



NANO2ALL

SOCIETAL ENGAGEMENT ON RESPONSIBLE NANOTECHNOLOGY

D3.3 Responsible Innovation Agendas at national level



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CONTENTS

1. Introduction.....	6
1.1 The NANO2ALL project.....	7
1.2 The NANO2ALL dialogues	7
1.3 Purpose of this document	9
2. General description of the dialogue events	10
2.1 General description of the citizen dialogues.....	11
2.2 General description of national multi-stakeholder dialogues	13
<i>Dialogue participants</i>	13
<i>Dialogue format</i>	14
<i>Processing of dialogue data</i>	15
3. France.....	16
3.1 General dialogue details France	17
<i>Dialogue data</i>	17
<i>Notes from the organizer</i>	17
3.2 Recommended directions for change	18
Promoting a participatory democracy.....	18
Promoting quality control and transparency of research and innovation processes	19
Promoting interdisciplinary work in nanotechnology research	19
Facilitating the creation of socially responsible start-ups	20
4. Israel	21
4.1 General dialogue details Israel	22
<i>Dialogue data</i>	22
<i>Notes from the organizer</i>	22
4.2 Recommended directions for change	23
Fostering transparency in the system	23
Improving science communication and stakeholder discussions	23
Fostering ethical behavior and attention for safety.....	24
5. Italy	25

5.1	General dialogue details Italy.....	26
	<i>Dialogue data</i>	26
5.2	Recommended directions for change	26
	Increasing public knowledge and competences on nanotechnologies	26
	Fostering mediators for societal needs, values and concerns	27
	Improving regulation for more societal engagement	27
	Greater interaction between stakeholders, earlier and across all stages of the R&I system	28
6.	Poland.....	29
6.1	General dialogue details Poland	30
	<i>Dialogue data</i>	30
6.2	Recommended directions for change	30
	Fostering collaboration and trust	30
	Involving citizens by focusing on current social problems.....	31
	Enhancing attention for ethics, safety and legislation	31
7.	Spain.....	33
7.1	General dialogue details Spain	34
	<i>Dialogue data</i>	34
7.2	Recommended directions for change	34
	Fostering bi-directional communication between science and society.....	34
	Promoting science as part of cultural identity	35
	Promoting synergies between different actors	36
8.	Sweden	37
8.1	General dialogue details Sweden	38
	<i>Dialogue data</i>	38
8.2	Recommended directions for change	38
	Improving regulation on safety and labeling of nanotechnology products	39
	Increasing public knowledge on nanotechnologies	39
9.	General reflections	41
9.1	Overview of the recommended directions for change	42
9.2	Reflections on the responsible innovation agendas	43
9.3	Reflections on the participant group compositions of the dialogues	44
9.4	Reflections on the dialogue format	45
9.5	Concluding remarks.....	46
	Appendices	46
	Appendix 1. Poster 1 – Brain Computer Interfaces.....	48

Appendix 2. Poster 2 – Brain Computer Interfaces.....	49
Appendix 3. Poster 3 – Nanomedicine	50
Appendix 4. Poster 4 – Nanomedicine	51
Appendix 5. Poster 5 – Nanotextiles	52
Appendix 6. Poster 6 – Nanotextiles	53
Appendix 7. Table innovation agenda France	53
Appendix 8. Table innovation agenda Israel.....	55
Appendix 9. Table innovation agenda Italy.....	56
Appendix 10. Table innovation agenda Spain	57
Appendix 11. Table innovation agenda Sweden.....	58

1. Introduction

The national responsible innovation agendas have been constructed based on the input acquired from several national multi-stakeholder dialogues that were organized across Europe in the context of the NANO2ALL project. This introductory chapter provides a brief description of the NANO2ALL project and its dialogue approach, and then explains the purpose of this D3.3. document.

1.1 The NANO2ALL project

NANO2ALL is a 3.5-year-long European dialogue project that aims to contribute to the establishment of Responsible Research and Innovation (RRI) practices in the field of nanotechnology. It is focused on transparent co-production of knowledge through inclusive and participatory approaches, including national and EU-level dialogue sessions that engage both citizens and relevant stakeholders.

Funded by the European Commission and led by SPI (Sociedade Portuguesa de Inovação), the NANO2ALL project addresses the “societal engagement on responsible nanotechnology” topic of the Call for Nanotechnologies, Advanced Materials and Production of the Horizon 2020 Work Programme 2014-2015. In the past, various other engagement projects, public surveys and deliberative experiments related to nanotechnology have been performed. NANO2ALL builds on these activities and aims to further the discussions on what would be needed to enhance societal engagement in nanotechnology research and innovation processes. The main aim of NANO2ALL is to contribute to the responsible development of nanotechnology by establishing a European-wide sustainable platform for mutual learning and informed dialogue among citizens and stakeholders involved in the co-production of knowledge.

The project website is an online-tool which documents the NANO2ALL process and provides open data access to the results of the project’s activities. Visit www.nano2all.eu for more information.

1.2 The NANO2ALL dialogues

The third work package of the NANO2ALL project is characterized by a three-phase dialogue approach (Fig 1). This approach encompassed the consecutive organization of a set of national citizen dialogues (April-June, 2017), and a set of national multi stakeholder dialogues (October 2017-February 2018) in 6 countries: Israel, Italy, France, Poland, Spain and Sweden, each focusing on a specific nanotechnology application field (Table 1)¹. The third dialogue phase consisted of the organization of a final European stakeholder dialogue event in Brussels (April, 2018). Each of the dialogue phases was characterized by its own specific aim, scope and set of dialogue methods. And although each of the dialogues can be seen as a self-contained event, the outcomes of the different dialogue phases did feed into each other, i.e. the outcomes of the citizen dialogues were used in parts of the national multi-stakeholder dialogues, and the outcomes of the multi-stakeholder dialogues were used as enriching discussion material in the European dialogue. The dialogues allowed for deliberation of values and purposes underlying a responsible technological future for nanotechnology, and the articulation of recommendations to enhance responsiveness and societal engagement in nanotechnology research and innovation processes, both at national

¹ See deliverable 3.1. (The NANO2ALL dialogue methodology) for more information on the choice of nanotechnology application fields.

and EU level. These recommendations have been translated into two deliverable documents: *D3.3 National Responsible Innovation Agendas* (the current document), and *D3.4 European Responsible Innovation Agenda*. A final step in the project (work package 4) will be to translate the innovation agendas into a roadmap that presents an action plan on how the responsible innovation agendas can be brought into practice.

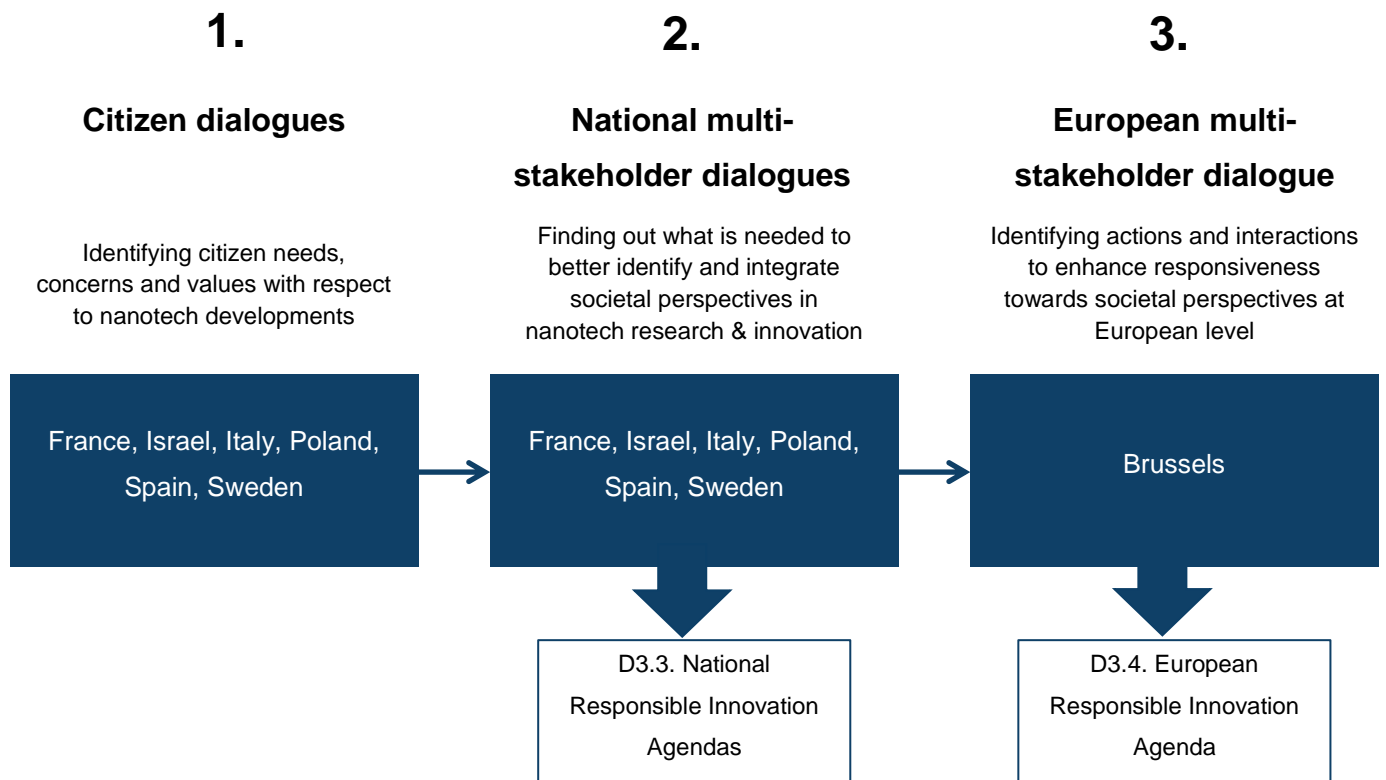


Fig. 1. Overview of the NANO2ALL three-phase dialogue methodology

Nanotechnology application field	Dialogue countries
Nanotextiles	Poland & Italy
Nanomedicine	Israel & Sweden
Nano-enabled brain-computer interfaces	France & Spain

Table 1. Overview of dialogue countries and the respective nanotechnology application fields their national citizen and multi-stakeholder dialogues focused on.

1.3 Purpose of this document

The purpose of D3.3. The National Innovation Agendas is to describe – from a national perspective - what actions and interactions are needed throughout the nanotechnology value chain to better identify and integrate societal needs, concerns and values in nanotechnology research and innovation processes. Thus, the agendas will *not* identify specific desirable nanotechnology research and innovation trajectories (as was presented in the grant agreement), but instead focus on what processes and arrangements need to be put in place to generate meaningful discussions among actors about desirable innovation pathways ². In other words: how we can make responsible innovation work in each of the national contexts? What actions are required? And what collaborations are needed?

The chapters in this document report on the national dialogues that took place in the past year and present the national innovation agendas. Chapter 2 first presents a general description of the dialogue events. Although the innovation agendas are based on the outputs of national multi-stakeholder dialogues, the chapter will also provide some background information on what happened in the national citizen dialogues, since some of the citizen dialogue outcomes fed into of the multi-stakeholder dialogue exercises.

Chapters 3 to 8 present the responsible innovation agendas for each of the dialogue countries. Since the type of dialogue discussions that emerged at the different dialogue locations varied quite extensively (i.e. some focused on very specific actions, others discussions remained more abstract), we chose to present the responsible innovation agendas as short paragraphs indicating the directions for change that were suggested by the participants. Note that despite the dialogues having a focus on a specific nanotechnology application field, many of the dialogue discussion actually centered on issues related the broader research and innovation system. Hence, most content of the responsible innovation agendas also applies to this level.

The final chapter provides an interpretation of the dialogue outcomes, and a reflection on the dialogues, the format and the responsible innovation agendas that were produced in these events. Important considerations to be taken into account for the work in Work Package 4 are also shared in this chapter.

² The decision was made in collaboration with the EC, who had indicated that a focus on how to make RRI work would be of more value to them.

2. General description of the dialogue events

This chapter provides some background on the national dialogue activities that have taken place in context of the NANO2ALL project. The first section shortly describes the activities and types of outcomes of the national citizen dialogues. The outcomes of these dialogues have been used as input for the national multi-stakeholder dialogues to enrich discussion and reflection processes of stakeholders. The second section of this chapter more elaborately outlines the activities of the national multi-stakeholder dialogues, which produced the actual responsible innovation agendas that are presented in this document.

2.1 General description of the citizen dialogues

Between April and June 2017, six national citizen dialogues were organized in science centres located in Israel, Italy, France, Poland, Spain and Sweden. In these dialogue sessions, a group of approximately 12 citizens came together to explore one particular nanotechnology application field (i.e. nanomedicine, nanotextiles, nano-enabled brain computer interfaces), and reflect on their underlying needs, concerns and values with respect to developments in this field. A playful dialogue format was employed to engage citizens in discussing the complexities surrounding nanotechnology developments and their potential impacts. Participants prototyped their own future nanotechnology devices, based on information cards and other inspiring materials, and subsequently built future narratives around these objects (see Fig 2 and 3). The narratives revolved around (a) specific story character(s) and described a particular, sometimes unexpected, way in which the imagined device could be used in the future and the resulting impacts and implications of such use. The narratives served as a fruitful starting point for discussion. The contextualized stories helped participants to make sense of broader impacts of technology, and facilitated the articulation of their own underlying perspectives³. Table 2 presents the themes that were discussed for each of the nanotechnology application fields.



Fig. 2 Participants prototyping a nanomedicine application

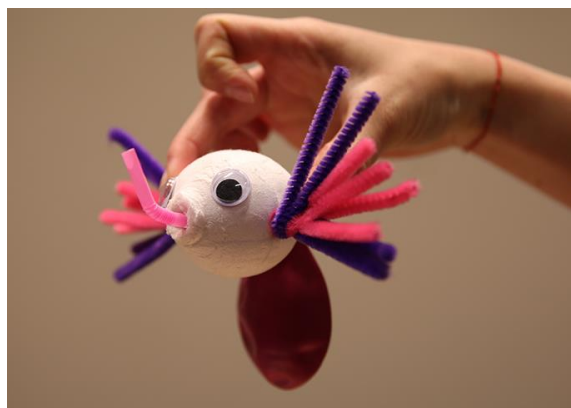


Fig. 3 A nanomedicine prototype created by participants, called Dr. Plupp

The citizen narratives and the plenary discussions around these have been used to create six big posters (2 per topic) with illustrations that depict the main discussion themes: the so-called citizen science fiction posters. These posters were used in one of the exercises in the national multi-stakeholder dialogues to get stakeholders in a reflective mind-set and have them open up their perspectives. The posters can be found in the appendix of this document. In addition, the outcomes of the plenary discussions about values, needs and concerns also fed into the scenario exploration game that was played in the national stakeholder dialogues (see section 2.2. and

³ For a more extensive description of the citizen dialogue format, see Deliverable 3.1. The NANO2ALL Dialogue Methodology.

Deliverable 3.1. for more information).

Topic	Themes that were discussed in relation to three nanotechnology application fields during the NANO2ALL citizen dialogues
Nanomedicine	<p>Values</p> <ul style="list-style-type: none"> • Everyone should be able to participate in society and lead a good and dignified life • Everyone should have equal access to nanomedicines <p>Needs</p> <ul style="list-style-type: none"> • Treatment of people under stress and trauma • Treatments for people with disabilities • Accessible nanomedicines • Affordable nanomedicines <p>Concerns</p> <ul style="list-style-type: none"> • The use of nanomedicine to improve normal functioning and natural abilities • Without equal access to nanomedicines new social inequalities could emerge • Developments in nanomedicine may lead to loss of certain jobs and professions • Physical side-effects of nanomedicines • Obsessive striving for perfection or perfect health • Knowing too much about the state of our bodies and health might make us feel sicker than we truly are
Nanotextiles	<p>Values</p> <ul style="list-style-type: none"> • Everyone should have equal opportunities • People should show solidarity with one another • Technologies should contribute to health and wellbeing • Technologies should contribute to collective and individual security • One should take care of the environment <p>Needs</p> <ul style="list-style-type: none"> • Citizen involvement in setting research goals • Citizen involvement in discussing responsible use of technologies • Technologies that make life more easy, efficient and comfortable with the aim to increase quality of life. • Technologies that are sustainable <p>Concerns</p> <ul style="list-style-type: none"> • The search for improved collective health and security might come at the cost of individual privacy, particularly in the case of nanotextiles that can monitor bodily functions or environmental conditions • Data acquired by new nanotextiles can be used to make new distinctions between people, which could lead to exclusion and discrimination of certain groups. • Technology-dependence; people might lose personal control and the ability to think for themselves • What happens if technology fails or breaks down?
Nano-enabled brain computer interfaces (BCIs)	<p>Values</p> <ul style="list-style-type: none"> • Technologies should contribute to people's wellbeing and quality of life • Everyone should have equal access to technologies that can improve health or enhance human beings. • People should be able to decide for themselves whether they would like to make use of a technology. <p>Needs</p> <ul style="list-style-type: none"> • Improving health; using BCI's to recover functions in people suffering from problems with cognition or movement.

	<ul style="list-style-type: none"> • Involvement of citizens in the development of new technologies <p>Concerns</p> <ul style="list-style-type: none"> • Unethical or inappropriate use of the data acquired by BCIs • Health risks of brain implants • The use of BCIs as intelligence- or strength enhancing devices. Without equal access to these types of application, new social inequalities could emerge. • The effect that BCIs have on the boundary between “being human” and “being a machine”
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Table 2. Themes that were discussed in relation to the three topics

2.2 General description of national multi-stakeholder dialogues

Between October 2017 and February 2018, national multi-stakeholder dialogue events took place in science centres located in Israel, Italy, France, Poland, Spain and Sweden. The dialogues revolved around the question: how to better identify and integrate societal perspectives in nanotechnology research and innovation processes? Each of the dialogue sessions focused on a specific nanotechnology application field (i.e. nanomedicine, nanotextiles, nano-enabled brain machine interfaces, see Table 1, chapter 1), but most of the actual discussions that took place seemed to concentrate on the (nanotechnology) research and innovation system in general. The outputs of the multi-stakeholder dialogues were the six national responsible innovation agendas that are presented as such in this deliverable document.

Dialogue participants

The dialogue participants were recruited by the science centres, who hosted the dialogue sessions. The project aspired to bring together heterogeneous groups of approximately 12 participants, having diverse views on the topic of the dialogue. The VU provided a guideline on what types of stakeholder groups should ideally be included in the dialogue process (see Deliverable 3.1). The guideline referred to the following types of actors:

- Policy-makers
- Civil society organizations
- Business and industry representatives
- Nanoscientists
- Citizen dialogue representatives
- Non-fixed position (actors that do not a formal stance with regard to nanotechnologies, such as a journalist or an artist, and who can therefore bring new perspectives to the discussion).

The chapters presenting the responsible innovation agendas will further report on the actual participants that attended the various dialogue sessions.

Dialogue format

The dialogues were 8-hours in length and consisted of three main blocks⁴:

Block 1: What's important?

The first block of the dialogue aimed to get the participants in a reflective mind-set and to create a better understanding of what societal perspectives could entail in relation to nanotechnology developments. Participants explored and discussed two citizen science fiction posters (see appendices 1 to 6), which visualized ambiguous story elements on the impact of a hypothetical future nano-application. The story elements were based on the citizen narratives created in the citizen dialogues. They offered an inspiring perspective on how technologies are embedded in society and encouraged participants to think about broader effects of new technologies.

Block 2: Scenario exploration

In the second block of the dialogue, participants played an adapted version of the Joint Research Centre's Scenario Exploration Game. The purpose of the Scenario Exploration Game was to have participants experience and act through plausible alternative futures, by thinking and conversing systemically outside of their usual frame of reference. Each participant played the role of a specific actor (i.e. a policy maker, a business, a researcher, and a civil society organization), and took actions to reach their visions through three game rounds over a fictional 15 year time horizon. A fifth participant, the Public Voice, analyzed the actions taken at every round and gave feedback and value to the actions taken by the other actors. Success in the game took several forms: 1) as an individual actor wielding most influence throughout the three rounds on the development of the scenario, 2) as an individual actor reaching one's own long-term objective, or 3) as a collective, assessing whether the actions of all players have brought them to a desirable future in the game.

The game was played to give participants an understanding of the importance of external drivers on how to reach one's objectives in the research and innovation system, and to help participants later in the day to think of future strategies to align scientific values and objectives with societal values and needs.

Block 3: What (inter)actions are needed and what are their preconditions?

In the final block of the dialogue, participants worked in pairs and in sub-groups to discuss actions and interactions that should take place in the future to make sure that societal perspectives are better reflected in nanotechnology research and innovation. In three dialogue sessions (Israel, Italy and Poland) participants mapped the required actions and interactions on a simplified innovation stage model, and summarized these in a table in which the preconditions for each of the (inter)actions were also added. Since the mapping exercise turned out to be less effective than hoped for⁵, the format of the last block was slightly adapted for the dialogue sessions in Spain, Sweden and France. Instead of mapping, each participant wrote down which actions they themselves could undertake to better identify and integrate societal perspectives, and what they would need from others. These inputs were then collectively discussed and condensed into a table.

⁴ For more detailed information on the dialogue format, see the moderator manual of the national multi-stakeholders, which is part of Deliverable 3.1. The NANO2ALL dialogue methodology.

⁵ See chapter 9 for a more detailed reflection on the adaptation of the block 3 exercise.



Fig 4. Photos of a national stakeholder dialogue event. A: use of citizen science fiction posters in block 1. B: the scenario exploration game. C: mapping required actions and interactions. D: collectively condensing discussed (inter)actions and preconditions in a table.

Processing of dialogue data

Various types of data were collected in the national stakeholder dialogue sessions. Audio-recordings were made of the plenary discussions in block 2 and 3, and the tables summarizing the identified (inter)actions and preconditions were digitalized. Each of the science centres created a summary on the dynamics of their dialogue session and the main themes that were discussed. All this data was analyzed and translated into the responsible innovation agendas presented in the next chapters.

3. France

3.1 General dialogue details France

Dialogue data

Location of the dialogue	Espace des Sciences Pierre-Gilles de Gennes, Paris
Topic	Nano-enabled brain machine interfaces
Date of the dialogue	23 November, 2017
Participants	<p>10 participants (6 men, 4 women):</p> <ul style="list-style-type: none"> • Researcher and university professor in Nanomedicine • Representative of a CSO devoted to informing the public about risks and benefits of nanotechnology • Participant who participated in the French citizen dialogue (1) • Participant who participated in the French citizen dialogue (2) • High level scientist and policy maker, involved in field of material sciences • Former researcher in biochemistry, consultant for industrial sector • Toxicologist and consultant for industrial sector • Science journalist • Science explainer in educational CSO

Notes from the organizer

A very serious and nice atmosphere characterized the day: it was collaborative but not consensual, and it did not hide the diversity of points of views while also respecting them. The workshop was not without some difficulties: due to last-minute schedule conflicts, representatives of the scientific community with specific expertise on nanotechnology could not be present at the event for its entire duration, and thus were unable to share their fullest expertise. Moreover, we believe that having a “hard” industry representative – people whose business performance would depend on the application of nanotechnology – at the dialogue could have helped the discussions touch upon the truly conflictual issues of RRI in nanotechnology, perhaps by challenging the general underlying consensus shared by all participants on the need to exercise stronger civil society control over the development of technology with high potential impact.

Participants coming from critical citizens’ associations had a negative a priori opinion on the Nano2All project: the website and material consulted prior to the workshop made it appear as a pro-nanotech exercise. Participants expressed doubts on the fact that their critical voice would be heard in Brussels, at the European level. Despite this attitude, they accepted to participate constructively and took the occasion to refine their position and arguments, and finally expressed positive feedback concerning the dialogue event.

3.2 Recommended directions for change

The participants discussed a broad range of themes and suggested quite specific actions that could be undertaken by different actors in the (nanotechnology) research and innovation system to enhance the integration of societal perspectives. Below, the themes have been summarized and clustered in different “directions for change”. The original responsible innovation table that was created by participants can be found in Appendix 7.

Promoting a participatory democracy

In the dialogue session, participants referred several times to the term “participatory democracy”, pointing at a system in which citizens are heard and can influence the development of research and innovation. Questions were raised on how such a participatory democracy could be shaped in practice. Participants seemed to suggest three main strands of actions that could contribute to establishing a participatory democracy: 1) promoting a scientific culture & critical attitudes among citizens, 2) promoting the involvement of civil society organizations (CSOs) in nano-related topics, and 3) increasing the willingness and ability of industry, researchers and policy-makers to listen to the voice of citizens.

Promoting a scientific culture & critical attitudes among citizens

With respect to the first suggestion, participants stressed the importance of citizens actively searching for opportunities to get involved in discussions and debates about research and innovation. Public events should be organized to provoke encounters between civil society, industry, research, policy-making and other relevant actors. Contact should be ensured between citizens and their elected representatives on nano-related issues. Some questions still remained unanswered. How to get citizens involved in discussions on nanotechnology? Which citizens will feel attracted to come to these events? How to involve groups that do not have a particular interest for research and technology? It was mentioned that citizens should have a critical attitude; they should raise problems, perform their own research on solutions, voice criticism, and question electoral candidates about their plans related to nanotechnology research and innovation. One participant referred to such undertakings as “a citizen duty”, comparable to the duty of having to vote. Others called it “politicizing the issues from below”. To allow for critical attitudes amongst citizens and to ensure constructive debates, some participants emphasized the importance of an informed citizenry. Citizens should have opportunities to engage in life-long learning and should be able to gather information by themselves, i.e. know how to perform “an investigation”. Participants expressed the need for unbiased information that is spread amongst all groups in society.

Promoting the involvement of civil society organizations in nano-related topics

A second direction for change that participants called for was a more prominent role for CSOs. Participants seemed to attribute much value to the work of CSOs as counter-lobbyists, and articulated a desire for more financial support to facilitate the creation of CSOs. Some participants even suggested that the funding of CSOs should be proportional to the potential impact of new technologies (i.e. the number of people that will be affected by a technology). One suggested way to finance this was to transform budgets of ministries (or at EU level) nowadays devoted to communication and outreach into support for CSOs as auxiliaries and consultants for public policies. Participants also talked about what focus CSOs should have. Some mentioned that CSOs should not solely aim attention at bio-ethics or issues related to health and environment, and stressed that much of the current legislation

is outdated and not applicable to the issues we will be facing in 20 years time. For this reason, they argued for CSOs that focus on nano-systems at large. Many of the future issues around nanotechnology will not necessarily be linked to impact or toxicology of specific nanoparticles, but will be related to the broader impacts that developments in the field can have (e.g. questions concerning big data, in the case of nano-enabled brain-machine interfaces). Other participants explained that for CSOs to have constructive impact on research and innovation, they should try to understand the evolution of public opinion and transparently communicate about the actors and powers at play.

Increasing willingness and ability of industry, researchers and policy-makers to listen to the voice of citizens

Participants mentioned that if we want the participatory democracy to work, we need companies, researchers and policy-makers that want to listen to the voice of citizens. It was suggested that companies should put procedures in place to understand public opinion, and not just for marketing and communication strategies. Companies should be willing to participate in debates with citizens and other participatory democracy approaches. One participant also mentioned that researchers need time and money to open up towards society; to communicate about their work and consult people outside academia about research priorities, for example. Participants also stressed the need for public consultation performed by research funders, since they often determine research agendas.

Promoting quality control and transparency of research and innovation processes

The theme of improved quality control and transparency in research and innovation emerged several times in the dialogue discussions. Participants suggested that quality standards and quality control should be imposed on nanotechnology research and innovation processes. It could be something analogous to the ISO system, but adapted to issues related to ethics, health and environmental impacts. Another point that was mentioned was the protection of whistle blowers, both in research and industry. Participants explained that particularly in industry, little protection is currently in place and this should change.

Promoting interdisciplinary work in nanotechnology research

Participants expressed the need for improved integration of ethics in nanotechnology research practices. They suggested that researchers should engage in the development of training modules for secondary schools on ethics and the social impacts of research, and emphasized that university students in the field of nano should receive interdisciplinary education. The ministry plays an important role, and should support changes in this direction. Nanotechnology research should not be practiced in an isolated manner, but should interact with scholars of humanities, ethics and the social sciences. Several participants stressed that mere collaboration with the humanities and social sciences does not suffice, and pointed out that these scholars should be part of the actual laboratory teams. It was also suggested that more spaces for ethical reflection should be developed within research institutions, either by making use of already existing structures (e.g. ethical committees in hospitals) or by developing new ones. Participants wanted to see the customs of ethical life being institutionalized, also making sure that researchers are not just focusing on how to influence peer scientists, but take into account the perspectives of civil society. Some introduced the idea that representatives of civil society could be part of the call-writing process for publicly funded research, and could participate in the definition, evaluation and implementation of research programmes.

Facilitating the creation of socially responsible start-ups

A final theme that was discussed related strongly to the role of industry and business in making nanotech innovation more responsive towards societal perspectives. The comments of participants seemed to suggest that there was not much confidence in nanotechnology industry and companies. Participants referred to secret developments and non-transparent business models, and the sole strategy to commercialize. On the other hand, participants also recognized that companies exist, which work according to a different business model and take social responsibility very seriously. Several participants suggested that governments should protect and help start-ups and small and medium enterprises, which want to engage in alternative – and more responsible - routes, to compete with big players.

4. Israel

4.1 General dialogue details Israel

Dialogue data

Location of the dialogue	Bloomfield Science Museum, Jerusalem
Topic	Nanomedicine
Date of the dialogue	19 October, 2017
Participants	<p>13 participants (8 men, 5 women):</p> <ul style="list-style-type: none"> • Representative of advisory company for corporate responsibility • Post-doctoral researcher in the field of nanomedicine • Representative of popular science internet news paper • Representative of the ministry of health – working in the field of social inequality • Representative of the ministry of justice – working at the authority for privacy protection • Citizen dialogue representative (biology PhD. Student) • Citizen dialogue representative (retired electrician) • PhD student in Science and Technology Studies • Science educator with microbiology background • Representative of a health maintenance organization • Retired professor and developer of pharmaceutical products • Retired professor and developer of cancer nanomedication • Retired director of an optical biomedical company

Notes from the organizer

The dialogue session in Israel hosted a group of participants that were eager to share their opinion and really interested in exchanging views. Due to this session being one of the first that was organized, some hurdles with the dialogue format were experienced, which prevented the discussions from reaching the desired level of depth⁶. The final exercise, in which participants had to identify actions and interactions to enhance the integration of societal perspectives in nanotechnology research and innovation, focused mainly on how the system is currently organized and left little room for discussion on how to better identify and integrate societal perspectives.

⁶ See chapter 9 for a reflection on how and why the block 3 exercise was adapted.

4.2 Recommended directions for change

The participants of the Israeli multi-stakeholder dialogue discussed quite extensively the structure of the current system. Several themes came up on how the system could be improved, although it was not always clear how these themes specifically related to improving the integration of societal perspectives in nanotechnology research and innovation processes. Not all of the suggestions were fully developed in the discussions, but the themes do provide an idea of the “directions for change” that were considered important in this particular dialogue session. The original responsible innovation table that was created by participants can be found in Appendix 8.

Fostering transparency in the system

Transparency was a prominent theme in the discussions that took place. Participants were particularly concerned about the general lack of awareness about the research that is being performed and the medical (nano)products that are currently on the market. Participants suggested the establishment of an organized and accessible databank in which new research and products under development are described. Patients could then explore for themselves what is currently on the market and what is not, or they could check the current stage of development of certain drugs. This would allow them to find out for themselves which drugs might be relevant to try. One of the participants did mention that it might be difficult to publish information on products that are still under development, due to market competition. Another aspect of transparency that participants spoke of was the transparent supervision over pricing of medical products, particularly if the development of these products was publicly funded. Lastly, it was mentioned that policies and guidelines to supervise research and innovation processes should be openly accessible to both researchers and others in society who would like to check whether researchers that received public money are using the money in an appropriate way.

Improving science communication and stakeholder discussions

Communication with citizens was a topic that came to table several times. Yet, the suggestions of the participants seemed to focus more on informing and educating citizens than on taking citizen perspectives into account in research and innovation processes. Many participants agreed with one another that improved science communication is needed, and that policy-makers should do something about this. Some proposed more communication on basic research through cooperation between the education system and academia. Others mentioned that media should cover more on science and technology developments to dispel public concerns. One of the participants nuanced that dispelling concerns is not the role of the media, and emphasized that media should also be critical of what is happening in science and technology. Many participants wanted to see more communication and reporting to the general public about what research is currently performed. They wanted this information to be disseminated via non-commercial media channels, and the content should be accessible and comprehensible to everyone (e.g. written in clear language).

The moderator of the session tried several times to encourage the participants to also consider in what way citizens and societal actors could or *should* influence the nanotechnology research and innovation system. However, the participants seemed quite reluctant in working with this idea. Some participants expressed their concern that citizens might not be able to help in setting research priorities, since they can be influenced easily by (false) stories that are told to them. Others explained that they do think it would be legitimate to involve citizens in priority setting for publicly funded research, since it relates to how their tax money is spent, but stressed that much of the research

in the field of medicine is actually performed by private companies. Participants did feel that platforms for continuous dissemination and discussion between interested parties (including patients and citizens) should be developed, although it did not become entirely clear what should be discussed within these platforms. Participants spoke more concretely about the need for feedback on how patients value the drugs and medical products that are being developed, and suggested some form of “satisfaction research”. Such feedback would be important for both the public and private sector in the nanomedicine field.

Fostering ethical behavior and attention for safety

The participants made several comments on ethical behaviour and safety in nanotechnology research and innovation processes. Participants agreed that quality control and ethics are important in research and innovation, but did not immediately specify what kind of quality control should take place (or by whom) and what ethical principles should be adhered to. Some aspects that came up throughout the dialogue include: 1) clear criteria for professional quality and avoiding harm to basic principles, particularly if researchers receive public funding, 2) weakening the relations between industry and healthcare organizations/doctors, 3) attention for safety of people working with nanoparticles that could penetrate the body/environment and result in toxic effects, and 4) assuring patient confidentiality and privacy in times of big data, specifically if sensitive data can be collected via nanomedicines/nano-medical devices. One of the participants mentioned that in each of the research and innovation phases (from basic research to selling products on the market), we should anticipate potential problematic situations that might arise. It was not specified who should be responsible for this.

5. Italy

5.1 General dialogue details Italy

Dialogue data

Location of the dialogue	MUSE - Museo delle Scienze, Corso del Lavoro e della Scienza 3, Trento, Italy
Topic	Nanotextiles
Date of the dialogue	21 October 2017
Participants	<p>12 participants (8 men, 4 women):</p> <ul style="list-style-type: none"> • Representative of the council on university and research • Representative of the provincial health service • Representative of CSO focused on women's business in professional arts • Representative of a CSO focused on textiles and health • Nanotechnology researcher (1) • Nanotechnology researcher (2) • Journalist of local newspaper • Wikipedia journalist and science educator • Citizen dialogue representative (1) • Citizen dialogue representative (2) • Representative of a textile company (1) • Representative of a textile company (2)

5.2 Recommended directions for change

The participants to the Italian multi-stakeholder dialogue discussed quite extensively the interactions needed between different actors in the nanotechnology research and innovation system to enhance the integration of societal perspectives, considering different actors' weight and roles at several stages in the research and innovation process. Below, their suggestions have been summarized and clustered in several "directions for change". The original responsible innovation table that was created by participants can be found in Appendix 9.

Increasing public knowledge and competences on nanotechnologies

Knowledge and competences (among all stakeholders and citizens in particular) was a topic that was brought to the table repeatedly. Many agreed that reliable information is needed at all levels, some referring to it as a right. Participants considered this as a fundamental and transversal prerequisite for all interactions between actors in the research and innovation processes, including in the integration of societal needs.

Participants felt that media and industry had a responsibility to provide correct and complete information (e.g. on nanotechnology product ingredients and their traceability) in a transparent way. In connection to this, participants indicated that media should follow a professional and ethical code of conduct, while industry needed to show more discipline in what concerns their advertising activities. Some participants even suggested that an authority responsible for the transparency of information, as early as at the product development phase, could ensure this is the case. Another suggestion was that public entities funding innovation could play a role in bringing citizens and industries together to exchange information.

The question of whether responsibility should fall more on media (i.e. inform about the goals and the results of research) or on citizens and individuals (i.e. request and gather information, keep themselves up to date) was raised. At the same time, participants recognized that citizens' own competences and critical thinking still require improvement, especially in light of the complexity of nanotechnology developments. The need to empower citizens themselves, via education, with the right tools to avoid misinformation about nanotechnology and recognize trustworthy references was stressed. It was not made obvious who would deliver education, but media, "competent agents" (see below) and policy makers were each mentioned in connection to this aspect.

Fostering mediators for societal needs, values and concerns

Participants seemed hesitant to suggest direct interactions between citizens and certain actors in the R&I field such as researchers, being concerned that citizens lack the knowledge and necessary competences. Nevertheless, they proposed potential mediators or spokespersons of societal needs, values and concerns. Two similar major recommendations emerged independently in the two exercise groups. It must also be mentioned that a few participants were of the opinion that consumer choices and market forces are enough to allow societal needs to become apparent.

For some, it was considered the task of policy makers to regulate and enforce the rules so that the needs of citizens are heard and to convey these needs to the various actors in the R&I stages, from basic research to product development. Other participants proposed to identify and involve one particular set of actors: citizens who are better informed about technologies and aware of the magnitude of the phenomenon of nanotechnology, or who have, due to their profession or medical conditions, specific societal needs or expertise. They could also already be active in existing civil society associations, citizen committees, municipalities etc. Grouped by participants under the label of "competent agents", this group would serve a double role: educate citizens so they are able to express their needs, and communicate these needs to the right actors in the R&I system. One participant did point out that such groupings of competent agents could be focused on majority-specific concerns and suggested that policy makers would need to include minority concerns for a more balanced view. The question of how to identify and foster competent agents' involvement was largely left unanswered, although the role of specialised media in helping these agents understand developments earlier in the research and innovation process was noted.

Improving regulation for more societal engagement

It was suggested that policy makers, in their capacity as mediators of societal values, needs and concerns, policy makers should ensure their integration via funding, monitoring and priority/agenda setting. A comment made repeatedly was that policy makers could further regulate to ensure greater integration of societal needs, values and concerns and enforce these regulations. The form of this regulation could take was not addressed. An additional suggestion was that civil society organizations could share the responsibility, exerting a verification function

towards industry, after receiving this mandate via policy makers. The overall impression is that regulation should be guaranteed by a set of different stakeholders so that citizens and their mediators have several access points in the process to bring in their perspective.

Greater interaction between stakeholders, earlier and across all stages of the R&I system

Most participants recognized that it is too late, at the market stage, to incorporate societal needs into research and innovation products. In general, most participants agreed on significantly more stakeholder interaction and need consideration, especially in the applied research and product development phases. Specific suggestions included: 1) greater awareness among researchers of needs and demands, enabling them to use these when carrying out applied research; 2) specialized media (with support from industry) that signals to those concerned an applied research development that is approaching the pre-industrial stage; and 3) better use of focus groups and testers, which were, it was felt, underutilized.

To facilitate this interactions, broader suggestions included: 1) greater communication between ministries (e.g. of industry, research); 2) greater collaboration between fundamental and applied science researchers, enabled by transparency and open access to research results; and 3) greater interaction between policy makers (also in their capacity to interpret the values of citizens and their needs), researchers and industry when setting the budget and strategic defining research priority areas. It was not always made clear how this will serve to better integrate societal perspectives, leading to the suggestion that participants also shared general thoughts on changes for a more desirable research and innovation system.

6. Poland

6.1 General dialogue details Poland

Dialogue data

Location of the dialogue	Bialowieza (hosted by Bialystok University of Technology)
Topic	Nanotextiles
Date of the dialogue	21 October 2017
Participants	<p>12 participants (4 men, 8 women):</p> <ul style="list-style-type: none"> • Representative of foundation dealing with issues of sustainability • Representative of budget commission of city council • Architect and civil engineer • Foresight specialist (1) • Foresight specialist (2) • Representative of the citizen dialogue (1) • Representative of the citizen dialogue (2) • Representative of foundation active in the field of education and sustainable development • Representative of strategy department of the city hall • Representative of major textile company • Former economic journalist and tax expert • Entrepreneurship, innovation and industrial policy specialist

6.2 Recommended directions for change

The discussions in the Polish multi-stakeholder dialogue seemed to revolve around three main themes, which are elaborated below. A note that should be made here is that the conversation seemed primarily centered on the question of what is needed to promote responsible innovation, instead of how to better identify and integrate societal perspectives. Although these questions partly overlap, the former has a slightly broader scope and thus resulted in recommendations and directions for change that relate more generally to the notion of responsible development.

Fostering collaboration and trust

Collaboration and trust were prominent themes in the dialogue discussions. Participants considered true cooperation of different stakeholders in the realm of responsible nanotechnology development critical, but also a hard challenge. They referred to having experienced “trust issues” in the Polish society, which obstructs willingness

of different stakeholders to interact and collaborate. Participants spoke of the different goals that each of the stakeholders has when it comes to nanotechnology development and the resulting conflicts of interests. Participants indicated that the trust issues might be overcome by putting stakeholders in (direct) contact with one another. They strongly recommended the creation of spaces in which stakeholders could exchange their goals and work on enhancing mutual understanding. Both online platforms as well as face-to-face events were indicated as possible solutions to eliminating prejudice. One participant suggested that local/regional collaborations between stakeholders might be a good starting point, since these types of relationships are more personal and lasting. Local communities, businesses and representatives of NGOs should form ties, and universities and researchers should also be active in the field of local and regional collaboration. It was considered the task of government programmes to create the conditions for the cooperation of various groups of stakeholders, but not to give guidelines on what this cooperation should look like exactly.

Involving citizens by focusing on current social problems

Participants stressed that, in an ideal situation, researchers and innovators should focus on developing products for which society has a real need. It was pointed out that the timely involvement of citizens would therefore be important. The question of *when* such citizen involvement should take place was raised. Many participants seemed to agree that citizens should be consulted about their needs and perspectives at the stage of applied research (put very simply), right before products enter the market. This way they can influence the actual development and creation of the products, instead of just evaluate products that are already on the market. Participants seemed hesitant to already involve citizens in earlier stages of development. Some particularly stressed that basic research should retain sufficient degrees of freedom and political influences should thus be minimized at this stage, while others used softer phrasing and spoke of “the dilemma between the researcher’s autonomy and the responsibility for his/her actions”.

Participants seemed to struggle with the question *how* to involve citizens in consultations. They referred to the usual lack of interest in these kinds of events, and pointed out that many citizens have to cope with more urgent daily struggles, such as poverty. So why would they be interested in joining a discussion on nanotechnology? It was suggested that current social problems (such as aging societies) might be a more productive starting point for discussions on responsible innovation and general reflections on technological, social and economic development in different countries and regions. Since such social problems affect everyone, participants considered it a great opportunity for broad involvement and the creation of joint activities to strengthen cooperation for responsible approaches.

Enhancing attention for ethics, safety and legislation

Participants mentioned that sufficient attention should be paid to ethics and safety around nanotechnology innovations. Some participants stressed that attention to ethics should not solely be focused on traditional bio-ethical issues, but should also consider the broader societal effects of new (nano)technologies. The questions that remained to be answered were *who* should identify such broader effects and at what stage of the research and innovation process should attention be paid to such matters? Some participants suggested that the third sector could play an important role here, but others countered this view by pointing out that the high levels of secrecy – present in the industrial world and surrounding contracts between researchers and companies - would make it difficult for the third sector – or any outsider - to find out what innovations people are currently working on, let alone to explore potential broader for society.

Participants seemed to recognize an increase in attention for user safety in the industrial sector and emphasized the importance of legislation and safety standards for product development. Yet, participants seemed concerned about the inability of legislation to keep up with the rapid developments in research and innovation. Several ideas were voiced on how this problem should be tackled, including: 1) raising early awareness amongst decision-makers on the potential effects of new developments to ensure timely consideration of implications for legislation 2) sufficient money for the ministry of development to make laws that can cope with novelties, and 3) improving the knowledge-level of legislators and policy-makers on the structure of innovation processes and their global dimension to make sure that the legislation matches the real-world situation.

7. Spain

7.1 General dialogue details Spain

Dialogue data

Location of the dialogue	Barcelona Institute of Science and Technology (BIST), Barcelona (hosted by Catalan Institute of Nanoscience and Nanotechnology – ICN2)
Topic	Nano-enabled brain-machine interfaces
Date of the dialogue	12 February, 2018
Participants	<p>9 participants (6 men, 3 women):</p> <ul style="list-style-type: none"> • Nanoscientist (nanometric techniques) and communicator • Research professor advanced electronic materials and devices • PhD student science communication on graphene • Science communicator • Representative of company leading scientific dissemination projects across Spain • Discussion generator and creator of opinion platforms related to science (background as a nanoscientist) • Policy-maker involved in supervising, supporting and facilitating the activities of Catalan research centers • Citizen dialogue representative • Scientist Bioinformatics (interested in how science and society should interact)

7.2 Recommended directions for change

The discussion in this dialogue session seemed to revolve around three main themes: 1) fostering bi-directional communication between science and society, 2) promoting science as cultural identity, and 3) promoting synergies between different actors. Throughout the session, many questions were raised and explored and several specific recommendations were made. These are all summarized in the paragraphs below. The original responsible innovation table that was created by participants can be found in Appendix 10.

Fostering bi-directional communication between science and society

Bi-directional communication between science and society was a recurring theme in the dialogue discussions. Participants were concerned about the gap between science and “the person on the street” and stressed the importance of both consultation of citizens in science policy-making processes, as well as education and dissemination activities to empower citizens to contribute to decision-making in an informed manner.

Improving scientific dissemination and communication to citizens

Although participants mentioned that there is already a system in place to inform and educate people on the importance of knowledge generation, they did provide several suggestions on how dissemination and communication activities could be improved in the future. Science communicators were seen as crucial actors to improve dissemination of scientific knowledge and in making science comprehensible to society. Several participants expressed the need for increased recognition of science communicators as legitimate interlocutors between science and society. Yet, other participants added that for improved communication about scientific developments, scientists themselves should also engage more extensively in communication activities, and they thus called for specific training activities for researchers to develop such skills, as well as recognition of outreach activities as a valuable element in academic CVs.

Improving consultation of citizens on science topics

A question that seemed more challenging for the participants to answer was how to ensure that science and policy-makers listen to citizen perspectives (and thus ensure that communication is *bi*-directional, instead of *uni*-directional). Participants referred to the vital role of government and policy-makers in this matter, who decide how public research grants are allocated across research fields and themes. One of the participants explained that many actors, including the private sector and universities, are nowadays consulted in the elaboration of public policies on science, yet, citizens are not. Participants seemed to agree that this could be a first point of improvement for policy-makers. Participants indicated that such citizen consultations should take place at an early stage of research developments to allow for timely changes of direction if needed. A suggestion that was made was to organize a citizen consultation periodically, parallel to the development of the national research plan every 4 to 5 years. Some participants also plead that if you want research to focus on societal impacts, government should carry out more periodic evaluations (particularly in university settings) of how research money was spent and the societal impact that was reached. It was stressed that for such undertakings, the use of appropriate indicators (i.e. not focusing on numbers of scientific publication) is crucial.

Despite the general agreement on the need for citizen consultations, the idea also raised many questions throughout the dialogue session. What does it mean to consult society? How to organize this? How to really integrate input from citizens? How many citizens should be consulted to get a representative picture of the public perspective? How to prevent bias in the group of citizens that attends consultation sessions (i.e. only people who are already interested in science and technology)? And is bias actually something that we can prevent? One participant proposed that the role of civil society organizations might be of particular importance here, acting as a “loudspeaker” to make the voice of citizens heard. One participant also prompted the question: should we consult citizens about *everything*? Some considered it risky to do so. They explained that citizens might not see the (long-term) benefits of basic research and may thus fixate too heavily on allocating funds to applied research fields. These kinds of critical notes and questions did not generate unequivocal suggestions for change, but seemed to make participants realize that giving shape to bi-directional communication channels is a hard task.

Promoting science as part of cultural identity

Participants stressed that to make bi-directional communication work and get people involved in decision-making on science, it is crucial that citizens feel part of the science world and related policy-making processes. In order to establish this, participants suggested the promotion of science as part of the region's cultural identity. Policy-

makers should use science as a symbol of society's identity, and awareness should be raised about what science and technology have done in the country. Participants referred to the important role of media, science museums and social centres in bringing science closer to citizens. Some participants also touched upon the need for educational policies with inspiring scientific models to teach children about the scientific method and to keep them interested in science throughout their school years. These kinds of approaches were considered useful in establishing "a mood" in which people are more prone to show interest in scientific topics and discussions. Participants stressed that such a mood change cannot be established overnight, but requires a long-term approach.

Promoting synergies between different actors

One final theme that participants spoke of was the creation of synergies between science and other actors in society. Some participants considered it problematic that some science departments or research centres operate as silos in society, having little contact with other scientific fields/departments and societal actors. They called for more interdisciplinary collaboration between scientists and emphasized the need for more willingness amongst actors to enter such collaborations. Science centres were introduced as an actor that could facilitate and promote the creation of synergies.

One form of collaboration that received particular attention in the dialogue discussion was the one between scientists and policy-makers. Some participants felt that the government should create better instruments to consult scientific institutions in policy-making processes and expressed the need for a better representation of the scientific perspective in politics. They suggested the creation of an independent national research agency that could provide scientific advice to government and parliament without itself being influenced by political dynamics. In order to motivate scientists to enter such collaborations, they should receive recognition and remuneration for advisory work that they do. Participants stressed that the scientific community should see such activities outside academia as a valuable addition to a scientist's CV. What is intriguing to note is that these suggestions for improving the research-policy-making collaboration do not seem to relate to the question of how to better integrate societal perspectives in research and innovation processes, but instead express a need for scientists to also have their own voice in policy-making processes. Although this idea does not exclude society from getting involved as a whole, it does show how the central question of the dialogue was sometimes temporally transformed throughout the conversations. This is something that was also observed in other NANO2ALL dialogue sessions.

8. Sweden

8.1 General dialogue details Sweden

Dialogue data

Location of the dialogue	Innovatum Science Center, Tröllhattan, Sweden
Topic	Nanomedicine
Date of the dialogue	23 November, 2017
Participants	<p>12 participants (8 men, 4 women):</p> <ul style="list-style-type: none"> • Representative of umbrella organization of Swedish nanotechnology actors • Research manager of a company developing nanomedical products for cancer diagnostics and treatment • Representative of organization that strives for environmentally responsible behavior in the medical sector • Researcher in the field of nanotechnology, scientific instruments, nanosafety and nanotoxicology • Researcher in the field of molecular surface physics and nanoscience (1) • Researcher in the field of molecular surface physics and nanoscience (2) • Researcher in the field of nanomedicine and biomaterials • Researcher studying nanotechnology from a social perspective • Representative of a digital platform for dialogue and planning of systems • Representative of a national charitable environmental organization, focusing on chemicals and cosmetic products • Representative of an organization coordinating projects on nanosafety

8.2 Recommended directions for change

The discussions in the Swedish multi-stakeholder dialogue were primarily focused on issues of safety and transparency. Although both safety and transparency are relevant topics in relation to the concept of responsible research and innovation, the conversations seemed to elude the question of how societal perspectives can be integrated better in nanotechnology research and innovation processes. The directions for change presented below thus mainly reflect suggestions that relate to other – but not necessarily less relevant - aspects of responsible innovation than societal inclusion. The original responsible innovation table that was created by participants can be found in Appendix 11.

Improving regulation on safety and labeling of nanotechnology products

Many of the participants seemed concerned about the lack of regulation and proper labeling of nanotechnology products, particularly outside the medical field. They referred to the hard regulations and rigorous testing procedures that exist for the production of nanomedicines, and wanted to see similar strictness of regulations for nano innovation processes outside the medical field. Participants argued that irresponsible behaviour in other fields also damage the reputation of nanomedical products. Therefore, participants called for a closer dialogue between researchers, industry and policy-makers to discuss standards and labeling of products.

A prominent request of participants was a clear definition of how the “nano-concept” should be used in labeling and regulation. Several participants elaborated that not all nano particles are dangerous, and that distinction should be made between those particles and materials that need regulation and those that do not.

In addition, participants asked for the standardization of measurement methods to test and evaluate products and materials. One participant warned that we should not simplify this process, pointing at the enormous variety in properties of nanomaterials, and the consequential need for test methods that are relevant for the specific materials. Participants stressed that testing and evaluation should not only focus on the effects on the body, but should also take into account environmental impacts and life cycle effects. They believed that this is currently still missing in and outside the medical field. Participants underscored that strict safety regulation is needed as soon as possible, preferably coming from the EU level. Support from politicians was considered crucial, and some participants called for a coordinating European authority focused on the area of nanotechnologies.

Lastly, the need for transparent labeling of nanotechnology products was emphasized. Business and industry should exchange more information about the functions and properties of nanotechnologies and materials in their products. Participants accentuated that such labeling information should be written in clear language, which consumers can easily understand.

Increasing public knowledge on nanotechnologies

One of the prominent themes in the dialogue discussion was improving the education of the public on nanotechnologies. Participants explained that much is still unknown about the effects and the risks of certain nanoparticles and nanomaterials on the human body and the environment. Instead of banning all products with uncertain effects, participants seemed to agree that citizens should take more responsibility themselves in gathering information on nanotechnology risks and benefits to then decide for themselves whether they would like to use such products and to determine which risks they are willing to take. However, participants did emphasize that citizens should then have sufficient knowledge on how to judge such risks, and participants considered this something that still requires improvement. Two suggestions were made on how to accomplish this, which are elaborated below.

Accessible and understandable information

Participants mainly focused on two directions for change to stimulate citizens to make their own risk judgments. First is the increase of accessibility to information on properties of nanomaterials and nano-enabled products. People should be able to trust that the information on packaging is correct and is not hiding any details about the materials of which the product is made. Information about properties and risks should also be communicated in an

understandable manner. One participant pointed out that this may require the use of pictures or videos, instead of big pieces of text. Researchers were considered to have a significant responsibility in providing clear communication on nanomaterials and nanotechnologies, although financial incentives might be needed for them to really take up this role. In addition, it was mentioned that nanotechnology actors should attend to the needs and concerns of citizens and ask for their opinions. The argument of the participants suggested that the main goal of such undertakings would be to identify knowledge gaps and make sure that citizens focus on the “right” risks instead of those that were deemed irrelevant by the dialogue participants.

Increased number of educational programs on nanotechnologies and risk assessment

A second suggestion that was made was to set up educational programs, particularly in schools and colleges. Participants called for more focus in the school curriculums on nanotechnologies and strategies to process information on properties of materials. The idea of a web platform to educate students was also suggested. Policy-makers were considered an important facilitator of these changes. They should make policy on the school curriculums and provide funding for educational programs and communication channels.

9. General reflections

With the six national multi-stakeholder dialogues, the NANO2ALL project aspired to bring together various actors in a collaborative endeavor to develop national agendas for enhanced integration of societal perspectives in nanotechnology R&I. The dialogue participants engaged in lively discussions and proposed a broad range of actions and directions for change. Many of the suggestions made are not necessarily new to the debate around RRI, but reinforce current thinking about important themes and challenges that we face in democratizing science and technology governance. This chapter highlights some of the major recommendations presented in the agendas, and provides a broader reflection on these outcomes and the lessons that were learned.

9.1 Overview of the recommended directions for change

The agendas show a need for greater interaction and closer dialogue between researchers, industry, policy-makers, CSOs and citizens. Different dialogues events revealed different views on the scope and level of citizens' involvement in the research and innovation process. In some countries, participants called for the inclusion of citizens in policy-making processes via debates and consultations (e.g. perhaps related to current societal challenges), while in other dialogues, participants did not necessarily recommend placing citizens in direct contact with stakeholders such as researchers and industry, favoring instead the transmission of societal needs, values and concerns by mediators such as groups of better informed citizens, civil society organizations (CSOs) and policy makers.

Policy-makers were recognized as having a strong role to play in ensuring that these mediators can operate in the research and innovation system. Other systemic changes included a multi-stakeholder approach to funding processes and the implementation of research programmes.

Much was discussed about the need for deeper knowledge among the general public about nanotechnology, as a prerequisite to its engagement. Clear and understandable information and critical thinking skills were specifically mentioned across all dialogues. Both short and long-term solutions were proposed, among which the development of a scientific culture and a stronger role and greater responsibility of policy makers and CSOs in providing training and education.

Industry, researchers and policy makers were also urged to show greater openness and willingness to take societal perspectives into account. Various suggestions for actions that could enable this were made, such as the creation of spaces in which they could exchange their goals and work on enhancing mutual understanding. Such spaces could be established at local or regional levels where ties are stronger.

Moreover, it was acknowledged that researchers need time and funds to open up towards society and to feel that activities outside academia (i.e. advice to policy makers, outreach to the public) are considered a valuable addition to their scientific careers. Interdisciplinary collaborations were seen as a helpful means to connect researchers to other (societal) perspectives. For this reason, capacity building programmes for researchers to acquire the skills needed to communicate with other disciplines, particular stakeholders such as policy makers, and the general public were a concrete suggestion made by participants.

Some recommendations also touched on changes needed to promote responsible innovation more generally: issues of quality control, transparency and ethics, including the broader societal effects of nanotechnology, were very much on the minds of dialogue participants.

9.2 Reflections on the responsible innovation agendas

When reflecting on the responsible innovation agendas as presented in this document, several things stand out. Firstly, most of the recommended directions for change that are presented in the agendas are not nano-specific, but target the research and innovation system at large (or the pharmaceutical industry at large, in the specific case of the two nanomedicine dialogues). This is not surprising, since societal inclusion is a cross-cutting theme, being discussed in relation to a broad range of new and emerging technologies, from biotechnology to digital technologies and robotics. The broad nature of the suggested directions for change shows us that further collaboration and mutual learning between research and innovation fields, stretching beyond nanotechnology, is required to raise discussions on societal inclusion in R&I to a new level.

A second observation is that the presented directions for change seem to align with many of the ideas that have been around in the debate on how to bring RRI in practice. Although this means that not all of the suggestions are entirely new, the fact that they are reiterated does emphasize their lasting relevance, which can be regarded as an interesting result in itself. It shows that continuous attention and efforts are still needed to explore how true change into these directions can be established. In our view, the fact that the NANO2ALL dialogues did not only engage stakeholders that were familiar with the RRI concept, but also actors to whom the concept was (relatively) new, constitutes to such a continuous exploration. The dialogues seemed to enthuse many of them to further contribute to discussions on the restructuration of the R&I system, and such broad involvement of actors is crucial if we truly want to close the gap between how RRI is promoted in theory and the current cultures and practices that dominate R&I. Nevertheless, the alignment between NANO2ALL's dialogue outcomes on the one hand and the ongoing discussions on governance of R&I on the other, does imply that further analysis and prioritization of the points presented in the agendas is needed in the next stage of the NANO2ALL project. This will allow us to see which suggestions could be taken one step further and deepen the discussions on what short, medium and long-term actions are required to further our understanding of how societal perspectives can be better integrated in R&I processes.

Thirdly, in crafting the responsible innovation agendas, we noticed that the recommendations provided by the participants differed in the level of abstractness. In some dialogues sessions, the suggested actions for change were very concrete and specific, providing a high level of detail on who should be responsible for the actions and at what point in time they should be executed. In contrast, other dialogues produced suggestions for change that were of a more unspecified character, leaving questions open on precise responsibilities, approaches and timing of activities. The observed differences seemed to be related to 1) the adaptation of the block 3 exercise, with the adapted version of the exercise providing more opportunity to discuss detailed actions (see section 9.3), 2) the extent to which moderators encouraged participants to share more details, and 3) the amount of time that was left in the dialogue session to perform the final exercise. The responsible innovation agendas in this document were structured in such a way that they could account for the outcomes' differences in level of abstractness. By clustering the suggested actions of participants in "directions for change", broader themes could be highlighted, while allowing for different levels of specificity in the elaboration of these themes.

A fourth observation is that the responsible innovation agendas differ in thematic focus, with some voicing a strong call for increased influence of civil society in R&I (e.g. in France), while others (e.g. Israel, Sweden) are more targeted at themes and suggestions that stretch beyond the dialogues' central focus on enhancing the integration of societal perspectives in nanotechnology R&I, touching upon issues of quality control, transparency, labeling and safety of products. Although these themes are important in themselves and play an crucial role in the broader

framework of RRI, they were not always discussed in connection to the specific issues around societal inclusion. One possible reason for the observed deviations from the central topic is that the introduction of the dialogue and explanation of its aim were embedded in a more general explanation on the concept of RRI. Throughout the session, participants might have connected to those aspects of RRI that resonated most with their own vocabulary and interests. Yet, in some instances, the focus on themes as labeling, safety and education of citizens seemed to result from more technocratic perspectives on governance of science and technology, not always in line with the democratization ideal that is promoted by RRI scholars and practitioners. Although it is crucial that these perspectives are also brought to table, the discussions might have benefited from more explicit communication about the normative theory in which the project is grounded, bringing possible points of friction more readily to surface and thus preventing the discussion from eschewing conflict by focusing on those aspects of RRI that are easier to agree upon. Deeper discussions on the cultural differences between those promoting RRI and R&I practitioners seem essential to close the gap between the theory of RRI and the frames and practices that currently dominate (nanotech) R&I.

A final note about the responsible innovation agendas is that even though the presented ideas and suggestions give a clear impression of the “directions for change” that mattered to the participants, it is important to realize that no prioritization of actions and issues occurred yet. A wide variety of ideas was accepted, which could all co-exist on the agendas. This allowed the project to get a broad overview of the perspectives and ideas that stakeholders have, but does imply that a process of prioritization is still required in Work Package 4 before the agendas can be developed into roadmaps.

9.3 Reflections on the participant group compositions of the dialogues

The project aimed to gather well-balanced groups of participants to participate in the dialogue events with sufficient diversity in professional background and perspectives on the dialogue topic. Each of the organizations hosting a dialogue reached out to a wide variety of actors that matched the participant profile descriptions that were provided to them beforehand. In most of the dialogue sessions a considerable degree of diversity was established in the group composition, although specific stakeholder groups sometimes remained underrepresented. In France, for example, both dialogue participants and dialogue host missed a strong industry perspective that could challenge the general consensus in the group on the need to exercise stronger civil society control over development of nanotechnologies. In Spain, participants also referred to the lack of a strong business perspective, while in Sweden both policy-makers who had confirmed their participation canceled their attendance last-minute.

Several factors influenced the dialogue recruitment process. Firstly, the 8-hour time span of the workshop was quite an investment for dialogue participants, and dialogue hosts experienced this as a challenging factor in convincing stakeholders to attend the session. Secondly, for many of the science centers that hosted the dialogues, the organization of a multi-stakeholder event was a new experience (i.e. in general their activities usually focus on engaging citizens in the field of science and technology). For this reason, connections with stakeholders, such as industry and policy-makers in the field of nano, did not always exist yet. This required extra efforts of science centers to get these stakeholders on board. In some cases, NANO2ALL consortium partners could assist by linking the science centers to their relevant contacts in the dialogue countries. Many of the science centers did indicate that they envision a future role for themselves in providing a platform for multi-stakeholder interactions. They thus

regarded the NANO2ALL multi-stakeholder dialogues as a useful exercise to experiment with such activities and to further develop their networks. In this sense, the NANO2ALL dialogues contributed to capacity building of science centres to position themselves as platforms for RRI interaction. In this light, several dialogue hosts did indicate that hosting a multi-stakeholder dialogue was a challenging endeavor, which requires a very particular set of skills (e.g. moderation of conversations, dealing with power dynamics, etcetera). For this reason, it would be important to explore how science centers with an active role in similar (EU) RRI projects can be supported even more in connecting to relevant stakeholders and guiding multi-stakeholder interactions towards productive ends.

Although participant recruitment issues are part of event-hosting reality, it is important to remind that the lack of certain stakeholder perspectives most likely had a strong effect on the dialogue outcomes. It is thus relevant and necessary to take the group composition of the stakeholder dialogues into account when further developing the national responsible innovation agendas into the roadmaps of Work Package 4.

9.4 Reflections on the dialogue format

The NANO2ALL project developed an interactive dialogue format that aimed to establish an open and stimulating dialogue environment, in which participants could freely share their opinions and learn from each other's perspectives. In the evaluation interviews with dialogues hosts, it stood out that all dialogue sessions were characterized by a lively atmosphere, in which participants wanted to contribute actively to the discussions. The events did not only trigger valuable discussions on societal engagement in nanotechnology R&I, but also proved an excellent opportunity for participants to network with people from other sectors. The dialogues were thus an important capacity building activity in itself, in the sense that they connected (societal) actors and stakeholder groups that could collaborate in making nanotechnology R&I more inclusive.

The dialogue format consisted of three main exercise blocks. Although, we will not use this report to provide an evaluation of all the exercises in full detail, we will reflect on some observations that stood out. The most important critique that the dialogue hosts provided on the dialogue format related to duration of the event and the balance between exercises. The 8-hour format asked for substantial efforts of participants to remain focused throughout the entire day. General tiredness was observed at the end of the sessions, which was exactly the moment when the most significant exercise of the day took place: the identification of actions and interactions needed to enhance societal inclusion. Participants and dialogue hosts also indicated that they would have liked to see more time allocated to the final exercise, since they considered the discussions taking place here highly relevant. Although the scenario exploration game (block 2) was considered a fruitful exercise to stimulate understanding of other actors' perspective and provoked a lively discussion mode that set the scene for an interactive conversation in the final exercise block, dialogue hosts indicated that its duration was long. Some even decided to only play one of the two game scenarios to leave more time for the final exercise block, reporting that this still allowed participants to sufficiently experience the dynamics of the nanotech R&I system. Generally, the comments of dialogue hosts thus suggest that the dialogue methodology could be improved by creating a different balance in activities, spending less time on the second block and more time on the final one.

A final point on the dialogue methodology that should be made is that we adapted the block 3 exercise after the first dialogues were executed. The reason for this was that the exercise in which participants had to map actions and interactions on a simplified innovation stage model did not prove to be as effective as foreseen in the development and testing phase. The structure of the exercise put too much emphasis on discussing the current

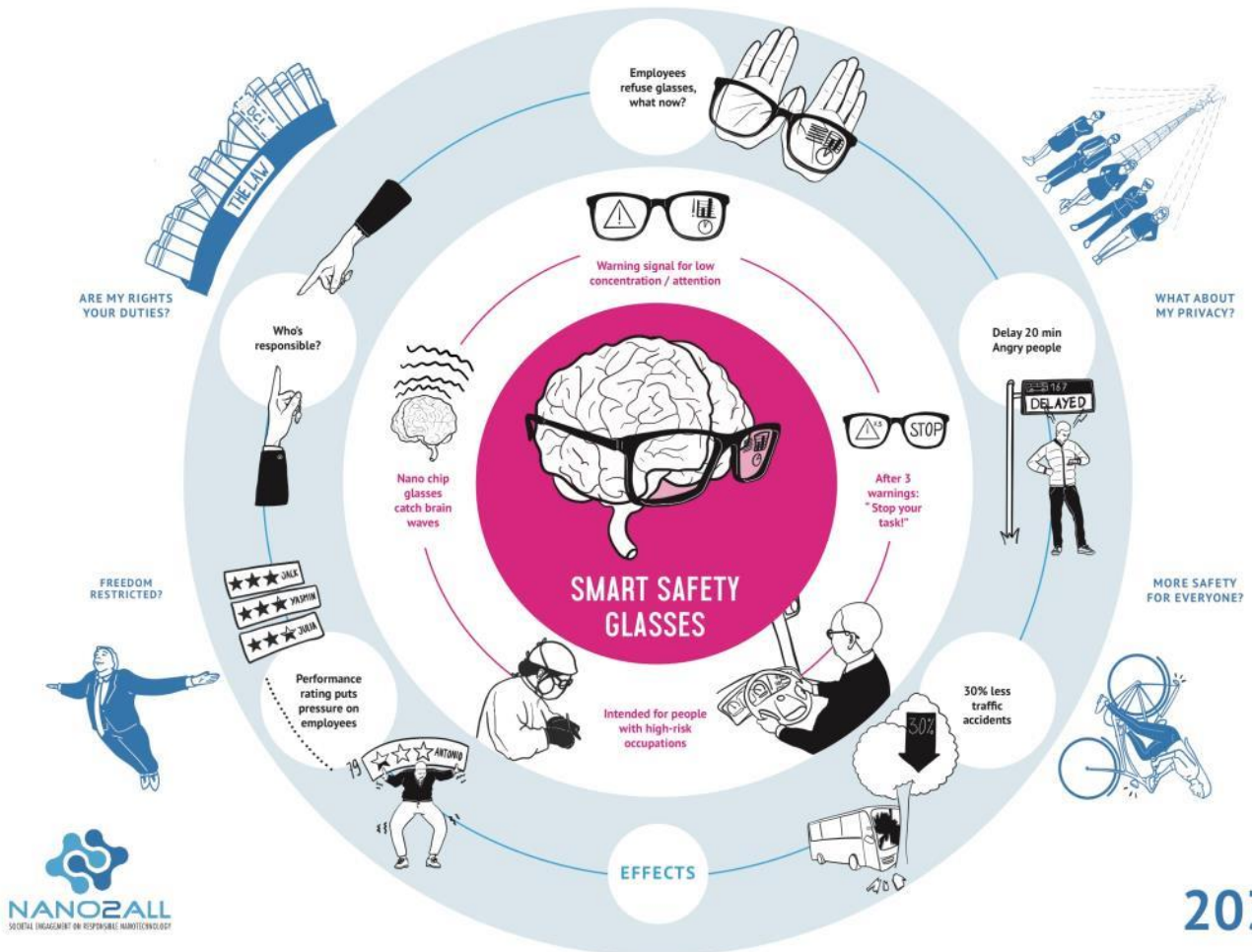
structure of the nanotechnology research and innovation system, leaving little room to reflect on what should be *improved* in the system to better integrate societal perspectives. The exercise was adapted in such a way that participants had to focus *from the start* of the exercise on actions that they themselves and other actors could undertake to enhance societal inclusion. This adaptation helped to make the discussion more productive in terms of identifying actions and interactions that would constitute the responsible innovation agendas.

9.5 Concluding remarks

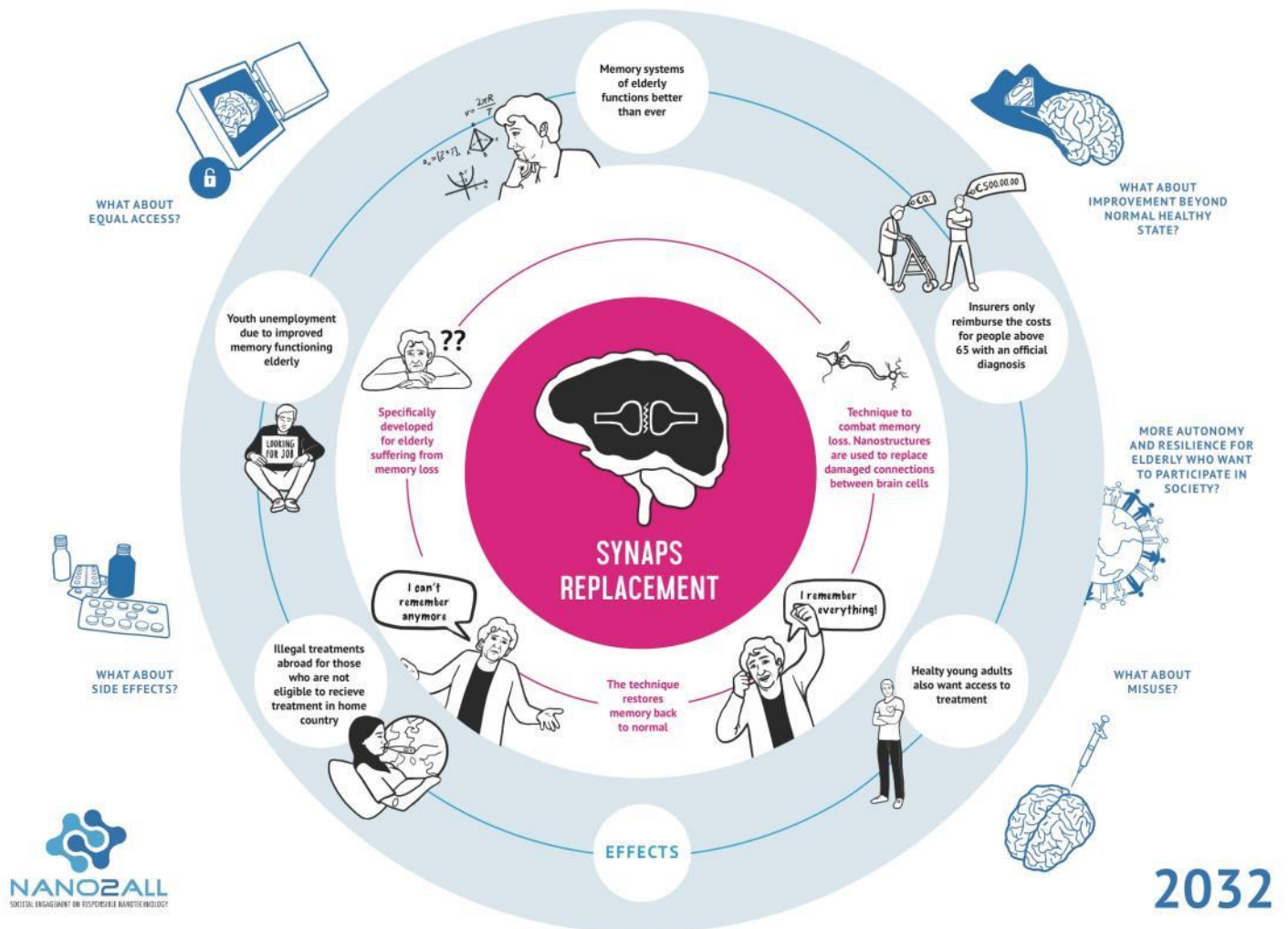
NANO2ALL looks back on insightful dialogue journey, in which many fruitful and engaging discussions have taken place with groups of highly motivated participants in various countries. Collaboratively, they have explored the RRI concept and the question of how to enhance the integration of societal perspectives in nanotechnology R&I in particular. A broad range of suggestions for action have been made that reinforce current thinking about important themes and challenges that we face in democratizing science and technology governance. These will be shared with the EC and taken further to the next stage of the NANO2ALL project, in which analysis and prioritization of the suggestions will take place to serve as further input for the responsible innovation roadmaps that will be created in Work Package 4.

Appendices

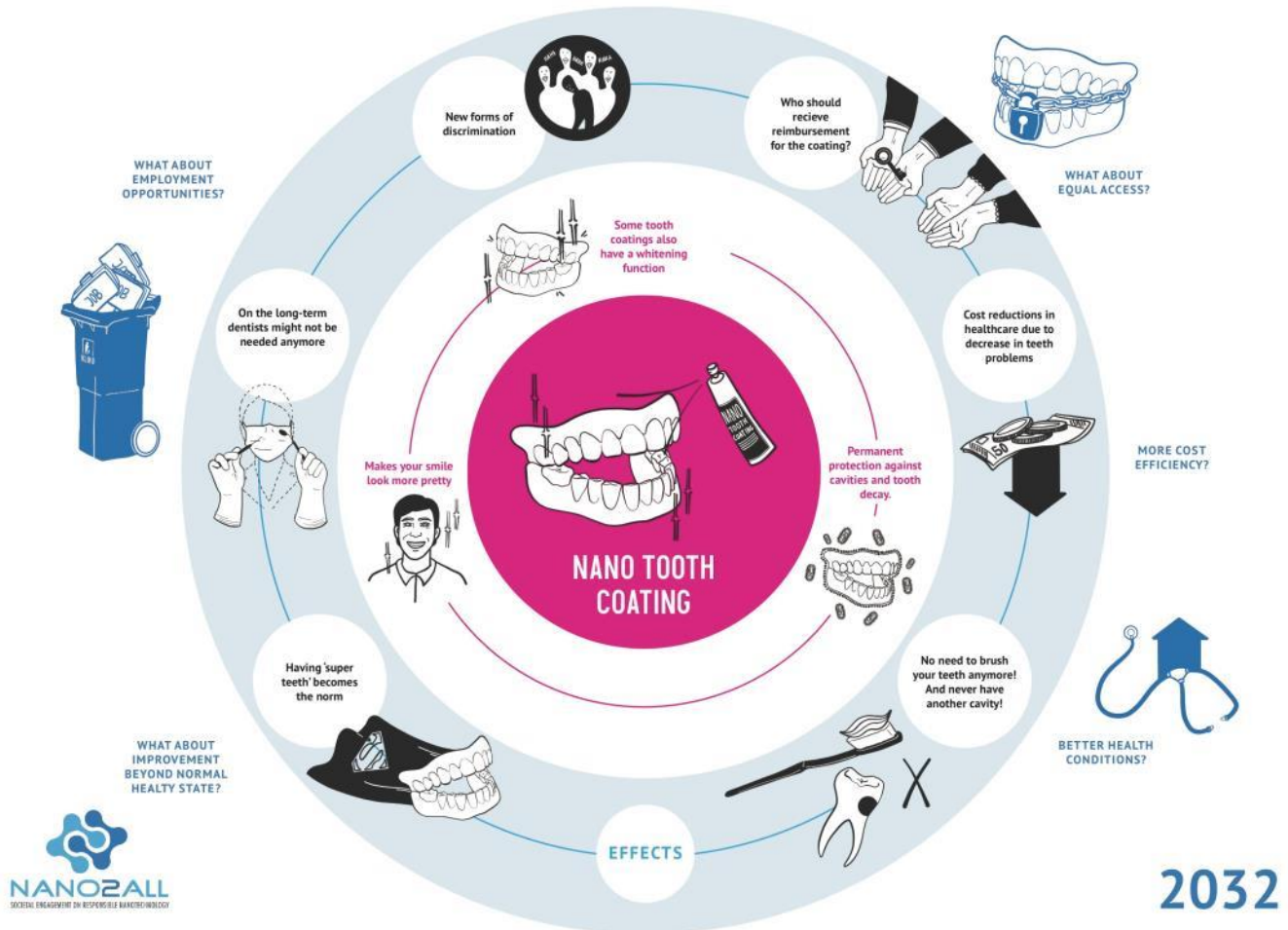
Appendix 1. Poster 1 – Brain Computer Interfaces



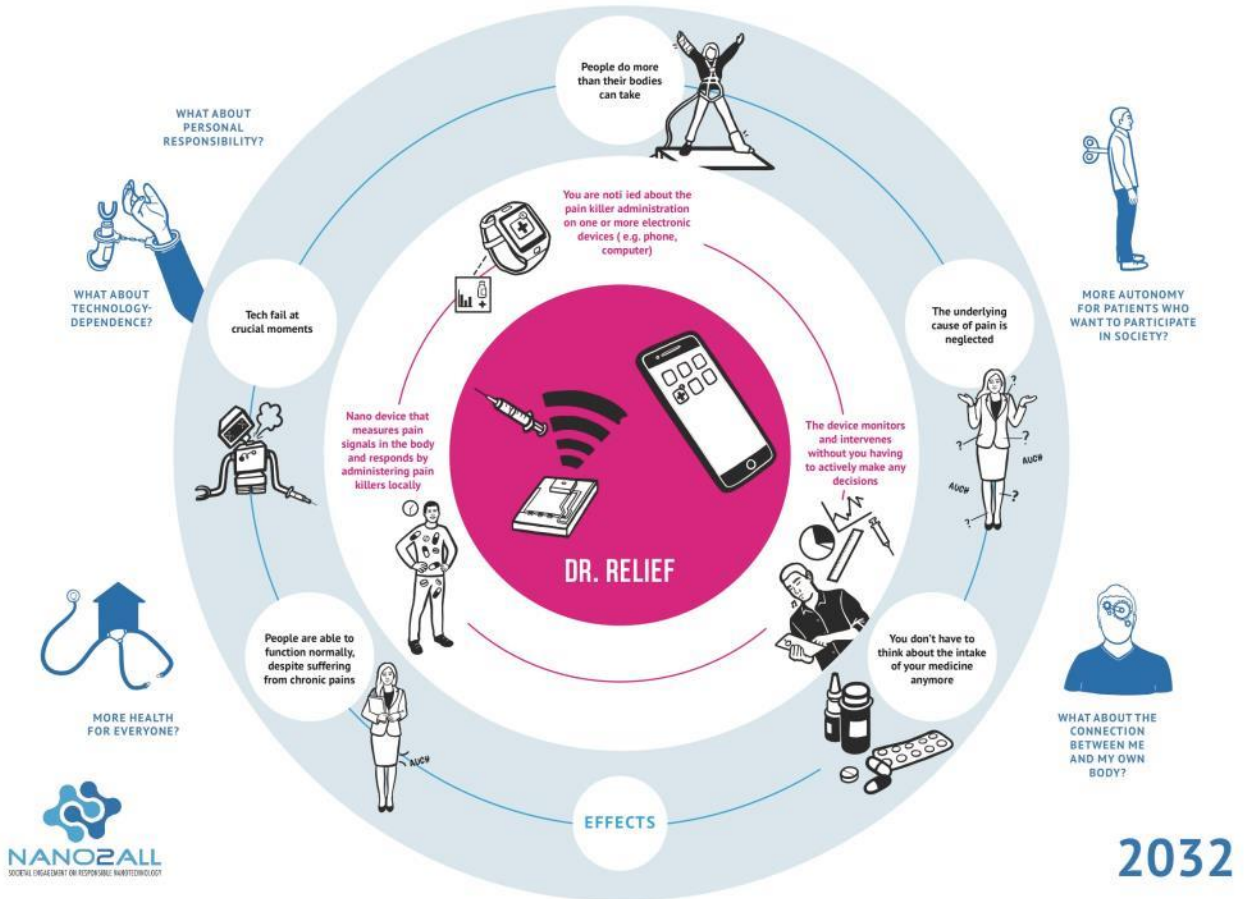
Appendix 2. Poster 2 – Brain Computer Interfaces



Appendix 3. Poster 3 – Nanomedicine



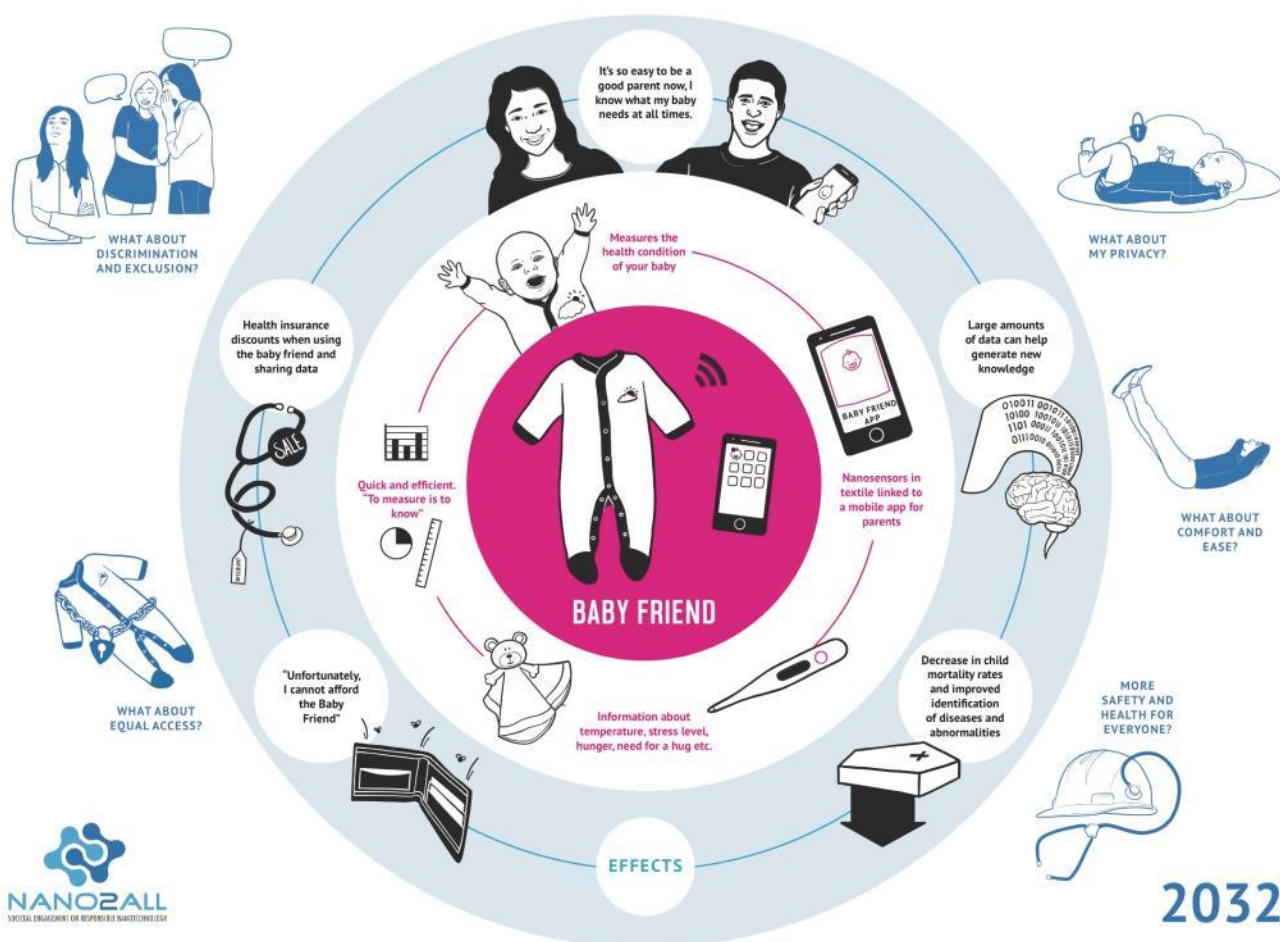
Appendix 4. Poster 4 – Nanomedicine



Appendix 5. Poster 5 – Nanotextiles



Appendix 6. Poster 6 – Nanotextiles



Appendix 7. Table innovation agenda France

The table below was created by the participants during the French multi-stakeholder dialogue session. Note the structure of the table slightly differs between the different dialogue countries due to changes in the dialogue format (see other appendices).

Actor	What?
Citizens	<p>Ensure opportunities for life-long learning, information gathering and information sharing, reaching all sectors of society ("education populaire"), as informed citizens are essential for constructive debates, and unbiased information needs to be guaranteed;</p> <p>Ensure that contact between citizens and their elected representative takes place on nano-related issues;</p> <p>Facilitate and support financially the creation of civil society organisations.</p>

Researchers	<p>Protection of whistle blowers;</p> <p>Development of spaces for ethical reflection within research institutions, that is, development of opportunities to address ethical issue as a standard (“environmental”) components of research institutions (“Lieu de vie éthique”);</p> <p>Greater opportunities for researchers to understand civil society by including civil society representative in the definition, evaluation and implementation of research programmes;</p> <p>Engage in the development of training modules for secondary schools on ethics and the social impacts of research;</p> <p>Promote transdisciplinary research teams including humanities, social sciences, hard sciences,...</p>
Industry/business	<p>Protect whistle blowers within industries;</p> <p>Impose quality standards and quality control, analogous to the ISO system, but adapted to issues related to health and environmental impacts;</p> <p>Protect and help SME which engage in alternative routes;</p> <p>Put in place procedures to understand public opinion which go beyond marketing and communication;</p> <p>Participate in debates with citizens and participatory democracy approaches.</p>
C.S.O	<p>Capacity building to better understand the evolution of public opinion, and better understand the actors & powers at play and thus have a stronger and more constructive impact;</p> <p>Ensure funding for the role of CSOs as counter-lobbying; funding should be proportional to the extent of the potential impact of new technologies;</p> <p>Support CSOs to focus on the nano-systems at large, and not only on bioethics or health- and environment-related issues.</p>
Policy-makers	<p>The role of policy makers was mostly considered by participants as enabling and facilitating other actors’ roles. Recommended actions concerning policy makers were mostly included in recommendations for other actors.</p>
Others	<p>At the EU level, transform the budget nowadays devoted to communication and outreach into support for CSO as auxiliaries and consultants for public policies;</p> <p>Promotion of “scientific culture”: generate public events to foster discussions and debates, provoke occasions of encounters between civil society, research, industry, policy making, etc.</p>

Appendix 8. Table innovation agenda Israel

The table below was created by the participants during the Israeli multi-stakeholder dialogue session. Note the structure of the table slightly differs between the different dialogue countries due to changes in the dialogue format (see other appendices).

(INTER)ACTIONS NEEDED	PRECONDITIONS
Investigate the knowledge among the public, what do they know? What do they need?	<p>Be attentive of citizens and their concern.</p> <p>Meet the concern with information and education. Help the citizens with information about what really is a problem or concern.</p> <p>The citizen needs to be more responsible for acquiring knowledge.</p> <p>The relevant information needs to be easy to find.</p>
<p>Politicians – Need of closer dialogue between researchers, industry and policymakers to be able to debate standards and labelling of products.</p> <p>The hard regulations who is existing for example medicine products should be applied to all/some of the nano products.</p>	<p>Using a language and labelling that is easy for the public to understand.</p> <p>A labelling of all nano products for consumers needs to be done right away. (CE-labelling) EU-allocation?</p> <p>For the safety and the confidence, we need a strict regulation on how to use the nano concept.</p>
Educate students in nanotechnology – investment, so we can increase the knowledge among the public. A way to do it could be to create a web platform.	<p>Resources for educating teachers in all levels.</p> <p>The web platform has to be easy to use.</p>
Develop relevant methods to investigate future impact in health or environment for “nanomaterials”. LCA should be used.	Make sure that Life Cycle Analysis, LCA, is made in the early process of development of new products.

Appendix 9. Table innovation agenda Italy

The table below was created by the participants during the Italian multi-stakeholder dialogue session. Note the structure of the table slightly differs between the different dialogue countries due to changes in the dialogue format (see other appendices).

(INTER)ACTIONS NEEDED	PRECONDITIONS
----	Knowledge and competence, as fundamental step for each inter(action)
Interaction between citizens and “competent agents”	Needs must be expressed by (citizens’ associations), those who are “competent agents”
Interaction between “competent agents”, policy-makers and specialized media: the media inform the “competent agents” about the goals and the results of the research.	Ability to balance different needs with a defined economic base (policy maker)
Interaction between policy-makers and researchers: non-refundable loans or co-foundation	Total budget and priority setting
Interaction between policy-maker and industry	Total budget and priority setting
Collaboration between applied researchers and fundamental researchers	Transparency and access to research results
Interaction between media and citizens: to inform about the developments of the products	Knowledge and competence Professional ethics
Interaction between citizens, policy makers and applied researchers	Citizens at the center: They must have representatives in the nonprofit associations that provide them with information and communications
A two-way interaction between policy maker and researchers	Policy makers interpret the values of citizens and their needs and in turn have to regulate all sectors and eventually fund, monitor and filter
Interaction between policy- makers, industry and market	Media in the role of communicators among these 3 actors
Interaction between industry and citizens	Guarantors advising / information provider

Interaction between policy- makers and fundamental researchers	Loans
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Appendix 10. Table innovation agenda Spain

The table below was created by the participants during the Spanish multi-stakeholder dialogue session. Note the structure of the table slightly differs between the different dialogue countries due to changes in the dialogue format (see other appendices).

Actor	What?	When?	Required
Citizens	<p>Try to make real needs reach the researchers.</p> <p>Civic centers as organizers of events related to science. Word of mouth to create interest in science.</p>	Parallel to the initial investment in science and monitoring of developments	<p>Bidirectional communication channels.</p> <p>More information about the real state of the investigation.</p>
Researchers	<p>Break insulations by actors.</p> <p>Responsible communication to society.</p> <p>Improvement of communication capacity of researchers. Training and recognition, remuneration, CV.</p> <p>Integration to the science of the will of the citizen.</p> <p>Creation of an advisory body to governments. Dialogues as an information tool to society. Citizen Science.</p> <p>Integration of science as a citizen culture.</p>	Periodically, recurring	<p>Education policies with inspiring scientific models.</p> <p>Support in the creation of scientific vocations.</p> <p>Policy making training programs for researchers.</p>
Policy-makers	Real consultation to the citizenship.	Periodically, during planning of research	Knowledge of the sectors furthest from science.

	<p>Creation of committees by sectors to filter the information.</p> <p>Communicate R&D investment decisions/ information more concretely to citizens, in terms of actual research carried out (and benefits)</p> <p>Use science as a symbol of society's identity. (Hoarding).</p> <p>Evaluation and evaluation of scientific institutions.</p> <p>Social impact evaluation.</p>		<p>Development of new databases or population samples.</p> <p>Overcoming the citizen-science gap.</p> <p>Incorporation of scientists in political bodies.</p>
Industry/business			<p>Capital. Institutional support, training, economics.</p> <p>Support to Spin-offs.</p> <p>Public regulation.</p>
C.S.O	<p>Group. Act as a speaker</p> <p>Break conflicts of interest by participating.</p>	<p>Link between science and society.</p> <p>Bridge for information transmission.</p>	<p>Society trust</p> <p>Get the appreciation of science</p> <p>Predisposition to collaboration</p>

Appendix 11. Table innovation agenda Sweden

The table below was created by the participants during the Swedish multi-stakeholder dialogue session. Note the structure of the table slightly differs between the different dialogue countries due to changes in the dialogue format (see other appendices).

Actor	What?	When?	Required
Citizens	<p>Meet the concerns of citizens with education about the real risks.</p> <p>Platforms with information</p>	<p>Now and forward</p> <p>From younger age to elder.</p>	<p>The adults: Own responsibility to get new information.</p> <p>The knowledge is low.</p> <p>Prioritise the communication of</p>

	Education in school.		knowledge which already exists.
Researchers	<p>Subjects close to cancer threatments</p> <p>Investigate the knowledge and attitude among the public</p> <p>Information easy available</p> <p>Infrastructure for clinic studies</p>		Use EU-allocation
Policy-makers /Authority	<p>Debate standards and labelling of products. (CE)</p> <p>Regulation</p> <p>Clear language</p> <p>Including</p> <p>Standardized measurement methods</p> <p>The hard regulations that already exist, for example for medicine products, should be applied to all nano-products.</p> <p>Mediate to school - write it in the schoolcurriculum</p> <p>Dialogues</p>	Acute, as fast as possible	<p>Use EU-allocation</p> <p>Development of standardized measurement methods</p> <p>Health/environment</p> <p>Work international and at EU-level</p> <p>A coordinating authority organization for the nano-area in the EU</p>
Industry/business	<p>More information exchange of the functions and properties of nano materials.</p> <p>Responsibility</p> <p>Transparency is important.</p> <p>Clarity on packaging</p> <p>Nano-discussions linked to sustainable development</p> <p>L.C.A. (Life Cycle Analysis)</p>	<p>Now, because some companies use "nano" as a positive prefix.</p> <p>Other companies as big ones are afraid of using "nano" because of the risk-connection.</p>	<p>Definition of nano concept.</p> <p>Labelling of nano-products. (CE?)</p>
C.S.O	Nano-discussions linked to sustainability		

Others	Definition of nano concept		What signals does the nano-labelling of products transmit?
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NANO*futures*



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