pinpoint a nationally dominant imaginary. The understanding of science and technologies' role in imaginaries of the future and identity and the space for more critical voices seem to differ among regions. In the case of Basque Country, where the regional government pushes a tech-savvy identity, the same dynamic as in Smallman's UK case might be present but than on a regional level. The Danish case seems to represent a category by itself. In this case, including critical voices in the debate seems to be an inherent part of good STI policy in the nationally dominant view. The imaginaries that came up with the growing

populist discontent in the beginning of the century seems to have been going against the embedded deliberation practices.

In order to successfully engage the public and meet the objectives for engagement which include considering priorities and concerns of the broadest range of actors, we have formulated a set of recommendations based on the dynamics of the sociotechnical imaginaries per country. When taking stock of these recommendations, the following themes stand out: 1) the readiness of citizens to participate in co-creation activities, 2) industry attitudes, and 3) diversity of voices.

When looking at the readiness of citizens to participate in engagement activities we see that in Denmark deliberation is culturally embedded and it is therefore anticipated that citizens are probably willing and ready to participate in engagement activities. While in Italy, Spain, Bulgaria, Estonia and Serbia this is not so. We recommended to find tailormade ways to pull in participants. For example, the Basque identity as a forerunner in technology, and the newly emerged drive of Spain to put itself on international science community map, might be effectively addressed as a source of eagerness among citizens to particate in thinking about how KETs can improve the future. Furthermore, we noted that mistrust might play an important role in the willingness of citizens to participate in Italy, Spain and Serbia. Here, attention has to be paid to accommodating this mistrust in engagement activities as an important source of information about concerns and fears.

The different industry attitudes to engagement also play an important role in the recommendations formulated. In several countries, namely Denmark, Serbia and Bulgaria, industry displays one-way communication and participation attitudes. For example, in Denmark industry is mainly involved in customer consultation and in Serbia a hierarchical relationship is prevalent among doctor-patient relations. This is in contrast with for example Italy, where industry is one of the main initiators of RRI practices, which indicates that industry might be open for two-way engagement practices.

Lastly, to accommodate the priorities and concerns of the broadest range of actors it is of high importance to include a diversity of voices and concerns. In several countries, such as Italy, Estonia and Bulgaria, dominant sociotechnical imaginaries and co-existing contesting sociotechnical imaginaries call for the need to leave room for the latter to emerge during engagement activities. In the case of Estonia, emphasis should be placed on giving space to discontent without disregarding it for being overly emotional. In the case of Bulgaria, the dominant sociotechnical imaginary placing large expectations on STI for economic advancement might leave little room for critical concerns of citizens. Furthermore, in several countries great differences are seen between generations or socio-economic groups. For example, in Denmark there seems to be a gap between higher educated citizens who benefit from eHealth and lower socio-economic groups. In Estonia, the population of rural areas, and the older generations, might be harder to reach and might be found to be less motivated in engagement in the specific issues of the case studies.

Understanding the dynamics between sociotechnical imaginaries seems an important preparatory step for organizing engagement in science and technology. Digging into the imaginaries helps bring excluded voices into view and emerging discontent. These insights can feed into the process of designing engagement activities, pinpointing where extra attention is required to enable engagement that is inclusive to the broadest range of social actors, priorities and concerns.

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