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DELIVERABLE

6.2

ONLINE GUIDELINES AND EASY-TO-UNDERSTAND INFORMATION FOR PUBLICS AND STAKEHOLDER GROUPS WANTING TO BE INVOLVED WITH NANOTECHNOLOGY R&I

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CONTENTS

1. INTRODUCTION

This deliverable compiles the results and output gathered for each of the subtasks of GoNano Task 6.2: *Information and guides for publics and other stakeholders to have a voice in nanotechnology research and innovation"*. As part of its overall efforts towards training and community capacity building in Work Package 6, Task 6.2 aims to: "*offer guidelines to other stakeholders and citizens who would like to have a voice in nanotechnology"* (p. 28 of the Description of Action (DoA)).

Task 6.2 is divided in multiple subtasks, as listed in the DoA (p. 28):

1. Mapping *"already available opportunities for public and professional stakeholders to have a say on the development of nanotechnology"*;
2. Developing an online resource database for this purpose, *"drawing on experiences from the pilot studies to inform guidelines on where in the research and innovation trajectory stakeholders and publics might make valuable contributions"*;
3. Developing guidelines for and citizens and CSOs who would like to engage with nanotechnologies;
4. Producing easy-to-understand information on nanotechnology and the results of the project in the form of small videos and short stories: *"The purpose is to make it easier for citizens and stakeholders to understand the key concepts and possible developments of nanotechnology in order for them to engage in research activities or in the public debate on nanotechnologies. The focus can be basic information, key developments, concerns, questions and ideas from citizens and stakeholders."*

The next chapter summarises the main findings and outputs of each of these subtasks. The annexes reproduce the subtask outputs in their entirety: Annex A contains the full report on the review of opportunities for citizens and societal stakeholders to engage with nanotechnologies (subtask 1). Annex B offers screenshots of the public engagement database on the GoNano project website (subtask 2).[1] Annex C reproduces the citizens' guide on how to become involved in nanotechnologies (subtask 3). Annex D provides screenshots from the website section '*Join the Nanodebate*' on the GoNano project homepage, providing information on nanotechnologies for citizens and stakeholders.[2]

[1] This content can also be accessed directly at: http://gonano-project.eu/category/public-engagement-database/
[2] For direct access to this website section: http://gonano-project.eu/join-the-nanodebate/

2. SUMMARY OF FINDINGS AND OUTPUT FROM THE SUBTASKS

2.1. SUBTASK 1: MAPPING OPPORTUNITIES FOR CITIZENS AND SOCIETAL STAKEHOLDERS TO ENGAGE WITH NANOTECHNOLOGIES

This report examines existing opportunities for citizens and professional stakeholders to engage with nanotechnologies. The report reviews European projects and other initiatives that aim to engage citizens and stakeholders with nanotechnologies (and emerging technologies more broadly). The explorative review of 49 engagement initiatives in this report resulted in the following findings:

- The bulk of public engagement initiatives on emerging technologies in the sample are from EU projects funded under the NM(B)P and Science in Society programmes.
- Relatively few engagement initiatives focus exclusively on nanotechnologies; those that do are predominantly EU-funded (86%).
- The majority of engagement initiatives reviewed (78%) are organised in a top-down fashion; they are carried out by technology 'enactors' or engagement professionals, often in return for payment or other forms of compensation.
- There is significant variation in the types of public engagement offered by the different initiatives.
- The different types of engagement activities are unevenly distributed: 45 initiatives (92%) have engagement activities that fall within the 'Inform' category. Relatively few initiatives aim to empower citizens and stakeholders.
- Only 3 out of the 49 initiatives reviewed currently offer concrete opportunities for citizens and CSOs to engage specifically with nanotechnologies.

These findings suggest that concrete opportunities for citizens and CSOs to actively engage with nanotechnology research and innovation processes are relatively scarce, despite a plethora of public engagement initiatives. The overall conclusion from this review is that the current engagement landscape does not fully address recent policy objectives to actively involve citizens and civil society in the development of research and innovation missions and projects. To strengthen the role of civil society in European research, there should be more attention to the active involvement of citizens and CSOs in shaping the research and innovation agenda. Public engagement needs to focus on the empowerment of citizens and CSOs, moving beyond the conception of societal stakeholders as passive recipients of information. Better alignment of research and innovation with the values, needs and expectations of society requires that the responsive capacity of research and innovation is enhanced.

The full subtask report can be found in Annex A below.

2.2. Subtask 2: Developing an online resource database for citizens and COSs who would like to engage with nanotechnologies: the online public engagement database

To make it easier for citizens and CSOs to identify suitable engagement opportunities, GoNano developed an online public engagement database[3], based on the subtask report described in section 2.1. The database lists 24 organizations and projects that are currently inviting input from citizens and CSOs or offer guidance on how to become involved in the (nano)debate. The list is not meant to be exhaustive but gives a first indication of what is out there and how to get involved.

The database has 3 pages, listing three types of initiatives; 1) EU-projects; 2) Networks or platforms; and 3) Local projects and organisations. Please see Figure 1 for a screenshot of the first page of the public engagement database. See Annex B, Figure 10-12 for a complete overview of the public engagement database pages.

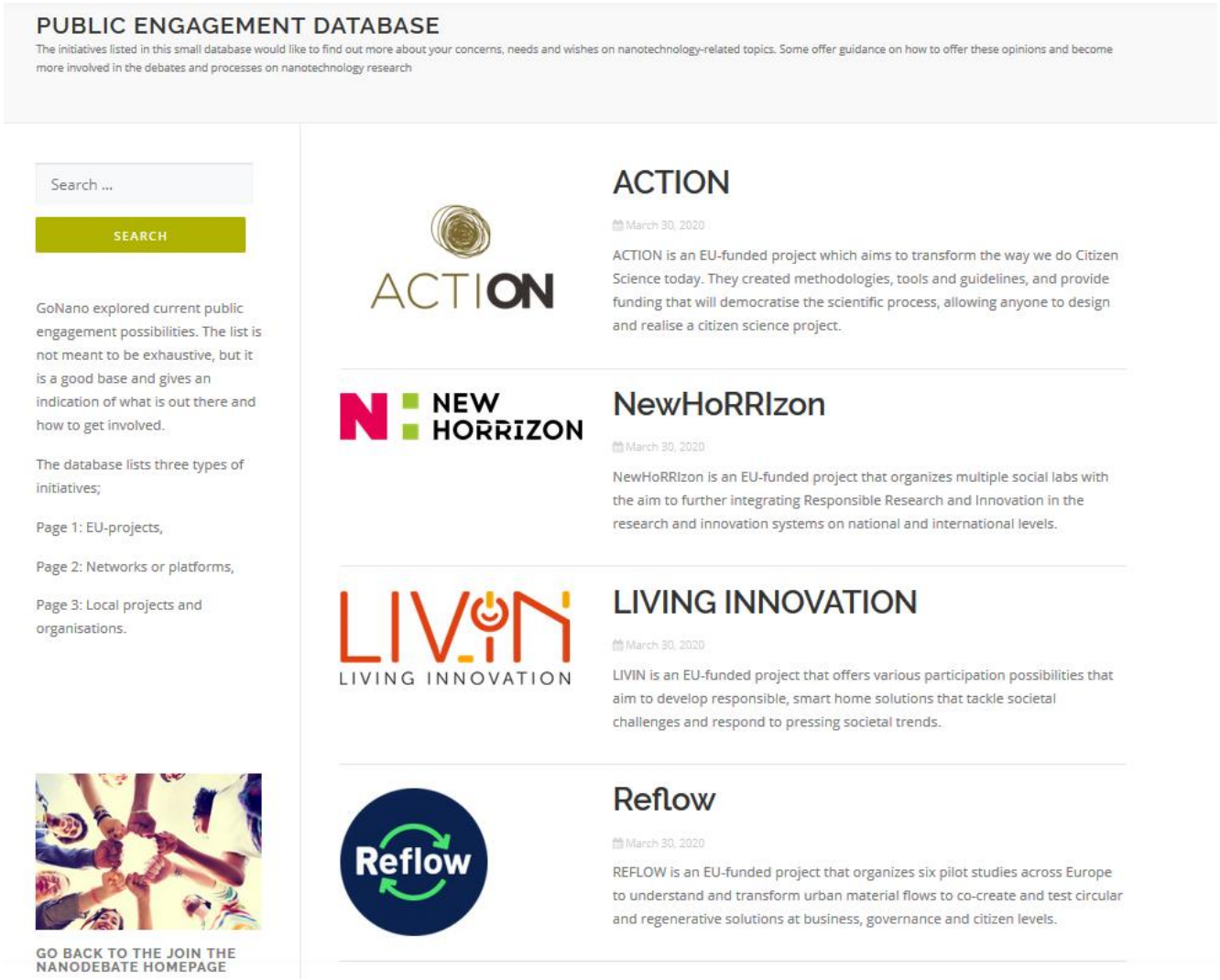


Figure 1: Screenshot of a small section of the public engagement database. The database lists in total 24 initiatives which are currently interested to invite citizens and CSO's or offer guidance on how to become involved in the (nano)debate.

[3] Please visit the public engagement database on http://gonano-project.eu/category/public-engagement-database/

Each listed initiative has an individual page with a summary of what the project or organisation is about, what the initiative is aiming for in terms of public engagement, and what means for engagement they have available. As an example, please see Figure 2A for a screenshot of the earlier mentioned ENoLL initiative and Figure 2B for the ACTION project.

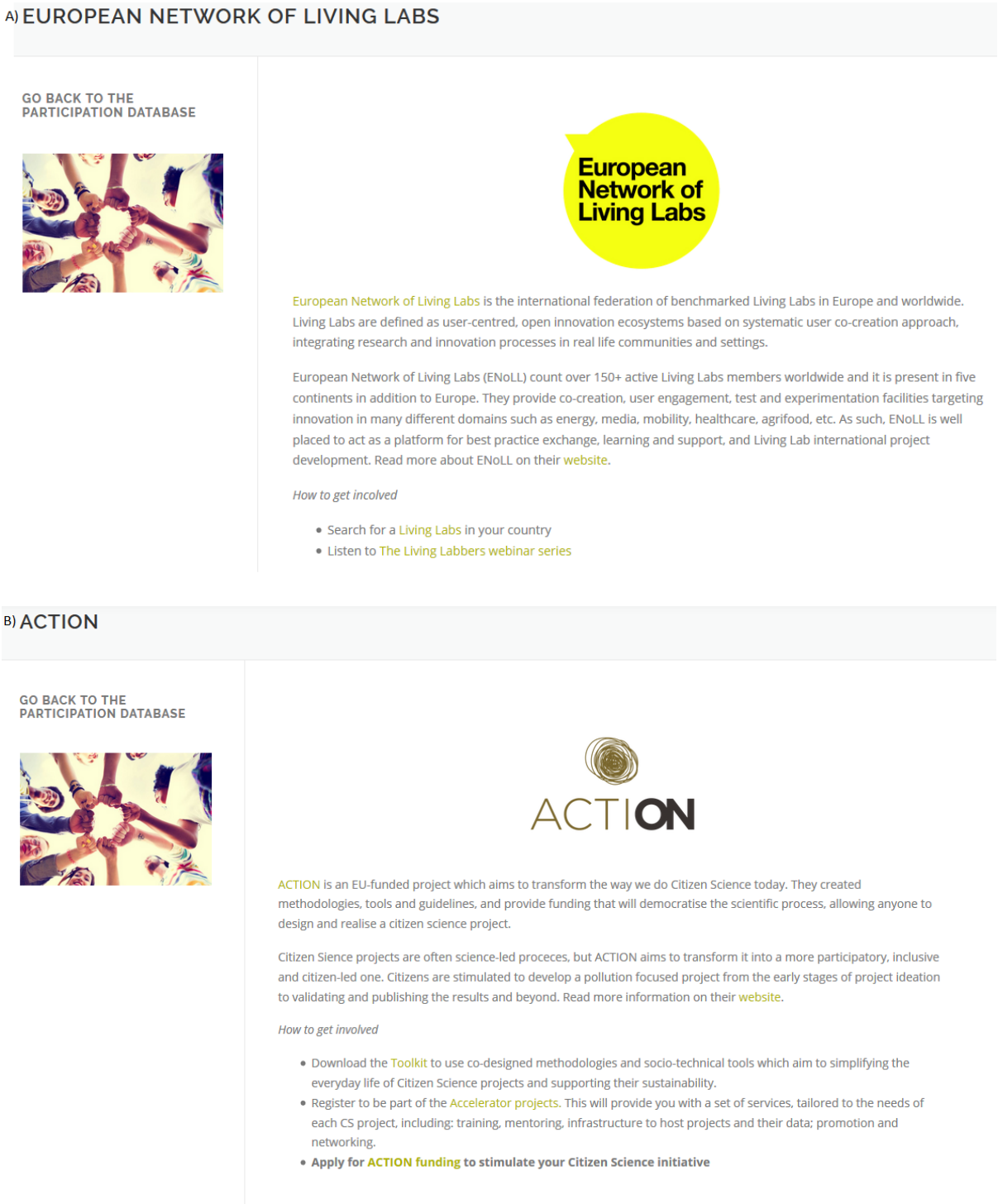


Figure 2: Screenshot of two public engagement initiatives; 2A is the ENoLL initiative and 2B is the ACTION project. Both pages summarize what the organisation or project is about, what they are aiming for in terms of public engagement, and what means for engagement they have available.

Screenshots of the database are reproduced in Annex B. The full database is directly accessible at: http://gonano-project.eu/category/public-engagement-database/.

2.3. SUBTASK 3: DEVELOPING GUIDELINES FOR STAKEHOLDER AND CITIZENS WHO WOULD LIKE TO HAVE A VOICE IN NANOTECHNOLOGY R&I: THE 'HOW-TO' GUIDE FOR CITIZENS ON JOINING THE NANODEBATE

With the '*How to..*' guide for citizens, GoNano aims to support citizens who would like to engage with nanotechnologies to express their own needs and concerns and ensure that their thoughts are taken into account in future developments. The guide offers a five-step approach which helps citizens define their interests, identify the right engagement opportunity, and become involved in nanotechnology research and development.

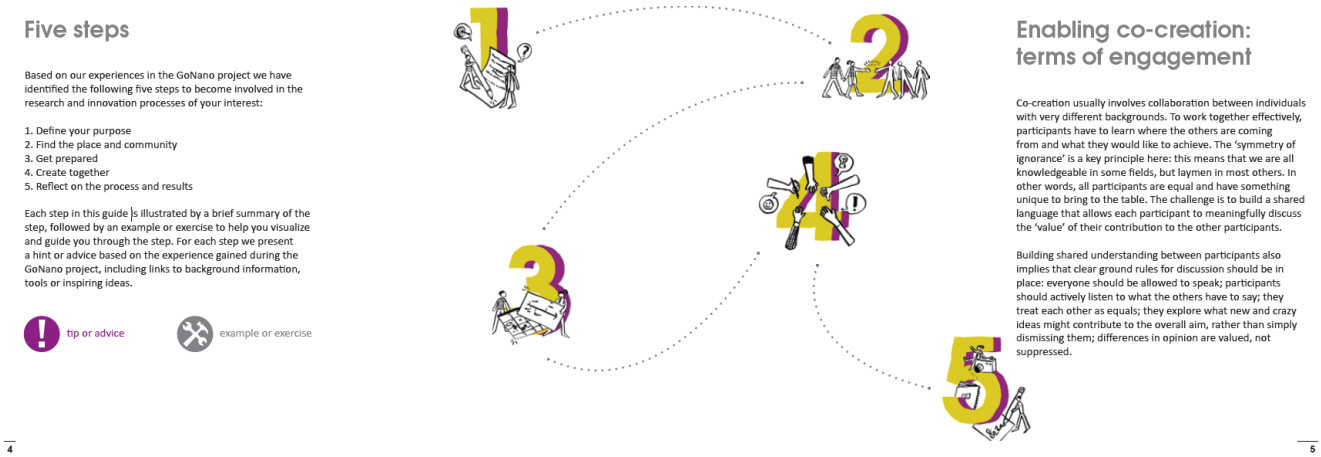


Figure 3: Page 4 and 5 of the 'How to..' guide. On the left-hand side: the five steps on how to become involved in the research and innovation processes of your interest are summarized. On the right-hand side: the terms of engagement for enabling co-creation.

As depicted in Figure 3, the five steps are:

1. Define your purpose;
2. Find the place and community;
3. Get prepared;
4. Create together;
5. Reflect on the process and results.

Each step in this guide is supported by a brief summary of the step, followed by an example or exercise to help visualize and act as guidance through the step. For each stage there is a hint or advice based on the experience gained during the GoNano project. This also includes background information, tools, formats and inspiring ideas. As an example, Figure 4 gives a preview of the first step.

Figure 4: The first step on how to become involved in the research and innovation processes of your interest. This step helps to define your motivation and expectations.

Please see Annex C for the complete '*How to..*' guide. The guide is also available on the GoNano project website.[4]

[4] To access the 'How to..' guide, please see the sidebar on http://gonano-project.eu/join-the-nanodebate/

2.4. SUBTASK 4: PRODUCING EASY-TO-UNDERSTAND INFORMATION ON NANOTECHNOLOGY AND THE RESULTS OF THE PROJECT: THE WEBSITE SECTION '*JOIN THE NANODEBATE*' ON THE GONANO PROJECT WEBSITE.

The findings from the GoNano project have been made available in a dedicated section on the project website to make it easier for citizens and societal stakeholders to understand the key concepts and possible developments of nanotechnology and support them to engage in research activities or in the public debate on nanotechnologies.[5] This website section offers all the output developed as part of Task 6.2, but also includes relevant outputs from other GoNano work packages and external content. A brief summary of the website sections is given below; a full description is available in Annex D, and directly on the website.

1. The homepage of the section: 'Join the nanodebate' introduces the information available on the other pages. The sidebar at the right-hand side provides easy access to tools developed or citizens; the public engagement database (mentioned in section 2.2) and the 'how to' guide (mentioned in section 2.3) (see Figure 5 for a preview of the webpage and see Annex D, Figure 13 for the complete screenshot),

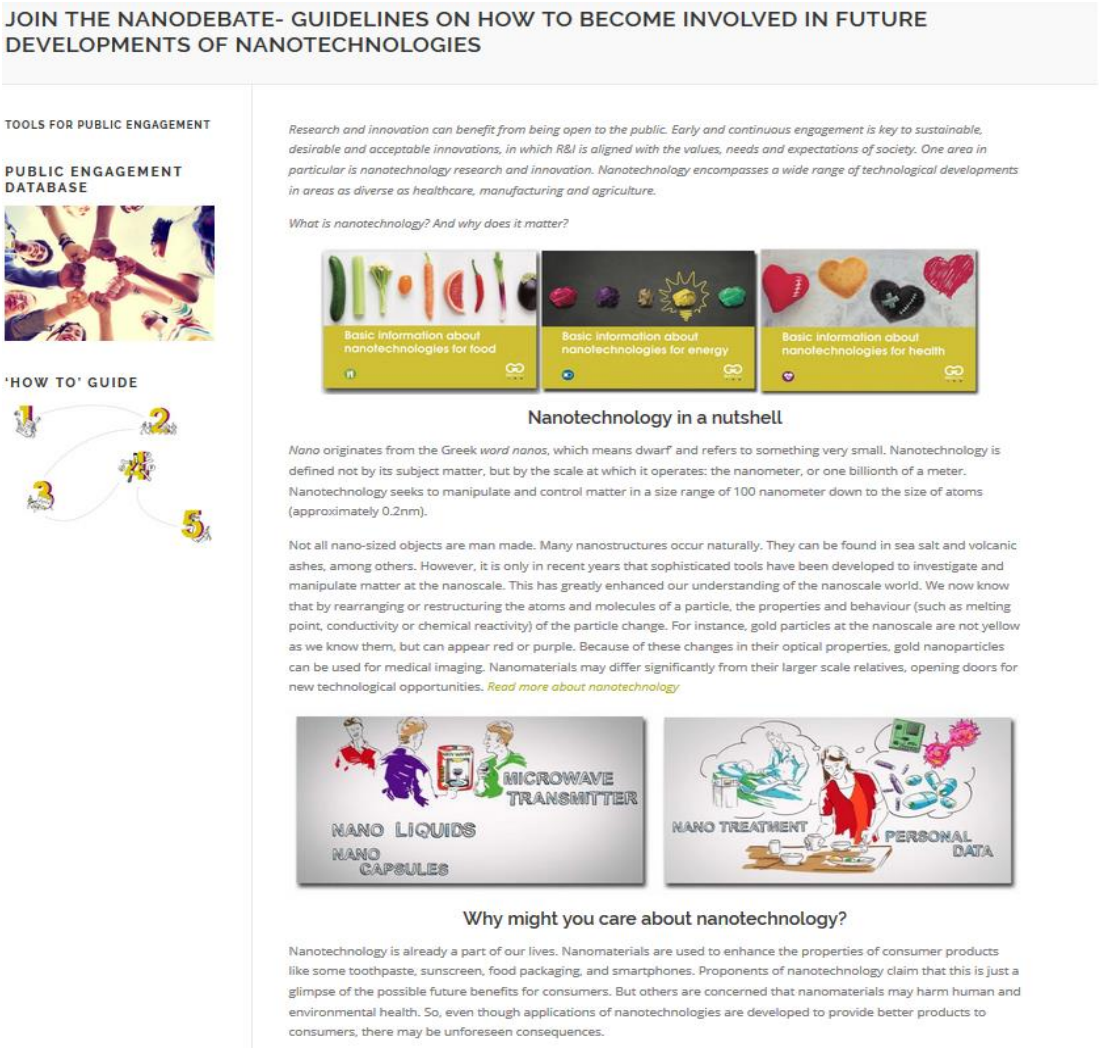


Figure 5: A screenshot of the 'Join the nanodebate' homepage that gives a brief summary and access to the Nanotechnology in a nutshell, Why might you care about nanotechnology, Join in: engagement opportunities, and The GoNano approach webpages.

[5] Please visit http://gonano-project.eu/join-the-nanodebate/

2. The page: *Nanotechnology in a nutshell*[6] presents easy to understand information on nanotechnology. This section briefly answers the question *what is nanotechnology?* and provides some examples of nanomaterials applications in commercial products. Supporting background material, including informative videoclips and brochures (developed by GoNano in other work packages, see Figure 6 for the cover page of the brochure on nanotechnology for energy) are listed in the sidebar at the right-hand side (please see Annex D, Figure 14 for a screenshot of the Nano in a Nutshell webpage and Figure 15 for the three brochures about nanotechnology for energy, food and health),

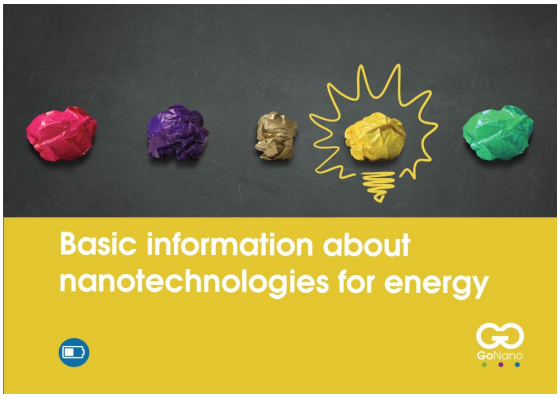


Figure 6: Brochure on Nanotechnology for energy.

3. The page: *Why might you care about nanotechnology*[7] gives a short introduction about the governance of nanotechnology. The videoclips (see Figure 7 for an overview of the videoclips available on 'Future scenarios' section on the GoNano YouTube channel) and posters of future scenarios that GoNano developed are introduced as an example to help visualize future nanotechnology applications and raise questions on acceptability, sustainability and desirability that come with it (please see Annex D, Figure 16 for a screenshot of the webpage and Figure 17 and 18 for the future scenario posters and booklet),

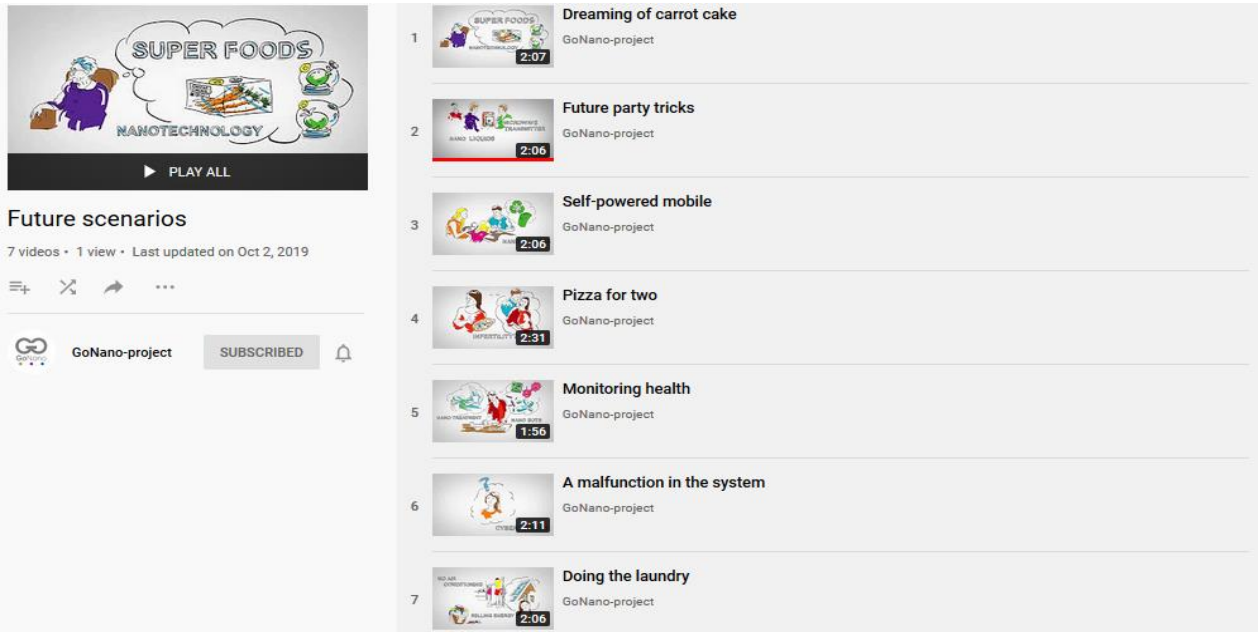


Figure 7: Overview of the 'Future scenarios' section on the GoNano YouTube channel

[6] Please visit http://gonano-project.eu/nanotechnology-in-a-nutshell/
[7] Please visit http://gonano-project.eu/future-scenarios-with-nanotechnologies/

4. The page: *Join in: engagement opportunities*[3] provides the public engagement database developed as part of subtask 3. Please see section 2.2 for further detail.

5. The page: *The GoNano approach*[8] summarises the aims, activities and main findings of the GoNano project. It provides a complete overview of the outcomes and results per work package, including the deliverables, toolkits, videoclips and the white papers (please see Figure 8 for a preview of the webpage. See Annex D, Figure 19 for the complete screenshot of the webpage and Figure 20 for an overview of the 'Best practices in co-creation' videoclips on the GoNano YouTube channel).

Figure 8: Screenshot of 'The GoNano -co-creation approach' webpage. The sidebar provides easy access to the deliverables, toolkits, videoclips and white papers.

[8] Please visit http://gonano-project.eu/the-gonano-co-creation-approach/

ANNEX A: FULL REPORT OF SUBTASK 1

Overview of opportunities for citizens and societal stakeholders to engage with nanotechnologies

AS PART OF TASK 6.2: INFORMATION AND GUIDES FOR PUBLICS AND OTHER STAKEHOLDERS TO HAVE A VOICE IN NANOTECHNOLOGY RESEARCH AND INNOVATION

Contents

1. INTRODUCTION

This report maps existing opportunities for citizens and Civil Society Organisations (CSOs) to engage in (nanotechnology) research and innovation processes.

The GoNano project is built on the assumption that several types of knowledge are needed to define the sustainability, acceptability, and desirability of nanotechnologies. As part of its overall efforts towards training and community capacity building in Work Package 6, Task 6.2 aims: *'to offer guidelines to other stakeholders and citizens who would like to have a voice in nanotechnology'* (p. 28 of the Description of Action (DoA)). This task is divided in multiple subtasks, as listed in the DoA (p.28):

- Mapping *"already available opportunities for public and professional stakeholders to have a say on the development of nanotechnology"*;
- Developing an online resource database for this purpose, *"drawing on experiences from the pilot studies to inform guidelines on where in the research and innovation trajectory stakeholders and publics might make valuable contributions"*;
- Developing guidelines for and citizens and CSOs who would like to engage with nanotechnologies;
- Producing easy-to-understand information on nanotechnology and the results of the project in the form of small videos and short stories: *"The purpose is to make it easier for citizens and stakeholders to understand the key concepts and possible developments of nanotechnology in order for them to engage in research activities or in the public debate on nanotechnologies. The focus can be basic information, key developments, concerns, questions and ideas from citizens and stakeholders."*

This report addresses the first subtask. It examines existing opportunities for citizens and professional stakeholders to engage with nanotechnologies. The report reviews European projects and other initiatives that aim to engage citizens and stakeholders with nanotechnologies (and emerging technologies more broadly). A key finding of the report is that concrete opportunities for citizens and CSOs to actively engage with nanotechnologies are relatively scarce, despite a plethora of public engagement initiatives. For those citizens and stakeholders interested in engaging with nanotechnology, suitable engagement opportunities can be hard to find. The report concludes that more engagement initiatives are needed that focus on the 'empowerment' of citizens and stakeholders rather than on passive engagement. The responsive capacity of research and innovation needs to be enhanced in order to align research and innovation with the values, needs and expectations of society.

The findings from this report have been used as input for other subtasks of Task 6.2, such as the online resource database and the guidelines and information for citizens who would like to engage with nanotechnologies. The outcomes of all these subtasks are compiled in deliverable D6.2.

The report is structured as follows: Chapter 2 describes the research setup and methodology of this review. The findings of the review are presented in Chapter 3. Chapter 4 reflects on these findings and draws conclusions.

2. RESEARCH SET-UP AND METHODOLOGY

The first step in this review was to collect an initial database of projects and organisations to be reviewed. Different WP6 partners contributed to the mapping exercise: partner OsloMet reviewed existing engagement initiatives, working from a list of projects suggested by DPF, with additions from project partners (the report from OsloMet is reproduced in annex 1 below). DPF subsequently complemented the overview by adding further initiatives.

The resulting database combined projects and organisations suggested by the WP6 project partners with relevant initiatives listed in GoNano project deliverables D1.1[9] and D5.2[10]. The initial list was later supplemented with initiatives encountered during the analysis. The suggested sources were selected for review based on two selection criteria. First, the initiative needed to focus on engaging citizens and/or CSOs. Engagement was interpreted in the broadest possible sense of the word, covering a wide range of activities to engage publics with research and innovation processes including education, outreach, public consultation, public dialogue, participation and empowerment. Second, the initiative should focus on nanotechnologies. During the initial review of initiatives, it became clear that the vast majority of engagement initiatives do not focus solely on nanotechnologies but also include other topics such as biotechnologies or information and communication technologies. To obtain a better view of the overall engagement landscape, the final overview of engagement initiatives also includes initiatives with a broader scope.

In total, 49 initiatives were reviewed: project websites of the initiatives were analysed in search of information on how citizens and CSOs were engaged. The main target groups and the overall approach to engagement were documented for each initiative.

This review does not purport to be an exhaustive analysis of public engagement initiatives across Europe. Given the sheer number of engagement and participation initiatives at regional, national and international levels and across the different thematic areas of Horizon2020 and earlier Framework Programmes, a full review of all available engagement initiatives is beyond the scope of this exploratory review. Rather, this review aims to elucidate the sorts of public engagement opportunities that a quickscan of online resources brings to the fore. The findings of this review may shed some light on the nature of current engagement initiatives.[11]

[9] http://gonano-project.eu/wp-content/uploads/2018/08/1.1.pdf

[10] http://gonano-project.eu/wp-content/uploads/2020/02/D5.2-Second-briefing-report-on-the-nanotechnology-RI-policy-context-as-input-to-developing-the-GoNano-white-papers.pdf

[11] For additional information about previous nanotechnology outreach and dialogue initiatives, please visit this review report of the NanoDiode project (2014), or the more recent review on RRI in H2020 by the NewHoRRIzon project (2017).

3. FINDINGS

The majority of the 49 initiatives that were reviewed, (30 initiatives, or 61%) were projects funded as part of the European Union Framework Programmes for research and innovation.[12] The remaining (19, or 39%) initiatives and organizations were local initiatives, science centres or online platforms.

Table 1 below lists all EU projects. Table 2 lists the remaining initiatives. Both tables summarise for each initiative:

- the project name, duration and related funding programme (weblinks have been provided for all projects with active websites),
- the main target group,
- the public engagement initiatives developed as part of the initiative (including weblinks where possible),
- the direction of the initiative: top-down (the initiative is carried out by technology 'enactors' or engagement professionals, often in return for payment or other forms of compensation) or bottom-up (where citizens or societal stakeholders self-organise to become involved in nanotechnologies) (please see also the discussion of top-down and bottom-up on page 16 below),
- the level of participation (each level indicates the strategy to involve participants during the engagement initiative, ranging from 'Inform' to 'Empower') (for further information, see the discussion of the IAP2 spectrum on page 17 below),
- and the overall approach towards engagement of the initiative: passive (the objectives, scope and content of the engagement initiative are fixed) or active (which aims to enhance the involvement and participation of citizens and stakeholders in the research and innovation process) (please see also the discussion of passive and active engagement on page 20 below).

Table 1: List of reviewed EU-funded projects on public engagement (in alphabetical order).

Project name, timeline and funding	Main target group	Description of public engagement activities	Direction of engagement	Level of participation	Engagement approach
ACTION (2019-2022) Funding: H2020- SwafS	Citizens	ACTION has a citizen science toolkit that includes methodologies, methods, tools, services and other resources that respond to a wide range of citizen science characteristics, to change the way of citizen science: from a predominantly scientist-led process to a more participatory, inclusive, citizen-led one.	Top-down	Inform-Involve	Active

[12] GoNano is part of the EU NMBP program and many consortium partners are involved in EU-funded projects. This particular perspective could suggest a bias towards European initiatives that resulted in the predominance of EU-projects in our sample. It could also be that the European Framework Programmes themselves put more emphasis on outreach and engagement than comparable national or regional programmes.

		ACTION is looking for new and ongoing citizen science projects related to any form of pollution in Europe and worldwide. Action provides financial funding to set up your own citizen science project.	Bottom-up	Collaborate-Empower	Passive
Citizen Sense (Project ended) Funding: FP7-IDEAS-ERC	Citizens	Citizen Sense organized talks during the scope of their project. Now that the project has ended, a Citizen Sense Kits is available for educational purposes.	Top-down	Inform	Passive
		Citizen Sense also supports citizen-led research and how to get these issues on the political agenda.	Bottom-up	Involve-Empower	Active
CONSIDER (Project ended) Funding: FP7-SIS	All stakeholders	CONSIDER offers key recommendations for different stakeholder groups on how to improve the involvement of civil society in research.	Bottom-up	Inform-Empower	Passive
D-NOSES (2018-2021) Funding: H2020-SwafS	Citizens, CSOs and local authorities	D-NOSES organizes citizen science and co-creation tools to design odour pollution control measures at local, national and global levels with CSOs, NGOs, local public authorities, odour emitting industries and academia to empowering citizens.	Bottom-up	Inform-involve-Empower	Active
		D-NOSES will also develop local case studies in 10 European and non-European countries for validating methodologies and producing do it yourself guidelines for project replicability.	Top-down	Consult	Passive
EnRRICH (Project ended) Funding: H2020-SwafS	Students and CSOs	EnRRICH aimed to build the capacity of staff in higher education to facilitate their students' development of knowledge, skills and attitudes and competencies in responsible research and innovation, and respond to the research needs of society, particularly underserved civil society organisations.	Top-down	Inform	Passive
		EnRRICH organized pilot studies and disseminated good practice and relevant resources to embed the 5 RRI policy agendas.		Involve	
FRAMINGNANO (website no longer active) (Project ended) Funding:	Citizens, CSOs and other stakeholders	FRAMINGNANO aimed to build a deliberative process that allowed nanotechnology stakeholders to engage in an ongoing dialogue about the governance of nanotechnology development. By focusing on risks and concerns, the project pursued both	Top-down	Inform–Consult-Involve	Passive

FP7-SIS		Environment, health and Safety as well as Ethical, legal, societal implications Information. Information from Cordis-EU			
Gov4Nano (2019-2022) Funding: H2020-NMBP	All stakeholders	Gov4Nano aims to support consensus building, prioritization and harmonization of practices amongst stakeholders, with a focus on key aspects for risk governance of nanotechnologies, including risk assessment, risk management, risk perception and risk communication, risk-benefit evaluation, and risk-transfer and the societal desirability of nanotechnology applications. *No participation information yet*	Top-down	Inform-Consult	Passive
GRRIP (2019-2022) Funding: H2020-SwafS	Citizens and other stakeholders	GRRIP will offer public engagement possibilities to fundamentally improve responsible research and innovation practices in the marine and maritime sector.	Top-down	Inform-Collaborate	Active
HubIT (2017-2020) Funding: H2020-SC6	Citizens, CSOs and other stakeholders	HubIT plans to activate the constructive interactions between ICT developers, SSH researchers and other stakeholders (e.g. NGOs, citizens and users) leading to a responsible approach to research and innovation through the uptake of SSH expertise and RRI actions. *No participation information yet*	Top-down	Inform-Consult-Involve	Passive
Irresistible (Project ended) Funding: FP7-SIS	Citizens	Irresistible aims to raise awareness on RRI by increasing pupils' content knowledge about research. This was achieved by combining formal (school) and informal (science centre, museum or festival) educational approaches to introduce relevant topics and cutting-edge research into the programme.	Top-down	Inform	Passive
LIVING INNOVATION (2018-2021) Funding: H2020-SwafS	Citizens and CSOs	LIVING INNOVATION offers Webinars: hosting talks about co-creation and sharing the results of the LIVING INNOVATION co-creation workshops led by industry.	Top-down	Inform	Passive
		LIVING INNOVATION organises co-creation workshops jointly develop solutions that simultaneously satisfy user needs, tackle societal challenges		Involve-Collaborate	Active

		and create new business opportunities.			
Making Sense (Project ended) Funding: H2020-ICT	Citizens	Making Sense offers a toolkit on how to organise citizen sensing campaigns for positive social change to assist local communities to make sense of their environments and address pressing environmental problems.	Bottom-up	Inform-involve	Active
NANO2ALL (Project ended) Funding: H2020-NMP	All stakeholders	NANO2ALL offers a 'for you' webpage where stakeholders can find suitable information about your role in nanotechnology development.	Top-down	Inform	Passive
		NANO2ALL organized multi-stakeholder events for deliberation of values and purposes underlying a responsible technological future for nanotechnology. Experiences are shared in their materials and results website section.		Consult-Involve	
NANOCAP (website no longer active) (Project ended) Funding: FP6-SaS	All stakeholders.	NANOCAP aimed to deepen the understanding of environmental, occupational health and safety risks and ethical aspects of nanotechnology by organising a structured discussion between environmental NGOs, trade unions, academic researchers and other stakeholders. The aim was to develop balanced position statements on nanotechnologies and giving them the opportunity to formulate their positions within their actual policy context supported by scientific input, to inform their members and the general public and to discuss the issues. Information from Cordis-EU.	Top-down	Inform-Consult-Involve	Passive
NanoCode (Project ended) Funding: FP7-SIS	All stakeholders	NanoCode consulted stakeholders to explore knowledge, attitudes, reactions and proposals in relation to the Code of Conduct. The engagement of stakeholders in the debate would help to increase awareness on the Code of Conduct for responsible nanotechnology and nanoscience research and in shaping its content to the stakeholders' needs and expectations, making it a more accepted, concrete and practical instrument for decision-making in nanotechnology and nanoscience R&D.	Top-down	Consult	Passive

		NanoCode provide a 'CodeMeter' tool to assess the performance of the Code of Conduct.		Inform	
NanoDiode (Project ended) Funding: FP7-NMP	Citizens, CSOs and other stakeholders	NanoDiode consulted users via organized user committees, enabling stakeholders to participate in the research and innovation process, modulating research directions in light of societal considerations. There most important outcomes are summarized in the following fact sheets.	Top-down	Inform-Consult-Involve	Active
NANOPLAT (website no longer active) (Project ended) Funding: FP7-SIS	CSO and other stakeholders	NANOPLAT provided an online tool to stimulate discussions between stakeholders in various geographical regions on how to identify the needs and interest of relevant stakeholders across the value chain of consumer products. Information from NANO2all	Top-down	Inform-Consult	Passive
NANORIGO (2019-2023) Funding: H2020-NMBP	All stakeholders	NANORIGO aims to develop and implement a transparent transdisciplinary Nanotechnology Risk governance framework and a related risk governance council. *No participation information yet*	Top-down	Inform-Consult-Involve	Passive
NewHoRRIzon (2017-2021) Funding: H2020-SwafS	All stakeholders	NewHoRRIzon developed the Societal Readiness Thinking Tool. This offers practical guidance on how to mature the societal readiness of research projects.	Top-down	Inform	Passive
		NewHoRRIzon invited stakeholders to take part in a Social lab to co-create tailor-made pilot actions that will stimulate an increased use and acceptance of RRI across the different research topics.	Top-down	Collaborate	Passive
NanoYou (Project ended) Funding: FP7-NMP	(young) Citizens	NanoYou offers materials to learn more about nanotechnology and nanoscience, such as audio-visual materials, posters and presentations, and arts and images.	Top-down	Inform	Passive
OrganiCity (Project ended) Funding: H2020-ICT	Society and other stakeholders	OrganiCity developed the OrganiCity Playbook and Worksheet which provides an overview of what Experimentation as a Service is, which explores how citizens, businesses and city authorities can work together to create digital solutions to urban challenges.	Top-down	Inform	Active

		Organicity organized different experiments about current challenges to have multi-stakeholders collaborate in co-creating solutions.		Collaborate	Active
PERARES (Project ended) Funding: FP7-SIS	CSOs and researchers	PERARES aimed to strengthen public engagement in research by involving researchers and CSOs in the formulation of research agendas and the research process. They suggested a bullet point list for CSOs who wish to become involved in research.	Bottom-up	Inform-Empower	Active
PRISMA (Project ended) Funding: H2020-SwafS	CSOs and researchers	PRISMA has a RRI Toolkit available to align research and innovation processes to societal needs and challenges.	Bottom-up	Inform-Involve-Collaborate	Active
REFLOW (2019-2022) Funding: H2020-MSCA	Citizens, policy makers and industry	REFLOW will organize 6 pilot studies across Europe that will test approaches to city circularity, each focusing on a different resource flow. At the heart of these pilots is a productive 'making' approach that empowers citizens and engages policy makers and industry leaders.	Top-down	Inform-Involve – Collaborate	Active
RiskGONE (2019-2023) Funding: H2020-NMBP	All stakeholders	RiskGONE aims to establish a science-based nanomaterials safety governance body, in the form of a transparent, self-sustained European Risk Governance Council, with representatives from EU Member States and public authorities, scientific experts, civil society and industry. *The plan is to construct an online discussion platform about risk governance of nanotechnology, but not detailed information is available yet.*	Top-down	Inform-Consult-Involve	Passive
RRI-Tools (Project ended) Funding: FP7-SIS	CSOs and other stakeholders	RRI-Tools aims to bring multiple stakeholders together to collectively work on the design of a better relationship between research and innovation on the one hand and society on the other. They offer tools for applying RRI concepts and strategies in particular contexts and within specific areas.	Bottom-up	Inform-Involve	Active
SISCODE (2018-2021) Funding: H2020-SwafS	Citizens, CSOs and other stakeholders	SISCODE offers co-creation opportunities in participation labs about a large variety of topics.	Top-down	Inform-Collaborate	Active

System2020 (2018-2021) Funding: H2020-NMBP	Citizens	System2020 provides a science education map where citizens can find science education initiatives.	Top-down	Inform	Passive
TIME for NANO (Project ended) Funding: FP7-NMP	(young) citizens	TIME for NANO aimed to engage with the public through outreach, dialogue and education, offering a Nanokit – tangible hands-on activities on nanotechnologies.	Top-down	Inform	Passive
TRACES (project ended) H2020-SC6	All stakeholders	TRACES aimed to provide new directions for cultural heritage institutions (e.g. science museums) to contribute productively to evolving European identity and reflexive Europeanization. TRACES created Creative Co-Productions in which various stakeholders worked together in longer term engagements to collaboratively research selected cases of contentious heritage and develop new participatory public interfaces.	Top-down	Inform-Consult-Involve	Passive

Considering the EU projects in Table 1, the bulk of initiatives have been funded under two specific challenges:

- 28% of EU projects were funded under the Nanotechnologies, Materials and Production Programme (known as NMP in FP6 and FP7 and as NMBP in Horizon 2020). Notable examples include educational programmes like NANOYOU and TIME for NANO and initiatives for co-creation and dialogue such as NanoDiode;
- 53% was funded under the consecutive EU Science and Society Programmes known as Science and Society in FP6, Science in Society in FP7 and Science with and for society in Horizon 2020. This includes projects like FRAMINGNANO, CONSIDER and LIVING INNOVATION;
- The remaining initiatives (19%) have been funded under various other parts of the EU programme such as the European Research Council (ERC), Information and Communication Technologies (ICT), the Marie-Sklodowska-Curie Actions (MSCA) and Horizon 2020 Societal Challenge 6: Europe in a changing world - Inclusive, innovative and reflective societies.

Table 2: Public engagement initiatives and organizations which are not EU projects (in alphabetical order)

Organisation	Target group	Description of public engagement activities	Direction of engagement	Level of participation	Engagement approach
Ars Electronica	Citizens	Ars Electronica is a worldwide platform for art, technology and society science innovation that focusses on current developments and possible future scenarios, and the question of how these will change our lives. They have, at least, two initiatives that offer regular engagement processes around various topics; 1) Ars Electronica Export which is organizes exhibitions, projects, workshops and activities all over the world. And 2) Future lab which is an on sight artistic-scientific think-tank and studio-lab.	Top-down	Inform	Passive
BASF Dialog Forum Nano (initiative ended)	Citizens, CSOs and other stakeholders	BASF Dialog Forum Nano aimed to for shared understandings of nanotechnology by organizing dialogue events with CSOs and other stakeholders and an online consultation with citizens about, among others, nanotechnology.	Top-down	Inform-Consult-Involve	Passive
CPN - Centar za promociju nauke	Citizens and researchers	CPN promote cooperation and mutual understanding by offering diverse events including Science clubs, Science festival, Workshops, and Science education for responsible citizenship.	Top-down	Inform-Involve	Passive
DesignLab	All stakeholders	DesignLab facilitates and develops research, education, collaborations and events. DesignLab aim is to create and Innovative meaningful solutions for complex societal challenges with multi-stakeholders. Upcoming events can be found here.	Top-down	Involve-Collaborate	Active
Ecsite	Citizens, CSOs Science centres, museums.	Ecsite provides information and useful documents on science engagement in general, and Ecsite activities in particular. Their mission is to inspire and empower science centres, museums and all organisations that engage people with science, and to promote their actions.	Top-down	Inform	Passive
European Network of Living Labs	All stakeholders	The European Network of Living Labs is the international federation of benchmarked Living Labs in Europe	Top-down	Inform-Consult-Collaborate	Active

		and worldwide. Living labs operate as intermediaries among citizens, research organisations, companied, cities and regions for joint value co-creation, rapid prototyping or validation to scale up innovation.			
Futurescape city tours (project ended)	Citizens	Futurescape city tours organized local city tours and invited participants to talk about concerns and desires for the future of their communities with researchers, stakeholders, city planners, and officials.	Top-down	Inform-Consult	Passive
Hackathon.com	All stakeholders	Hackathon.com offers the opportunity to create an innovation with multiple stakeholders on locations all over the world. On their website they list various hackaton locations. Topics are broad and range from Big data to hacking health hackathons.	Top-down	Collaborate-Empower	Active
LiCalab - Living and Care Lab	Citizens (users), companies and organisations	LiCalab supports businesses and organisations in the health and care sector to test and validate innovations with end users. By organizing co-creation workshops, end users get together with developers to think about the new product or service Contact LiCalab.	Top-down	Consult	Passive
Living Knowledge	CSOs and researchers	Living Knowledge shares specific advices to CSOs on how to become involved in research.	Bottom-up	Empower	Active
		Organize Science Shops where they provide independent, participatory research support on behalf of CSOs in response to concerns experienced by civil society.	Top-down	Inform-Involve	Passive
MangorollaCIC	Young citizens	Mangorolla was set up to deliver excellent public engagement projects, aiming to help organisations connect with the communities with whom they need to be in conversation. Mangorolla started multiple '*I'm… Get me out of here*' initiatives to connect students will scientists, engineers, medic personal, researches, astronauts, and mathematicians. Initiatives: Organized zones 2020 and I'm a Scientist, Debate Kits and I'm an Engineer, Get me out of here! And I'm a GeoScientist, Get me out of here!	Top-down	Inform-Consult-Involve	Passive

NanoRESP (FR)	All stakeholders	The NanoRESP Forum is an open space for multi-stakeholder dialogue dedicated to nanotechnologies. Stakeholders are stimulated to share knowledge and practices and explore ways of responsible and relevant innovation. KET4LIFE is the overarching company which supports, besides NanoResp, also BioRESP and DigiRESP Dialogue Forums. More Information about NanoRESP (ENG) can be found here.	Top-down	Inform-Involve-Collaborate	Passive
Open Science	Young citizens	Open Science stands for a dialogue between science and the public. Open Science provide information based on current scientific knowledge and supports the social reflection of the impact of science. This is achieved by organising exciting events and projects, including Vienna Open Lab.	Top-down	Inform-Involve	Passive
TRACES	Citizens	TRACES is a non-profit organisation that creates spaces to reflect, experiment and innovate in the fields of science in society and public communication of science education and public engagement. This initiative aims to bring together important stakeholders to discuss sociotechnical controversies. The dialogue is largely organized to show technologically innovative companies the key to understanding and comprehending the position of citizens, by exploring the opinions, values and imaginations of all participants. Their position is to on the one hand create awareness among technical companies and on the other give society the opportunity to share and discuss their needs and concerns.	Top-down	Inform-Consult-Involve	Active
UK Research and Innovation	All stakeholders	UK Research and Innovation works in partnership with universities, research organisations, businesses, charities, and government to create the best possible environment for research and innovation to flourish. UK Research and Innovation organize public engagement initiatives on topics as Big Data, astronomy, molecular biology, and technology developments. Visit their public engagement page.	Bottom-up	Inform-Involve	Active

UKCPN	CSOs	UKCPN shares networking tips for CSOs wanting to initiate own research projects.	Bottom-up	Inform-Empower	Active
Waag	Citizens	Waag aims to explore the social and cultural impact of new technologies and their purposes for social innovation via:			
		Make offers research possibilities from a Do-It-Yourself perspective. These are topics from the community.	Top-down	Inform-Involve	Active
		Code works to raise awareness of the consequences of new technology and develops concrete alternatives to make citizens more resilient and agile		Inform-Involve	Active
		Learn develops a modern shaping of education and interaction to provide tools for publics to participate in society.	Top-down	Inform	Passive
		Care stimulates and works on developing and innovation of health technology concepts via the process of co-creation.		Collaborate	Active
Wetenschaps-forum	All stakeholders	Wetenschapsforum offers participate in an online discussion about scientific topics.	Top-down	Inform-Consult	Passive
Zooniverse	Citizens	Zooniverse is an online platform that offers the opportunity to participate in crowdsources scientific research by completing research tasks.	Top-down	Involve	Passive

The initiatives in both tables offer a wide array of public engagement initiatives. The CONSIDER project for example lists key recommendations on the website for different stakeholders on how to improve the involvement of publics in research. The Futurescape city tours organized face-to-face tours in urban environments and invited citizens to talk about concerns and desires for the future of their communities with relevant stakeholders. ACTION developed a citizen science toolkit and the opportunity to request for financial funding to stimulate citizens to participate in or set up their own citizen science projects. Zooniverse is an online platform that offers citizens an opportunity to participate in scientific research by completing research tasks. And LiCalab organized face-to-face public engagement workshops in the health and care sector in which developers of a new initiative get together with end-users to test and validate the innovation.

Most engagement opportunities have ended

More than half of the engagement opportunities in the reviewed initiatives have expired. This is partly due to the nature of EU-funded projects which mostly span 3 or 4 years. As a result, engagement opportunities occur in discrete moments in time. That said, most initiatives that facilitated participation events continue to provide information on how to engage after the engagement opportunity itself has ended. Organicity for example initially organised multi-stakeholder collaborations. After completing these activities, the project developed the OrganiCity Playbook and Worksheet as a Do-It-Yourself experiment.

Public engagement initiatives are predominantly organised top-down

The majority of engagement opportunities reviewed was organised top-down (78%). 'Top-down organisation' means that the engagement initiative is driven by technology 'enactors' (such as researchers, technologists, or producers) or engagement professionals (such as science centres, university communications personnel, engagement and communication scholars, consultancies and communications agencies), often in return for payment or other forms of compensation (as is the case in most EU-funded projects). Top-down organisation is contrasted with 'bottom-up organisation', where citizens or societal stakeholders self-organise to become involved in nanotechnologies. Very view of the initiatives in this review were clearly organized bottom-up, although 11 initiatives (22%) do provide bottom-up participation support to prospective organisers of engagement initiatives.

Focus of the engagement initiatives

Of the 49 reviewed initiatives, the majority (36 initiatives, or 73%) focused on emerging technologies or on research and innovation in general, rather than exclusively on nanotechnologies. Those initiatives that are dedicated specifically to nanotechnology (13 initiatives, or 27%) are predominantly EU-funded. Of these 13 initiatives, 7 initiatives (54%) are part of the NM(B)P programme, including Gov4Nano, NanoDiode and RiskGONE. Four initiatives (31%) are part of the Science and Society programmes, including FRAMINGNANO, NanoCode and NanoCap.

Only 2 out of the 13 initiatives focusing solely on nanotechnology engagement, NanoResp and BASF's Dialog Forum Nano, are not EU funded projects. Examining the NanoResp initiatives more closely, one could argue that it also considers public engagement more broadly: it is part of the TEK4LIFE initiative which organises three dialogue forums including DigiResp and BioResp, focusing on digital technologies and biotechnologies, respectively. And while the BASF Dialog Forum Nano focused specifically on nanotechnologies, the scope of the dialogue also considered chemical innovation more broadly.

Competing interpretations of 'engagement'

What stood out during this review was that all initiatives in the sample use the term 'public engagement', but there is significant variation in what public engagement *means*. TIME for NANO for example aims to educate the public by providing information and education material for citizens about nanotechnology. LIVING INNOVATION refers to public engagement as the opportunity to participate in multi-stakeholder co-creation events. In this initiative, citizens work together with developers to improve their research and/or innovation. Other interpretations of public engagement range from:

1) Providing information to citizens: Ecsite provides information and useful documents on science engagement. NANO2ALL offers a 'for you' webpage where stakeholders can find suitable information about their role in nanotechnology development.

2) Educating citizens about nanotechnology or public engagement: NanoYou for example offers materials to learn more about nanotechnology. The Irresistible project aims to raise awareness on RRI by increasing pupils' content knowledge about research.
3) Gathering information from citizens and stakeholders: NanoCode developed an online consultation process, by conducting electronic surveys for multiple stakeholders to explore knowledge, attitudes, reactions and proposals in relation to the nanotechnology Code of Conduct.
4) Involving citizens and stakeholders in research and policy: citizen science initiatives such as ACTION and Zooniverse aim to involve citizens in research processes by having the public collect and/or analyse scientific data. DesignLab offer citizens an opportunity to engage in dialogue with multiple stakeholders and become involved in the discussion of research and innovation processes.
5) Encouraging collaboration between stakeholders: NewHoRRIzon aims to stimulate and open-up an active cooperation between multiple stakeholders as part of a social experiment to create awareness on responsible research and innovation. SISCODE and LIVING INNOVATION organized multi-stakeholder co-creation events to work together with developers to improve their research and/or innovation.
6) Empowering citizens and stakeholders: ACTION aims to empower citizens to start their own public engagement initiatives by offering helpful toolkits and financial support. CONSIDER provides advice and guidelines on how to become involved in research and innovation processes and come in contact with organisations citizens want to engage with.

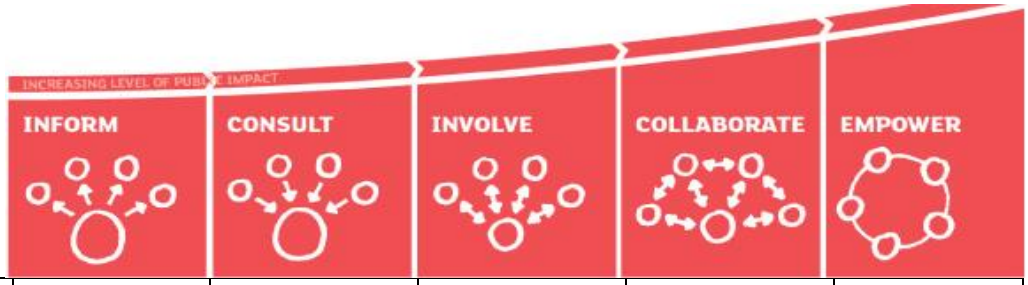
To get a sense of the distribution of the public engagement initiatives in the sample across these different interpretations of public engagement, the initiatives can be mapped on the International Association for Public Participation[13] (IAP2) participation spectrum[14] which distinguishes and formulates the following five levels:

1) Inform: to provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.
2) Consult: to obtain public feedback on alternatives and/or decisions.
3) Involve: to work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.
4) Collaborate: to partner with the public in each aspect of the decision, including the development of alternatives and identification of the preferred solution.
5) Empower: to place the decision in the hands of the public

Each level indicates the strategy to involve participants during the engagement initiative, ranging from 'Inform' in level 1 to 'Empower' in level 5. Figure 1 maps the public engagement initiatives reviewed onto the different levels of the IAP2 spectrum.

[13] www.iap2.org

[14] The participation spectrum can be traced back to the ladder of participation as first developed by Sherry Arnstein (1969). This ladder consisted of 8 levels, ranging from manipulation and therapy to delegated power and citizen control. Arnstein had a critical approach, reflecting on the participation approach and assessment of the amount of impact citizens have during the event. The IAP2 participation spectrum has, what the authors call, a "rationalist" approach, assessing the engagement strategy to involve publics in 5 more general levels. As the aim of this report was to provide an overview of opportunities for public and professional stakeholders and not to critically asses the level of impact the publics have during the event, it was decided to use the IAP2 participation spectrum and strategy.

					
ACTION	x		x	x	x
Ars Electronica	x				
BASF Dialog Forum Nano	x	x	x		
Citizen sense	x		x		x
CONSIDER	x				x
CPN	x		x		
DesignLab			x	x	
D-NOSES	x	x	x		x
Ecsite	x				
EnRRICH	x		x		
European Network of Living Labs	x	x		x	
FRAMINGNANO	x	x	x		
Futurescape city tours	x	x			
Gov4Nano	x	x			
GRRIP	x			x	
Hackathon.com				x	x
HubIT	x	x	x		
Irresistible	x				
LiCalab		x			
LIVING INNOVATION	x		x	x	
Living Knowledge	x		x		x
Making Sense	x		x		
MangorollaCIC	x	x	x		
NANO2ALL	x	x	x		
NANOCAP	x	x	x		
NanoCode	x	x			
NanoDiode	x	x	x		
NANOPLAT	x	x			
NanoRESP	x		x	x	
NANORIGO	x	x	x		
NanoYou	x				
NewHoRRIzon	x			x	
Open Science	x		x		

OrganiCity	x			x	
PERARES	x				x
PRISMA	x		x	x	
REFLOW	x		x	x	
RiskGONE	x		x		
RRI-Tools	x		x		
SISCODE	x			x	
System2020	x				
TIME for NANO	x				
TRACES (EU-project)	x	x	x		
TRACES (NGO)	x	x	x		
UK Research and Innovation	x		x		
UKCPN	x				x
Waag	x	x	x	x	
Wetenschapsforum	x	x			
Zooniverse			x		
Total	**45**	**19**	**28**	**13**	**8**

Figure 9: The public engagement initiatives in the sample mapped onto the IAP2 spectrum.

This mapping exercise shows that the different types of engagement activities are unevenly distributed. Of all the initiatives that have been reviewed, 92% have engagement activities that fall within the 'Inform' category (45 initiatives) (although the vast majority of initiatives cover multiple engagement levels, offering a variety of activities to 'Inform', 'Consult', 'Involve' and 'Collaborate'. An initiative like the Futurescape city tours for instance organises a multi-stakeholder city tour where citizens can share their concerns and desires for the future of their communities with relevant stakeholders. Citizens are *informed* about developments in their communities, but also have the opportunity to *discuss feedback* with other stakeholders. Hence, Futurescape city tours is mapped in both the 'Inform' and the 'Consult' level of engagement), 27% (13 initiatives) offer activities in the 'Collaborate' category, and 8 initiatives (16%) provide means to empower citizens and stakeholders.

A methodological consideration is in order here: the decision to categorise an initiative in one level rather than another is to some extent open to interpretation. For most cases, it is relatively clear what category they belong to. Educational projects such as TIME for NANO and NanoYou can be clearly mapped onto the 'Inform' level of engagement. But in some cases, the decision is less clear, as there are no clear-cut boundaries between the different engagement levels on the spectrum. Two initiatives that were more difficult to map were Open Science and TRACES (NGO): Open Science provides information based on current scientific knowledge and supports citizens to reflect of the impact of science through hands-on exercises in Open Labs. Such practical teaching techniques involve citizens in scientific experiments. Should these activities be categorised under 'Inform' or under 'Involve'? Citizens are involved in the experiments, but these activities mainly seem to serve educational purposes. There is no evidence that the organisers, in terms of the IAP2 spectrum, 'work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered'. It is unclear

whether the outcome and process of the engagement event is meant to shape the thoughts and opinions of researchers or developers. Hence, the decision to map Open Science under both 'Inform' and 'Involve' could be disputed.

A similar point applies to TRACES (NGO). This initiative aims to bring together important stakeholders to discuss sociotechnical controversies. The dialogue is largely organized to show technologically innovative companies how to understand and comprehend the position of citizens by exploring the opinions, values and imaginations of all participants. The aim is to create awareness among technical companies and give citizens an opportunity to share and discuss their needs and concerns at the same time. Multiple engagement levels can be recognized here; by sharing concerns, technological companies obtain feedback from the public which is a *consulting* activity; the active dialogue about the needs and concerns of citizens is a form of *involving* citizens, as aspirations are understood and considered; and technology companies have the chance to further *collaborate* with citizens by attracting them in the future developments of their research or innovation. The initiative thus includes activities that address the 'Consult', 'Involve' and 'Collaborate' levels of engagement. But since collaborations between companies and citizens are not part of the project itself, it was decided to map, TRACES under the 'Consult' and 'Involve' levels of engagement only.

The vast majority of public engagement activities focus on outreach rather than participation

These methodological considerations notwithstanding, the vast majority of initiatives are clearly situated at the left-hand side of the public engagement spectrum. These methods of engagement focus on disseminating information to citizens, rather than on participation and mutual learning. The role of citizens in these types of engagement is mainly as recipients of information that is provided by the initiative, for example by reading brochures, watching a webinar or filling in an online questionnaire. There are few examples of engagement initiatives that cast a role for citizens as providers of information, for example as knowledge co-producers in co-creation events.

Passive and active public engagement

These differences in the role attributed to citizens can characterized as *passive* or *active* engagement. Passive engagement means that the objectives, scope and content of the engagement initiative are fixed: the aim of the engagement initiative is to educate, inform or inspire citizens or stakeholders. In passive engagement, there is no direct feedback from the engagement initiative to the research and innovation process. In contrast, active engagement aims to enhance the involvement and participation of citizens and stakeholders in the research and innovation process. Active engagement includes creating awareness among researchers and developers and make them more responsive to feedback from citizens and stakeholders. Tables 1 and 2 indicate the approach of engagement for each initiative.

The European Network of Living Labs (ENoLL) is an example of active engagement. ENoLL organises Living Labs and stimulates co-creation among multi-stakeholders. Their aim is to create collaborative working environments for joint value co-creation, rapid prototyping or validation to together scale up innovation and businesses. The DesignLab at the University of Twente is

another example: DesignLab facilitates and develops multi-stakeholder research, education, collaborations and events with the aim to create innovative solutions for complex societal challenges.

Roughly half of the initiatives reviewed in the sample (26 initiatives, or 53%) provide passive engagement. Examples are the education materials from TIME for NANO or the electronic survey of the FRAMINGNANO project. 18 initiatives (37%) support active citizens and CSOs collaboration in research and innovation processes or aim to empower citizens to initiate their involvement in research and innovation. D-Noses for example provides co-creation tools to design odour pollution control measures with stakeholders. A smaller number of initiatives (10%) encourage both passive and active engagement. LIVING INNOVATION for example offers citizens an opportunity to be informed about emerging technologies by listening to webinars, but it also offers a possibility to actively collaborate with developers to improve their research or innovation.

'Passive involvement'?

The distinction between passive and active engagement also sheds a different light on the activities that are currently categorised under the 'Involve' level of engagement in the IAP2 spectrum. Many of the activities here do in fact 'work directly with the public throughout the process', but the role attributed to citizens is in many cases still passive. The citizen science initiative Zooniverse for example actively involves citizens in research. However, in most of the research activities, citizens are invited to collect and analyse scientific data for researchers. Citizens are much less involved in the discussion about the way research and innovation should be practiced. So even for some of the initiatives that are currently positioned at the right-hand side of the IAP2 spectrum, one might wonder to what extent these initiatives genuinely seek to partner with the public or put decisions in the hands of the public.

Current public engagement possibilities

In summary, roughly half of the 49 public engagement initiatives reviewed here are currently active. Most of these initiatives focus on research and innovation or emerging technologies more generally. Six initiatives offer concrete opportunities for citizens and CSOs to engage with nanotechnologies: NanoResp, LIVING INNOVATION, NewHoRRIzon, NANORIGO, RiskGONE and Gov4Nano. Three projects (NANORIGO, RiskGONE and Gov4Nano) are currently active, but aim to carry out concrete engagement activities at a later date. This leaves three projects (out of 49) currently offering concrete nanotechnology engagement opportunities: NanoResp, LIVING INNOVATION and NewHoRRIzon.

4. Conclusion

The main aim of this subtask was to map available opportunities for public and professional stakeholders to have a say in the development of nanotechnology. The explorative review of 49 engagement initiatives in this report resulted in the following findings:

- The bulk of public engagement initiatives on emerging technologies in the sample are from EU projects funded under the NM(B)P and Science in Society programmes.
- Relatively few engagement initiatives focus exclusively on nanotechnologies; those that do are predominantly EU-funded (86%).
- The majority of engagement initiatives reviewed (78%) are organised in a top-down fashion; they are carried out by technology 'enactors' or engagement professionals, often in return for payment or other forms of compensation.
- There is significant variation in the types of public engagement offered by the different initiatives.
- The different types of engagement activities are unevenly distributed: 45 initiatives (92%) have engagement activities that fall within the 'Inform' category. Relatively few initiatives aim to empower citizens and stakeholders.
- Only 3 out of the 49 initiatives reviewed currently offer concrete opportunities for citizens and CSOs to engage specifically with nanotechnologies.

Concrete public engagement possibilities are relatively scarce

These findings suggest that concrete opportunities for citizens and CSOs to actively engage with nanotechnology research and innovation processes are relatively scarce, despite a plethora of public engagement initiatives.

For those interested in engaging with nanotechnology, finding the 'right' engagement opportunity can be difficult. Since nanotechnology encompasses a wide range of technological developments in areas as diverse as healthcare, manufacturing and agriculture, chances are small that the topic discussed matches the topic the citizen or CSO representative wants to engage in. Additionally, the time-restricted nature of engagement activities restricts the window of opportunity for citizens to engage; they have to find the opportunity at the right time and be available in that timeframe.

To make it easier for citizens and CSOs to identify suitable engagement opportunities, GoNano developed an online public engagement database, listing organizations and projects that are currently inviting input from citizens and CSOs or offer guidance on how to become involved in the (nano)debate[15].

Engagement opportunities are organised in a top-down fashion

What's more, the majority of engagement initiatives in the review (78%) was organised top-down. Very few engagement initiatives organised by citizens and CSOs who would like to become involved in nanotechnology research and innovation were identified, although one initiative (ACTION) offered funding for citizen-led citizen science and several other initiatives offer guidelines and tools to support bottom-up public engagement.

[15] http://gonano-project.eu/category/public-engagement-database/

Engagement is focused more on information and education than on participation and empowerment

In terms of the IAP2 spectrum, only 8 initiatives offer activities on the highest level of engagement ('Empower'), where citizens and CSOs are equal partners. Active opportunities to have a say in nanotechnology research and innovation processes are relatively scarce, despite a plethora of public engagement initiatives.

This is a far cry from the policy objective expressed in the report 'Re-finding Industry', published by the High-Level Strategy Group on Industrial Technologies in 2018. The report called for more social dialogue and participation in Europe, noting that: *"Civil society has a central role in identifying the main challenges, and must be actively involved in the development of missions and projects. The role of society in the missions and projects is not only in the execution phase, but also in most phases of the public policy cycle. Civil society must also take part in the identification of the problem itself, in setting the agenda for solutions, in the policy making and evaluation."*[16]

The overall conclusion from this review is that the current engagement landscape does not fully address these policy objectives. To strengthen the role of civil society in European research, there should be more attention to the active involvement of citizens and CSOs in shaping the research and innovation agenda. Public engagement needs to focus on the empowerment of citizens and CSOs, moving beyond the conception of societal stakeholders as passive recipients of information.

Enhancing the responsiveness of research and innovation

This conclusion aligns with the aim of the GoNano project to enhance the 'responsiveness' of research and innovation in nanotechnologies to societal needs and values. The GoNano co-creation process focused specifically on the responsive capacity of nanotechnology research and innovation. The idea was to bring stakeholders with different backgrounds together to co-create future research lines and products. The co-creation process sought to move beyond traditional outreach efforts of, focusing instead on 'inreach', integrating feedback from citizens and CSOs in research and innovation decisions.

This explorative review of public engagement initiatives suggests engagement initiatives should be easier to find and focus more on empowerment and active participation of citizens and stakeholders rather than on passive engagement. Better alignment of research and innovation with the values, needs and expectations of society requires that the responsive capacity of research and innovation is enhanced.

[16] Re-Finding Industry. Report from the High-Level Strategy Group on Industrial Technologies. European Commission, 2018: https://ec.europa.eu/research/industrial_technologies/pdf/re_finding_industry_022018.pdf.

Annex 1: Sub-Task report 6.2.2 Mapping of guides for publics and Civil Society Organisations to have a voice in nanotechnology research and innovation (OsloMet)

Framing the task

According to the DOA, *"Go Nano partners will also offer guidelines to other stakeholders and citizens who would like to have a voice in nanotechnology R & I. This task will map already available opportunities for public and professional stakeholders to have a say on the development of nanotechnology, and it will develop an online resource database for this purpose. It will draw on its experiences from the pilot studies to inform guidelines on where in the R & I trajectory stakeholders and publics might make valuable contributions"* (p. 36).

The task for this specific contribution has been interpreted as follows:

- A number of project cases, defined as online resources, will be reviewed taking into account their usefulness for citizens and stakeholders who wish to engage. In the choice between an extensive (many cases, limited analysis) and an intensive (fewer cases more thoroughly reviewed) strategy, the consortium opted for a middle way. Approximately 15 suggestions for cases to be reviewed emerged. This will be further elaborated in the material and method section.
- The text will consider, simultaneously, both professional, sometimes even resourceful CSOs with a stake in the development, and individual citizens, i.e. motivated by curiosity, moral commitments, and expressing a desire to be involved in the R&I phase of nanotechnology development.
- The project reviews are summed up in a table with the following content 1) short sentence about the project 2) why they have an engagement process 3) who is the target group for participation 4) How useful is the project in this regard? 5) How can the CSO or citizen engage in the participation process 6) link to the website

There is obviously a need for distinguishing between the professional stakeholders and ordinary citizen-consumers. Different types of stakeholders enter such engagement processes with resources in the form of persons, time and money, in addition to a field of concern and expertise, while the citizen-consumers' main contribution is their representation of a common voice. Formal rules for CSO participation in hearings are not directed at citizen-consumers. Some of the reviewed resources, however, could be valuable for both stakeholders and concerned individuals, especially when they contain easy-to-navigate knowledge bases. We address these distinctions between usefulness for CSOs and/or citizens in the reviews.

The question of *"where in the trajectory",* as posed in the DOA, is a difficult one (Delgado et. al. 2011, p. 834-835). We do not really know if partners responsible for the pilot studies have concluded or even commented on this question. But the Go Nano pilots generally seems to have had an upstream ambition; envisioning potential functions, services or products prior to actual product or service design. A kind of midstream engagement might be seen if stakeholders or citizens are 'present in the laboratory', involved in testing out different approaches *("Some have suggested a type of "midstream" engagement in laboratories and research activities"*, Delgado et al 2011, p. 834). If the research process is less clearly a defined trajectory, the distinctions between up, mid and downstream might become a bit blurred, but it still seems like a good idea to differentiate between them. Downstream engagement could easily appear to be more like focus group exercises, allowing consumers or stakeholders to choose between different, pre-made products or prototypes.

Citizen or CSO engagement on nanotechnology development is probably most interesting, and most likely to appear as upstream exercises.

Materials and methods

The participants in the GoNano-consortium have been involved in a number of projects that in various ways and to a varying extent have included citizen/consumers and/or professional stakeholders. So, we expected consortium members to have a good overview of other projects. that may have addressed these issues too. We have queried the consortium members to come up with projects that we should look at to identify elements of or more complete how-to-guides for citizens or stakeholders that want to get involved in research and agenda-setting, preferably in nanotechnology-related projects and initiatives.

We sent out a request to all consortium members for suggestions for projects and initiative) that they would consider as potentially useful resources for how citizens (or stakeholders) could become involved in nanotechnology research and agenda setting. This would provide the base for GoNano's 'how-to guides' for prospective citizens and stakeholders: "if you would like to become involved, these are your options. Have a look at these projects that have done a similar thing. This project is currently inviting participants, so feel free to drop them a line…". Two partners responded, and the resulting list of resources (project and initiatives) is based on these inputs:
PERARES, SATORI, NANOCAP, Nano2All, NanoDiode, Seeing Nano, Waag Society co-creation navigator,Citizen Sense, FRAMINGNANO, NANOCODE, Nanoethics 2011, NANOPLAT, BASF's Dialog Forum Nano, OECD guidance on Stakeholder Involvement in Decision Making: A Short Guide to Issues, Approaches and Resources, SustainAbility's International stakeholder engagement standard - AA1000SES, SustainAbility report on sustainable food systems (2018), FRONTEER, LivingKnowledge: The International Science Shop Network, LivingInnovation, COMPASS, Engage2020.

After reviewing all projects, we found that three projects, COMPASS, OECD and Citizen Sense project were not relevant for our purpose, and they were subsequently omitted from this deliverable.
During the review of these resources, we identified one further initiative that we have included: UK Community Partner Network (UKCPN).

The review method is based on reading the websites of the above listed resources and downloading reports and deliverables that appeared as the most relevant for our task. For projects there were reviewed in Work Package 1 of this project, we used those reviews as background for our reviews here. We downloaded the parts of the resource or project that appeared most likely to give input to citizens and CSOs wanting to get involved. We both did word searches within those documents, but also read through certain parts to make sure we did not miss anything. On the other hand, we reviewed a number of project deliverables and webpages, and our search have been somewhat broad scoped and looking for the more obvious advices. This will have influenced the depth with which we engaged with each project or resource. Despite this, do we believe that we have identified some really valuable advice, tips and hints for organisations and individual citizens that want to get involved in research and innovation agenda setting.

The project reviews are written as short descriptions of the projects, followed by an assessment of the usefulness to identifying how citizens/consumers and CSOs could become involved in research and agenda-setting.

Summarized Findings

A majority of projects have focused on and argued for engagement rather than how citizens and CSOs that want to get involved can go about it. Although we try to address this knowledge gap in this report, is it important to have in mind why it has been and still is vital to maintain a clear focus on 'traditional' engagement. Public engagement is one way of increasing the involvement of citizens and CSOs in research projects and agenda setting. However various factors will have to be clarified and defined prior to such events (examples include How do you construct the public?; What are the goals and motives for involving them? Map various ways of empowering participants?) (Shelley-Egan et al., 2018). An obvious challenge is that organisers of engagement process may select just certain or convenient outputs or ignore them all together. This makes the issue of responsiveness especially salient. Involvement is by many considered as not just one of the four dimensions of the RRI (Responsible Research and innovation)-concept (Stilgoe et al., 2013), but perhaps *the* most important one (Shelley-Egan et al., 2018; Bickman and Rog, 2008, p. xv), as it is considered as a key to the sustainability, acceptability and social desirability of the innovation process and the commodification and commercialisation of the products that may result.

However, one should recall that there has been somewhat of a struggle to get researchers on board with the idea of involving stakeholders. The thrust of responsible research and innovation have largely come from policy makers and through the research funders, like the EU in H2020. To many researchers it has been a new concept, for instance to involve 'outsiders' in their research projects. How can such involvement be arranged and how can it be implemented productively in the science and technology? That there has been somewhat of a reluctance on the part of researchers, can help to explain why a majority of projects on involvement has focused on engagement, and less so on how CSOs and citizens can get involved, which is the primary scope of this work.

For this task report we considered the option of 'flipping' the outcomes of the projects that argued for and found various ways and motivation for engaging the public or CSOs. That is, based on such recommendations for engagement, one could formulate suggestions for citizens or professional stakeholders, so that they would meet or satisfy such recommendation. This would then increase their chances for being contacted by researchers that are in the process of engaging participants.

With this in mind, it may not come as a surprise that we have found few projects that have directly addressed options for citizens or professional stakeholders that want to get involved in projects and events on emerging technologies. Those that do, often start with the assumption that CSOs in particular that have specific social issues on their agenda (PREPEARES-project), and are ready to apply for funding and need researchers to achieve that (UKCPN). We believe that this is not the only option envisaged by CSOs that want to get involved. Although it is an option to be considered.

We will now turn to the most important and relevant findings. However, before that a caveat:
In the CONSIDER-project there were some interesting statistic they have produced that show how the role of CSOs in projects, tend to be perceived differently by the CSOs themselves, compared with the project coordinator. There was a tendency for Project coordinators to assign CSOs members a more passive role than what the CSOs themselves perceived, as we can see from the following table including some of the questions and responses. The explanation behind these differences in perception about roles in project initiation and execution may well be that they are not explicitly formulated, but are rather tacitly assumed. They could however have a chilling effect on the professional stakeholders' desire to participate in (further projects), if they get the impression that their role, expertise and input is not appreciated or not really taken into account.

Question	*CSOs members response*	*Project coordinator response*
CSOs as initiators of the project	*50%*	*19%*
CSOS are advisory board members	*50%*	*29%*
The primary role of CSOs are expertise, viewed as researchers	*33%*	*39%*

While the research performed in the CONSIDER-project had revealed substantial CSO involvement in research, the project's findings also suggest that most actors in research projects are not aware of options and models of such involvement. This points to the importance on clarifying conditions and expectations in projects were CSOs want to get involved.

Useful resources identified for CSOs and citizens

There are two projects (PERARES and CONSIDER) and one resource (UKCPN) that we have identified in our reviews that address and list specific guidelines for those who would like to have a voice in research and innovation. We believe that these specific ideas and suggestions would constitute valuable advice, particularly for CSOs. However, as we have touched upon already, many of these suggestions and ideas would also be of interest to individual citizens that would like to get involved in research and innovation projects and agenda setting. Of course, individual citizens do not have the resources in terms of staff, finances, website, but they might still find some of the listed advices useful.

We consider these suggestions to be of high value and relevance, and that is why we reproduce them here. However, this does not entail that other projects did not have interesting insights, and we will return to them, but the following ideas and suggestions are formulations that speak to our task more directly in a condensed form:

The first set of suggestions is retrieved from UKCPN- UK Community Partner Network. This appears as an interesting resource, however its focus is mainly on CSOs as initiators of research projects, often referred to as 'a partnership project'. This would then involve CSOs that want something specific from the university, for their own agenda, rather than making themselves available or wanting to get involved. However, we find that this list of networking possibilities would be quite helpful even for CSOs that want to get involved, without having explicit ambitions to apply for their own research project[17]:

[17] https://www.publicengagement.ac.uk/sites/default/files/publication/getting_started.pdf

However, perhaps your local university does not have an official entry point and you will have to find a sympathetic academic who might be interested in your project idea. Try looking at the staff websites for the area of work that your project idea falls into (e.g. Health or Social Work). Start networking by:

a. Attending events that are about your topic, but are of an academic nature
b. By signing up to any email lists or newsletters that are being published by the university
c. By following key academics on twitter or connecting on LinkedIn
d. Attend university student fares, Fresher's Week - again to link/network with student societies who can often put you in touch with relevant lecturers or heads of departments
e. Attending relevant public lectures. If any of the lectures are related to the work you do, ask if you can be part of the discussion panel, showcase your organisation or even conduct a lecture.

THE PERARES project has also suggested a bullet point list for CSOs who wish to become involved in research[18] :
Civil Society Organisations (CSOs) who wish to become involved in research:
- *Take every opportunity to lobby by attending meetings, talk to scientists, administration, and policy makers or write their specific requests into policy briefs*
- *Examine ways of developing skills around commissioning and managing research and build up skills and knowledge to impact research agendas*
- *Seek opportunities to become involved in developing and assessing research funding streams*
- *Look out for small scale funding schemes which might support them to develop research partnerships*

To the point of clarifying expectations and roles of CSO and researchers, the UKCPN also offer a "Principles of Practice for Community-University Partnership Working". The idea behind it is to provide clear foundations for a cooperation between CSOs and university researchers[19].

In the CONSIDER project, 5 key recommendations are highlighted for CSOs:
Recommendations to CSOs from the CONSIDER-project[20]
C1. Dare to take the initiative
C2. Act in line with your mission, priorities and reputation
C3. Be clear about your resources and be ready to raise funds
C4. Grow your research skills
C5. Raise your visibility
Each of these key recommendations have an accompanying description that includes a general description, guiding questions and a short, inspiring example of how issues related to the key recommendation was addressed in an actual project.

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[18] PERARES Deliverable report D8.1, p.14 https://www.livingknowledge.org/fileadmin/Dateien-Living-Knowledge/Library/Project_reports/PERARES_Experiences_and_attitudes_of_research_funding_Organisatins_towards_PE_with_research_with_and_for_CSOs_report_D8.1_2013.pdf
[19] https://www.publicengagement.ac.uk/sites/default/files/publication/principles_of_practice_for_cups.pdf
[20] http://www.consider-project.eu/guidelines-landing-page/csos

In the following we present the project and resource reviews. We start out with table one, which gives an overview of the most relevant projects, i.e. they speak more or less directly to the citizens and CSOs that want to get involved in research agenda setting. These were aslo the projects we highlighted under Useful resources above. These are then followed by the the actual project reviews of these.
Then follows a new table, Table 2, the gives an overview over the rest of the projects that were more focused on engagement, i.e. how and why researchers, industry and policy makers could engage the public in research and innovation activities and agenda setting. Eventhough they could be considered of little value due to such a focus, we believe that they still carry interesting insights, understandings and tips for CSOs and Citizens that want to be involved. Table 2 is subsequently followed by reviews of the projects in that table.

At the very end we have include an analysis of the findings and insights from the project reviews.

Table 1: The projects clearly relevant for citizens and CSOs aspiring to be involved in research agenda setting

Who (project/ resource)	**Target group**	**Usefulness**	**What is the aim of the engagement process?**	**Description of toolkit/guidelines**	**Website**
PERARES project	Researchers and CSOs	Specific advices to CSOs on how to become involved in research.	To establish a deeper and more systematic engagement of research bodies (such as universities, research councils, Science Shops) with civil society groups in setting research agendas.	Recommendations and Good Practice examples	https://www.livingknowledge.org/projects/perares/ [Accessed 18.11.2019]
CONSIDER project	Definitions of various stakeholders are not always easily distinguished. 'Citizens' and 'CSOs' are not always used in a consistent manner.	New options for the involvement of CSOs in research. Statistics on the role of CSOs in different phases of research projects.	To explore participatory practices that imply the view that the governance of science cannot be addressed solely by the research community and cannot be conceived apart from issues of public concern.	Key recommendations to different stakeholder groups on how to improve the involvement of civil society in research.	http://www.consider-project.eu/guidelines-landing-page [Accessed 25.11.2019]
UKCPN resource	CSOs	Tips for effective networking.	Initially or CSOs wanting to initiate own research projects. However, highly relevant for others not pursuing that opportunity.	Networking tips. Various resources :Getting started; Potential problems; Building partnerships; Principles of Practice	https://www.publicengagement.ac.uk/connect-with-others/uk-community-partner-network

PERARES – Public Engagement with Research And Research Engagement with Society (2010 - 2014).

This project aimed to strengthen public engagement in research by involving researchers and Civil Society Organisations (CSOs) in the formulation of research agendas and research process. The projects used various types of debates (or dialogues) on Science to actively articulate potential research ideas from the civil society. These were then forwarded to research institutes and results are used in the next phase of the debate. Thus, these debates move 'upstream' into agenda settings. To achieve this, partners linked existing debate formats – such as science café's, science festivals, online-forums – with the Science Shop network – that already linked

civil society and research institutes. To advance genuine mutual engagement, it is necessary to consider and implement forms cooperation between research funders, research bodies and civil society which have the potential to make a difference to research strategies and may become part of current research practices.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED

We have already highlighted a bullet point list from the PERARES-project for CSOs that want to get involved under Main resources (above). In this project one of the main advices or avenues for CSOs that want to get involved in social issues, is to initiate an application for funded of a research project that address the social issue that is on your agenda. This might look like a tall order, but definitely something that CSOs should explore. The cooperation that such making a research application would require may open for a more lasting relationship and mutual invitations to future project application processes, and making researchers aware of the skills and expertise CSOs represent.

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED

The project has focussed on CSOs rather than individual citizens.

CONSIDER project (Civil Society Organisations in Designing Research Governance) (2012-2015)

The projects analysis suggested that CSO participation in research is not an unconditional good in itself, and that in order for CSO involvement to be positive, the expected benefits for both the project, and the project partners, including CSOs, need to be more clearly defined. This can influence the choice and role of CSOs. The project found that where CSO participation is desired, funding schemes and calls should be adapted and designed in such a way that the specific characteristics of CSOs can be accommodated. Participation procedures should be simplified and administrative obstacles minimized. While the CONSIDER research has revealed substantial CSO involvement in research, their findings also suggest that most actors in research projects are not aware of options and models of such involvement. The more 'traditional' approach of engagement is the starting point that is how to engage CSOs and other professional stakeholders in your research. However, the project website offer both descriptions of various stakeholders (researchers, civil society, funders, evaluators and policy maker), but even Key recommendations to the different stakeholder groups. For civil society it is then a description of what a CSO is, why they would be interested in joining a project, and key recommendations for civil society. We presented the key recommendations that speaks directly to CSOs under Main resources (above). The project produced statistics on the state of the involvement of CSO in EU-funded research that have been presented earlier in this report. In one of the deliverables from the project (Deliverable 2.3) another view on CSOs participation in research projects was mentioned, that it would help "democratizing science", giving a say to citizens. However, they go on to emphasize that CSOs members are not lay citizens. CSOs members are usually skilled, have a curriculum and a research experience. However, the CONSIDER project were able to identify a few projects including citizens (citizen science projects, social and art sector projects).

USEFULNESS FOR CSOS WANTING TO GET INVOLVED

The CONSIDER project has dedicated resources for CSOs that aspire to get involved in research. The key recommendations appear as well argued and useful. The statistics collected on the current state of CSO involvement in EU-funded research, indicates although there is converging perceptions on the role of CSOs in many respects, there are some differing perceptions on the role of CSOs between project coordinators and the CSOs that have been involved. This concerns mainly 'Contributing expertise' and 'Initiators of the project'. The key recommendations for CSOs address these issues.

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED

The project did not address individual citizens in particular, but point to that the terms 'citizens' and 'CSOs' are often used somewhat interchangeable, and not always in a very consistent manner.

UKCPN (UK Community Partner Network). This is a network of people that are involved with CSOs, here taken to mean community-based organisations, that are interested in working with universities to address social concerns and inequalities. It was set up by two persons, one from a community-based organisation and one academic, building on theior experiences of working together in a successful way.

The network represents a way of sharing lessons on how to build and sustain partnerships between CSOs and universities. The network has developed a number of resources to help support and advice organisations to work

with universities. These resources include tips for how to prepare for working with universities, how to contact academics at universities, setting up a contract for the cooperation and troubleshooting.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED

This represent a valuable resource for CSOs, especially those that would consider seeking funding for projects with a research component. However, even for CSOs that are aspiring to get involved in research and innovation agenda setting, the website offers useful tips and hints.

Table 2: Reviewed projects with an engagement focus.

Who (project/ resource)	**Target group**	**Usefulness**	**What is the aim of the engagement process?**	**Description of toolkit/guidelines**	**Website**
SATORI project	Private and public stakeholders, including CSOs	Insights into a variety of participatory approaches	To strengthen ethical assessment and facilitate RRI	An EU framework for ethics assessment of research and innovation. Methods and success criteria for participatory workshops and exercises.	http://satoriproject.eu/the-project/
TIME for NANO-project	Young people	Limited	Engaging the public through outreach, dialogue and education	Nanokit – tangible hands-on activities on nanotechnologies.	http://www.nano2all.eu/wp-content/uploads/files/Societal%20engagement%20practices%20-%20Time%20For%20Nano.pdf
The Nanodialogues project	Citizens and policy makers	An important experimentation in trying to move public engagement 'upstream', and map public attitudes to inform policy-making	Experiment with new methods of 'upstream' public dialogue on nanotechnologies; - Inform institutional decision-making and priority-setting; - Generate intellectual and practical resources; - Identify wider lessons and insights.	The discussions showed that governance matters are interesting to the public at large.	http://www.nano2all.eu/wp-content/uploads/files/Societal%20engagement%20practices%20-%20Nanodialogues.pdf
Futurescape City Tours project	Citizens	Methods for including the less vocal	Informal conversations between citizens and policy makers, bureaucrats and researchers	A kind of walkshop in urban surroundings for deliberations on city planning and technologies surrounding everyday life.	http://www.nano2all.eu/wp-content/uploads/files/Societal%20engagement%20practices%20-%20Futurescape%20City%20Tours.pdf
NANOCUBE project	CSOs and researchers	Motivation for CSOs to reflect on here in the value chain, or what parts of the value chain does your CSO have stakes?	To provide advice towards fostering RRI in the entire product development process.	Precautionary approach and 'safe by design' principles	http://www.nano2all.eu/wp-content/uploads/files/Societal%20engagement%20practices%20-%20NANOCUBE.PDF
NanoTrust project	CSOs and policy makers	It is important for CSOs to consider the time frames and demands of process they consider participating in.	To assist policy-makers identifying issues related to the safety of various application of nanomaterials.	Dialogue on governance mechanisms for nanomaterials between various stakeholders	http://www.nano2all.eu/wp-content/uploads/files/Societal%20engagement%20practices%20-%20NanoTrust.pdf

NANOPLAT	CSO and other professional stakeholders	(1) Be specific: (2) Be political (3) Be responsible:	How to identify the needs and interest of relevant stakeholders across the value chain of consumer products.	Simple online tools for discussion between stakeholders in various geographical regions.	https://www.strategicdesignscenarios.net/nanoplat-project/
NANO2ALL Multi-stakeholder Dialogue	Citizens and CSOs	Organisation of multi-stakeholder events. Recruitment at local science centres	Deliberation of values and purposes underlying a responsible technological future for nanotechnology	A three-step dialogue methodology.	http://www.nano2all.eu/resources/nano2all-collected-practices-of-engaging-society-in-nanotechnology-development/
The NanoRESP Forum	CSOs, consumers	Engage multiple stakeholders in a discussion on concrete situations regarding nanotechnologies	To explore responsible innovation for nanotechnology-based industries	A platform for policy-making	http://www.nano2all.eu/wp-content/uploads/files/Nano2All%20-%20case%20study%20NanoRESP-final.pdf
Societal Incubator for Nanotechnologies	CSOs	To accelerate socially responsible innovation and increase the likelihood of social success.	A place for collective learning processes at which all parties involved get to know one another's opinions and motives better.	Inspired by incubators for start-ups. The design of a societal incubator. Consist of three discrete steps.	https://www.rathenau.nl/sites/default/files/2018-07/Beyond%20Public%20Acceptance_1.pdf
Waag Society Co-creation navigator	Citizens	To articulate the citizens' concerns	Co-creation. To help articulate visions, hopes, concerns	An approach of collaborative research.	https://waag.org/en/project/co-creation-navigator
UNEP: Handbook for stakeholder engagement	CSOs	For stakeholders wanting to be involved with UNEP	Mechanisms and practices for engagement in UN Environment's work.	A set of principles for engagement	https://www.unenvironment.org/resources/publication/stakeholder-engagement-handbook
BASF Dialog Forum Nano	CSOs	Bottom-up process on responsible innovation and governance of nanotechnologies	Address transparency needs by various groups. Developing shared understandings.	Dialogue events	https://www.basf.com/global/en/who-we-are/sustainability/we-produce-safely-and-efficiently/resources-and-ecosystems/nanotechnology/dialog/with-society.html
AA1000 AccountAbility Stakeholder Engagement Standard	CSOs Owners of the engagement	Mapping and identifying stakeholders	to enable organizations to respond in a comprehensive and balanced way to material issues, impacts and opportunities.	An applied global stakeholder engagement standard	https://www.accountability.org/wp-content/uploads/2016/10/AA1000SES_2015.pdf
SustainAbility and WWF	CSOs	Important for CSOs to engage with government and business.	It is intended to support those involved in sustainable food systems and diets initiatives	Research insights	https://www.wwf.org.uk/sites/default/files/2018-10/59078%20Sustainable%20food%20systems%20report%20-%20ONLINE.pdf

Fronteer	For companies that want to	Fronteer should be about empathy, inclusiveness, positivity and collaboration	Collaborations	Co-creation methodologies in the form of 5 white papers	https://fronteer.com/publications/
LivingKnowledge	CSOs Lay citizens	Empowerment of public engagement with, and participation in, all levels of the research and innovation process.	To promote an open debate of major societal challenges and knowledge exchange between civil society and research	A network of organisations to help, enable and support individuals and CSOs that need research support to pursue their non-profit interests	https://www.livingknowledge.org/
LIVINGINNOVATION	Citizens	Helping citizens to shape their future home, to become innovators, and having their voices heard	To co-create more responsible approaches to innovation	They organise co-creation workshops jointly develop solutions that simultaneously satisfy user needs, tackle societal challenges and create new business opportunities.	https://www.living-innovation.net/explore
PRISMA	CSOs	Stakeholder engagement and working towards this by defining the stakeholders, how to engage them and then act accordingly	When you want a comprehensive approach of stakeholder engagement.	RRI Tool: Stakeholder Engagement: A 5-step approach	https://www.rri-prisma.eu/
NewHORRIzon	CSOs	CSOs are invited to take part in Social Labs	Multiple stakeholders (from research, business, policy making, education and civil society) are involved in research and innovation on the project and system level to better align its processes and outcomes with the values, needs and expectations of society.	Societal Readiness (SR) Thinking Tool. This offers practical guidance on how to mature the societal readiness of research projects.	https://newhorrizon.eu/
Making Sense	Citizens	To assist local communities to make sense of their environments and address pressing environmental problems.	How, why and what motivates communities of *bottom-up citizen scientists*	An updated version of the Smart Citizen Kit (hardware). A manual on how to organise citizen sensing campaigns for positive social change	http://making-sense.eu/about/
Framing Nano	CSOs	Involving stakeholders, like CSOs, in innovative ways	To identify areas of consensus and conflicting views of the different stakeholders and to understanding existing stakeholders' positions	A Governance platform for the responsible development of nanotechnologies	https://www.framingnano.eu/
NanoCode	CSOs	Identifying and consulting with stakeholders	The engagement of stakeholders in the debate will help to increase awareness on the CoC (Code of Conduct for responsible N&N research) and in shaping its content to the stakeholders' needs and expectations, making it a more accepted, concrete and	A tool for the assessment of performances for the application of the CoC ("CodeMeter")	https://cordis.europa.eu/project/rcn/92804/factsheet/en

			practical instrument for decision-making in N&N R&D		
NanoEthics 2011	CSOs citizens	Organization of a conference entitled 'Governance and ethics of nanosciences and nanotechnologies', with active participation of several stakeholders, including CSOs and the general public	Raising awareness of CSOs and citizen (and others) on both the Code of Conduct for responsible N&N research and other initiatives in governance and ethics for this research. To map and present various stakeholders' opinions on this.	A final conference attended by various groups, including CSOs and the general public.	https://cordis.europa.eu/project/rcn/98076/reporting/en

The SATORI project (Stakeholders acting Together on the ethical impact assessment of Research and innovation). This project is often credited for coming up with the term "Mutual learning and Mobilisation", or MML. The project engaged private and public stakeholders from Europe and beyond in an intensive process of research and dialogue. The project's framework is a tool to strengthen ethics assessments overall, and facilitate responsible research and innovation. The project did substantial analytical work on the landscape of MML-projects as well as authoring a report on theories of learning to develop criteria for evaluating mutual learning.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED

Although the project focuses on engagement like many other projects, its emphasise on mutual learning stresses the point that all parties in projects must be ready and open to learn and listen. This would involve genuine exchange between stakeholders and scientists and the creation of new knowledge. The project also came up with lists for researchers on what to think of when defining participants that should be invited to co-creation sessions/meetings. One interesting and intriguing point was "Who will insist on being involved and cannot be excluded?", but even question on "Who will be affected by the issue now – and in the future?", can give some inspiration on how to think and argue when making contact with researchers or research institutions.

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED

It should be noted that the project did not engage with the general public, only with professional stakeholders - including CSOs.

Nano2All (Nanotechnology Mutual Learning Action Plan for Transparent and responsible Understanding of Science and Technology) (2015-2019). The Nano2all-project aimed at enhancing RRI practice in nanotechnologies through a participatory approach based on dialogue with citizens and relevant stakeholders. Based on a review of previous dialogue projects related to nanotechnology, the project identified best practices, tools and guidelines. It is this resource we have concentrated on in this review. It included a number of projects, and we will just highlight certain, relevant issues from each in the following:

Tools to increase mass engagement for Nanotechnology – TIME for NANO (2009-2011).

This was more of a traditional type as we understand it in our context, with its focus on engaging the public through outreach, dialogue and education. So, even in dialogue, terms like "fully engage" were used. This implies that it was the project that actively went out to an un-engaged audience, here: young people, rather than an engaged audience wanting to come in contact with the project. One thing that was deemed as successful from the project, was the so-called nanokit, where ten hands-on activities where included, together with actual nanomaterials. In summarising their appraisal the author of the review concluded that engaging society is a slow and difficult process and will requires time.

USEFULNESS FOR BOTH CITIZENS AND CSOS WANTING TO GET INVOLVED:

Limited. A 'paradox' is that such events though the engagement of the public, could raise the publics' awareness of issues related to nanotechnology, that potentially (hypothetically) would spur a desire to get more involved. So, through traditional engagement (pull), participants could become motivated for further exploration of the issue, up to the point that they want to get involved or even initiate in new research and agendasetting exercise. However, this is somewhat beside the points we are addressing here.

The Nanodialogues project - Nanodialogue on land remediation using nano-particles (British project by DEMOS 2006-2007)

The participants had been recruited by people that had previously expressed their interest in dialogue exercises and were paid for their time, but didn't know the topic or nature of the activity before the first meeting itself. Then followed an advice that alludes to how important facilitation is when inviting the public to engage. Expert advice was delivered in a conversational style, with participants being encouraged to challenge expertise, explore issues of uncertainty and identify topics of importance. This allowed their own social knowledge to be incorporated in the discussion. The fact that organisers were open to side discussions on participant interests' such as health and safety and trust in the government also contributed to an open and engaged process.

USEFULNESS FOR BOTH CITIZENS AND CSOS WANTING TO GET INVOLVED:

Be open and transparent about what you as a CSO or even a citizen know of the subject matter, and what you do not know and would like to learn more about.

Futurescape City Tours (FCT),

FCT a societal engagement practice developed by the Center for Nanotechnology in Society (CNS) at Arizona State University (ASU). The FutureCityTours themselves are a kind of walkshops, but in urban surrounding and involving citizens and open the possibilities for informal conversations with city planners, policymakers, researchers, and civic leaders and deliberate on the future of their cities or communities, revealing the role of technology in our everyday life. Moreover, in its choice of methods, modes of interaction, and facilitation, an FCT aims to be truly accessible and inclusive, to cater to those who are less vocal and articulate among the general public (and who get left out from more traditional approaches to public engagement such as focus group hearings, citizen juries or consensus conferences). In the case of the FCTs, the use of photography opens up new possibilities for reflection and communicating across language and knowledge barriers. Expectation of the project's or initiatives impact on policy making should be managed and be an explicit point on the agenda so as to avoid creating frustrations.

USEFULNESS FOR BOTH CITIZENS AND CSOS WANTING TO GET INVOLVED:

There are various ways on which one can participate and come up with inputs and reflections in a project. Here they used photography.

NANOCUBE is a project which was coordinated by the companies ARCHA and TECHA for the development of dermo-cosmetics and biomedical applications based on the use of nanomaterials. The H2020 RRI-PRISMA project supported ARCHA and TECHA to integrate principles of RRI in the development of NANOCUBE. The role of PRISMA was to provide advice towards fostering RRI in the entire product development process, ensuring in particular that the precautionary approach and the principle of "safe by design" are applied. The participants in the event were around 20 and were representing the entire value chain. But it does not appear that citizens were involved.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:

Where in the value chain, or what parts of the value chain does your CSO have stakes? Can a value chain perspective be a useful lens for the issues the CSO want to address? This could be a valuable and important reflection if you want to get involved in projects with industry.

NanoTrust was a Technology Assessment project carried out by the Institute of Technology Assessment of the Austrian Academy of Sciences. It was developed to assist policy-makers identifying issues related to the safety of various application of nanomaterials. The project aimed to support and maintain a governance framework to address identified research and regulatory deficits and to provide reliable information on these issues. Workshops consisting of stakeholders from different organisations were open to all that were interested. They were supposed to have regular meeting over a year, but the initially good turnout of NGOs (CSOs) declined. The reasons for their withdrawal were assumed to be that 1) meetings were considered to be too resource-

demanding for a longer-term commitment; 2) a fear of the NGOs/CSOs to be co-opted or assimilated in a network serving the public administration. The various dialogue initiatives over the project period presupposed voluntary participation. This could be a challenge for citizens or NGOs/CSOs that have limited resources to support a presence over longer time frames.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
As we can see for the summary, many CSOs withdrew from the project. From this it appears that it is important to query the project coordinator of a project your CSO wants to get involved in on time frames and the expected level of engagement.
USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED:
Citizens were not explicitly addressed in this project

NANOPLAT (Development of a Platform for Deliberative Processes on Nanotechnology in the European Consumer Market) (2008-2009). The NANOPLAT project developed a case for a more permanent form of deliberation to be necessary for enabling an ongoing process of collective responsibility. NANOPLAT developed a web-tool platform for stakeholders to exchange opinions and offer expertise on the ethical foundations of nanotechnologies and how they impact society. The project identified the needs and interest of relevant stakeholders across the value chain of consumer products. The simple online tools developed by NANOPLAT facilitated the discussion between remote stakeholders involved in the same nanotech sector, representing production, consumption and governance. The pilot experiment was too short to draw any in-depth conclusions, but it is clear from the experiment that an online deliberation platform was a promising tool for promoting a regular dialogue between various players on the European nanoscience and nanotechnology scene. The deliberative processes represent a democratisation of science, and as long as we distinguish between the public discourses and formal decision-making process, deliberation does not represent a threat to the numerical democracy. Before starting a deliberative process, it important to clarify the following questions: (1) Be specific: Choose relevant technology and possible specific applications; (2) Be political: Link the deliberation to the decision-making processes; (3) Be responsible: Choose an independent institution to run the process.

USEFULNESS FOR BOTH CITIZENS AND CSOS WANTING TO GET INVOLVED:
More discussions and deliberations are now taking place online that at the time of this particular project. This can be an effective way of getting your place at the table, and it is often a lower threshold to join than face-to-face meetings. Check the webpages of your local university/university college if any such events are planned. However, despite the obvious positive effect of being an effective way to talk and 'meet' online, it may also well be that it can be even more time consuming than regular meetings.

NANO2ALL Multi-stakeholder Dialogue organised at national and European level. The project used a three-step dialogue methodology: 1) National citizen dialogues, 2) National multi-stakeholder dialogues in six European countries, and 3) the organization of a final European stakeholder dialogue event. The dialogues took place between 2017 and 2019. Each new dialogue phase built on the prior one, i.e. the outcomes of citizen dialogues served as input for the national multi-stakeholder dialogues, and the outcomes of the national stakeholder dialogues served as input for the European dialogue event. The national multi-stakeholder dialogues were conducted as a 7-hour event with approximately 15 participants from six different countries. The six National Multi-stakeholder Dialogues (with representatives from policy, media, industry, civil society and others) aimed to explore both the dynamics of change, as well as future options and challenges. The participants were recruited at local science centres. They also hosted the dialogue sessions. A guideline was provided on what types of stakeholder groups should ideally be included in the dialogue process. The NANO2ALL project carefully selected relevant stakeholders for the European Dialogue event. At the end, 29 participants attended the dialogue including Nanoscientists, Policy-makers, Industry, CSOs, Intermediaries (including media, RRI experts, ethicists and social scientists) as well as national dialogue participants. Gender balance was also considered when selecting the dialogue participants. At the discussion, the participants consisted of 15 men and 14 women. Over the citizens' dialogues the participants explored and constructed possible scenarios of the future development of nanotechnology. Then the participants identified common concerns, values and needs regarding the future development of nanotechnology. In the first half of the national stakeholder workshops participants reviewed the future scenarios from the citizen dialogues, and in the latter part of the day participatory back-casting was used to explore desirable developments of nanotechnologies. The European multi-stakeholders dialogues built on the outcomes and lessons learned from the previous dialogues.

For the selection of stakeholder participants the project wanted to look for people who worked at an "intermediate" level in their organization. That is a stakeholder should not be too high up in order to ensure that the participant actually has some room for manoeuvres, but at the same time make sure that the stakeholder does have a sufficient level of influence to instil change.

USEFULNESS FOR BOTH CITIZENS AND CSOS WANTING TO GET INVOLVED:
Local science centres are often involved or contacted by researchers to recruit participants for various projects. Getting in contact with your nearest science center could be a great place to start if you want to get involved. Science centre often have their own recruitment strategy, using communication channels such as information posters, newsletters, informal and social networks, websites, press releases, direct emails, and local science festivals.

The NanoRESP Forum, a multi-actor dialogue forum fostering practices of responsible innovation.

The forum was created in France in 2013 inspired by the CNAM Nanoforum initiative. NanoRESP is originally a citizen initiative (by having been launched by an NGO), and further encouraged by public authorities and being such, it created the right dynamics to foster a democratic dialogue and at the same time, to empower participants to exercise their respective responsibilities. Already from the start, the NanoRESP Forum was aimed at contributing to a shared social vigilance and an exchange of experience, being less of a public debate and more of a stakeholders' dialogue to encourage RRI in the nanotechnologies. There was a low attendance by civil society. This was explained to be due to the complexity of the topics that were debated. Still, the forum was considered as a success due to the number of different stakeholders (from: industry, academia, civil society organisations, producers and consumers) that participated in mutual respect and in a transparent, democratic and socially inclusive framework. Not all the participating stakeholders share the same goals and interests. However, they discover that there are lessons to be learned through the exchange of experience with stakeholders they would hardly would have met, without the forum's platform.

The efforts to regulate nanotechnologies have created a space for learning. The project observed that the way we operate within uncertainty imply we may have to re-evaluate our methods: For example broad public debates can have a rather polarizing effect and thus, may no longer be suitable for addressing this kind of issues. Bilateral arrangements – such as a consultancy firm appointed by a company of the industrial sector to provide answers to questionings/issues on nano – are not pertinent either.
The project concludes that a more functional way to address RRI probably is to engage multiple stakeholders in a discussion on specific situations regarding nanotechnologies (or any emerging technology). Stakeholders should be guided to substantially consider their practices regarding nano and to examine different alternatives by focusing on real, existing cases derived from industry or the society.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
There may be national differences in how debates between stakeholders on nanotech unfold. If the topics appears as too complex, you may point out that framing complex matters in a more easy to understand language will increase transparency which would be good or even necessary when/if the product in question move towards the market. In a multi-stakeholder setting you can also be pretty sure that you are not the only one that struggle to understand complex or opaque aspects.

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED:
Multi-stakeholder dialogue may most often envisage CSOs as participants, rather than individual citizens, but not exclusively. There may be national differences in how debates between stakeholders on nanotech unfold. If the topics appears as too complex, you may point out that framing complex matters in a more easy to understand language will increase transparency which would be good or even necessary when/if the product in question move towards the market. In a multi-stakeholder setting you can also be pretty sure that you are not the only one that struggle to understand complex or opaque aspects.

Societal Incubator for Nanotechnologies initiative of the Rathenau Instituut

A "societal incubator" could contribute to embedding promising new technologies within society. A societal incubator is a gathering place for collective learning processes at which all parties involved get to know one another's opinions and motives better. It involves more than just looking for public acceptance. For example, a societal incubator challenges technology developers to show how innovation can contribute to solving

important societal challenges. In that sense, it can be viewed as an example of responsible research and innovation.

The societal incubator can serve two different but related purposes. It serves the interest of innovators who have an idea of a particular innovation and recognise the surrounding uncertainties that may negatively influence its societal acceptance. On the other hand, the societal incubator may also offer a particular opportunity to bring together different stakeholders around specific issues such as societal matters, environmental problems, health issues, etc related to nanotechnology in a broader context rather than with a focus on a particular innovation.

The societal incubator, which is inspired by the notion of incubators for instance for start-ups, consist of three steps: Step I – Information and Interaction: The aim here is to build on the knowledge and perspectives of as many stakeholders as possible that are relevant to the innovation concerned. Step II – Analysis: The learning process that has been initiated in Step I , creates scope for other stakeholders, playing a critical intermediary role, to contribute to the innovation process and to breaking free from waiting games. An analysis of this process will written up in a report, that sums up the results of the process and are made available to all participants in the societal incubator process. Step III – Continue or halt: Based on the outcomes of the two previous steps, the technology developer do now have in her hands a more effective and solid analysis to decide whether to continue with her innovation process, with increased possibilities for a socially robust solution/product. An additional possibility is that it now will become clearer to the innovator what stakeholders that are crucial in the continued process. Alternatively, the technology developer can choose to halt development of the product. In that case, a timely and informed decision can be made by the technology developer that can minimise potential (financial) damage.

USEFULNESS FOR CITIZENS AND CSOS WANTING TO GET INVOLVED:
There are currently many different types of initiatives that you can get involved with. What kind of interactions and with what kind of actors do you want to interact with?

Waag Society Co-creation navigator

Waag operates at the intersection of science, technology and the arts. Their work focuses on emergent technologies as instruments of social change, and their work is guided by the values of fairness, openness and inclusivity. Waag has a team of around sixty thinkers and makers that dedicate their time to empower people to become active citizens through technology. The activities of Waag are supported by the Creative Industries Fund NL and the Amsterdam Fund for the Arts (AFK). Waag is a non-profit foundation.

Individuals are welcome to participate in their events and activities and meet their staff. Whatever role or competence you have (for instance scientist, hacker, designers or citizen with interest in environmental issues), you may join them. All skills levels are welcomed. In each case, it is not the matters of fact of scientists, nor the matters of interest of industry, but rather the matters of concern of citizens that are articulated through their approach of collaborative research. This is based on co-creation by which they understand values-based, inclusive approach that focuses on bringing together different societal actors around matters of shared concern. As a generative method co-creation are understood to allow for more latent knowledge to emerge: visions and hopes or dreams that don't have the right words yet, but are fundamental to understanding the context of a potential intervention and do justice to lives and experiences of those involved.

USEFULNESS FOR CITIZENS AND CSOS WANTING TO GET INVOLVED:
This particular institution is based in the Netherlands, but such ideas appear to spread around Europe. This line of thinking with concepts like empowerment and co-creation is high on the agenda. Further does this imply that societal consultants, like Waag Society, are open and interested to get in touch with both citizens and participants from CSOs to run projects on empowerment and co-creation. Check out of there are similar consultants with this focus in your city.

UNEP: Handbook for stakeholder engagement (2018)

This is a 57-page booklet produced by UNEPs Civil Society Unit, aiming to inform and guide what they call “Major Groups” and stakeholders about UNs rules, mechanisms and practices for engagement in UN Environment’s work. Handbook is in PDF format, accessible on UNEPs homepage. It presents a set of principles for engagement,

like access to information, transparency and accountability for mutual trust and benefit, respect for diversity of views etc.

UN Environment operates with nine stakeholder categories, represented by not for profit, non- governmental organizations: Farmers, Women, the Scientific and technological community, Children and Youth, Indigenous Peoples and their Communities, workers and Trade Unions, Business and Industry, Non-governmental organizations and Local Authorities. Most of the text is about formal rules for engagement, like accreditation, how to participate in UN Agenda-Setting and Decision-making processes, different kinds of committees, code of conduct for participation, funding and the like.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
The target group is stakeholders wanting to be involved with UNEP. The relevance for publics and stakeholders/groups wanting to be involved with nanotechnology appears to be very limited, except perhaps for the general emphasis on the desirability of a broader engagement in environmental (and possibly also nanotechnological) issues. The listing of major groups/stakeholders might be interesting

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED
There seems to be limited relevance for individual citizens in this resource

BASF Dialog Forum Nano 2014/2015 (2016)

Dialog Forum Nano of BASF assessed various European tools and registers, mainly "in terms of how they address the transparency needs of three target groups: public authorities, consumers and workplaces. Information is provided through a 30-page PDF, accessible on BASFs homepage.

Dialog Forum is a continuous stakeholder dialogue on nanotechnologies, initiated by BASF SE. Representatives of environmental and consumer groups, research organizations, trade unions, public authorities and of BASF SE discuss political and societal issues related to nanotechnologies and try to develop shared conclusions and recommendations. Guest speakers are invited to provide further expert information and to discuss the latest developments.

It was designed as a bottom-up process around the issue of responsible innovation and governance of nanotechnologies. After the participants had been asked to state their priorities for the dialogue, and the group developed its own working agenda during the first dialogue event. The participants identified key issues and questions that could be clustered around three areas: Transparency, responsibility and dealing with uncertainty. In five dialogue events Dialog Forum discussed instruments whose common aim is to improve transparency on nano materials, but which differ significantly in terms of their thematic focus, scope and legal basis. Conclusions were organized along the following key issues and questions:
Easy Access to Information for all relevant stakeholders: Regulators, Researchers, Workers, Consumers, Companies, along the supply chain. What kinds of information is needed by different stakeholders? What kind of information is/should be available? How to deal with uncertainty?

Easy access means different things to different stakeholders. Participation & Involvement, Dialogue & Discussion: External stakeholder dialogue, special dialogues such as social dialogue, internal dialogues. Are stakeholder groups as much involved as they want/should? How to create inclusive, constructive and effective participatory processes. How to ensure that the dialogue is translated into practices? Confidentiality: How to ensure transparency and confidentiality at the same time?

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
Dialog Forum appears to be a well-organized and resourceful event, engaging a core group of between 15 and 20, the same number of "other participants" + 7 guest speakers. Results are interesting, but what target group it aims at is rather unclear.

It looks as if stakeholders/participants were invited into an event organized and financed by a major German business.

There is much to learn about the topic(s), but there is no information on how to engage with nano technology for stakeholders, CSOs or citizens, this, in addition to it being an initiative that is over, reduces its usefulness.

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED
No relevance

AA1000 AccountAbility Stakeholder Engagement Standard (2015)

The most widely applied global stakeholder engagement standard, supporting organizations to assess, design, implement and communicate an integrated approach to stakeholder engagement. A 40 page PDF, downloadable from the AccountAbility homepage.

The Standard has been designed to enable organizations to respond in a comprehensive and balanced way to material issues, impacts and opportunities. It emphasizes that stakeholder engagement must result in outcomes valued by those involved and must be communicated in a credible way.

Having profiled the stakeholders, the owners of the engagement should map them to determine which groups and individual representatives are most important to engage with in relation to the purpose and scope of the engagement. Mapping can be based on any of the criteria used to characterize the stakeholders. The owners of the engagement are able to map the stakeholders in any number of ways and may wish to use several maps to gain better insight. For example, the owners of the engagement may wish to map the stakeholders' level of influence against its willingness to engage, type of stakeholder against level of influence, or capacity to engage and knowledge of issues against expectations.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
It is interesting to know about the existence of a stakeholder engagement standard, even if this mainly is a tool for the target group "owners of the engagement". The standard might contribute to a professionalization of the CSOs, influencing their ways to operate.

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED:
No relevance

SustainAbility and WWF (2018): How Do You Engage to Support Sustainable Food Systems? Sustainable Food Systems and Diets: A Review of Multi-Stakeholder Initiatives. (SustainAbility and WWF)

The report distils research insights and is intended to support those involved in sustainable food systems and diets initiatives to understand the global landscape, identify gaps and maximize impact. It seeks to answer questions like: In what geographies and on what issues are initiatives aiming to improve the sustainability of food systems? What are the gaps, needs and opportunities to scale and accelerate sustainable food system initiatives? How can organizations best engage to support sustainable food systems?

The last question seems to move the perspective from pull to push.
In order to drive change, it is particularly important that initiatives engage with governments and the business sector. This is particularly critical to influence behaviors at a population level. The agile nature of the corporate sector means that businesses are particularly effective agents of change and increasing business engagement to do more to lead and drive initiatives, rather than just supporting them, will be important to accelerating the pace of change.

To maximize the impact of initiatives it is helpful to understand how they relate to food system challenges and identify opportunities to collaborate to effect change at a systemic level. This might include building alignment or collaborations between initiatives targeting different parts of the value chain to increase impact.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
The focus here is on food and not on nano. However, the stakeholder approach may be generalized to a certain extent. The advice; engage with government and business and try to understand how your initiatives relate to the system at large, and identify opportunities for collaboration, does not give much more than what is now considered common sense, however.

But at least, or at last, the target group seems to partly be the stakeholder.

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED:
No relevance

Fronteer

This is an Amsterdam based business that promotes innovation strategies and co-creation. Their homepage is basically an advertisement for Fronteer's services and approaches. They sell themselves through slogans like: "We apply collaborative innovation to accelerate innovation and strategy. Unique to our approach: Expert co-creation", and "When you're in the business of innovation, being up to date with what's happening in the world is absolutely key. In order to help our clients with the best innovations and strategies, we spend a serious amount of time deep diving into new trends, developments and innovations to get a grip on where things are headed".

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
Even if Go Nano is advocating RRI and collaborative innovation, the Fronteer's home page does not offers much meaningful advice for stakeholder groups trying to engage with nanotechnology development.
The target group seems to be businesses seeking organizational transformation and capacity building.

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED:
No apparent relevance

Living Knowledge. The International Science Shop Network

"The Living Knowledge Network is composed of persons active in - or supportive of - Science Shops and Community Based Research. Living Knowledge aims to foster public engagement with, and participation in, all levels of the research and innovation process.

We facilitate cooperation with Civil Society Organizations (CSOs) to generate research ideas, questions and agendas. We perform research in response to these questions, either ourselves or with the assistance of others, notably higher education students. Our goal is to co-create research to find solutions and therefore make a positive impact on real world problems."

From the Network homepage
""Living Knowledge" is the network of (persons or organizations involved in) Science Shops and similar organizations active in public engagement and involvement of Civil Society Organizations (CSOs) in Research & Innovation (R&I), and those who support those activities.

A 'Science Shop' is an entity that provides independent, participatory research support in response to concerns expressed by civil society. The use of the term 'science' here is in its broadest sense, incorporating social and human sciences, as well as natural, physical, engineering and technical sciences.

The Living Knowledge Network - with its persons or organizations involved - pursues the idea of public engagement with, and participation in, all levels of the research and innovation process: participation of citizens and/or CSOs in generating research ideas, questions, and agendas; participation in monitoring, steering, advising on or performing research; in data collection, data analysis or scenario development; and the co-creation of knowledge with the aim of contributing to social change.
Living Knowledge promotes an open dialogue and debate between science and civil society: It provides scientific knowledge for citizens in an open, action-oriented and participatory way. It brings civil society issues and interests to the scientific discussion. It promotes the co-creation of knowledge among Civil Society Organizations and researchers

Its objectives are to promote the open debate of major societal challenges and knowledge exchange between civil society and research, to promote public understanding of science and technology and, likewise, promote the understanding of the public by those in research and innovation, to facilitate co-operation among Science Shops, universities, community-based research organizations and related institutions in Europe and worldwide, and civil society and its organizations, to promote co-operation between experts and to strengthen existing expertise and interest in developing participatory research activities, to promote responsible research and

innovation among researchers and in institutions of higher education and research, to be the European contact for institutions and organizations that wish to act in the field of Public Engagement in Research, particularly by setting up international projects" (From information PDF, accessible from network homepage).

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
The Living Knowledge Network prioritize active collaboration with civil society organizations. It helps individuals and CSOs that need research support to pursue their non-profit interests. One aim is to enable citizens to articulate and represent their interests and needs and making research findings accessible to the public through information and education and to support its members by facilitating the exchange of information and providing mentoring, mediation and coaching. This means that the Network seems to be a potentially useful resource for stakeholders trying to engage in scientific and technological development. It is helpful to the degree that they accomplish the aim to be the European contact for institutions and organizations that wish to act in the field of Public Engagement in Research

The target group(s) are CSOs and "lay" citizens

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED:
When one aim is to enable citizens to articulate and represent their interests and needs and making research findings accessible to the public through information and education, and with lay citizens being in the target group, The Living Knowledge Network at least offers an opportunity to be a resource for citizen-consumers wanting to engage in nanotechnology development.

LIVING INNOVATION

Living Innovation is an initiative started by 14 European partners, including industry, civil society and research organizations. Its aim is to co-create more responsible approaches to innovation in the areas of smart homes and smart health. The "selling points" directed at citizens are: "Shape your future home, become an innovator and have your voice heard".

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
The initiative is probably a useful resource for business, governments and citizens engaging in smart homes. It is, however, not obvious that their approach to stakeholder engagement is original or transferable to our focus or methods. Nanotechnology might be a part of smart home solutions.
The target group seems to be companies, policy makers and citizens interested in smart home technology and development.

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED:
At least, living innovation reaches out to citizen-consumers, through their slogan 'Shape your future home', and individual citizens are targeted.

PRISMA

Prisma is another project arguing for the implementation of RRI; actually PRISMA is an acronym for Piloting Responsible Research & Innovation in Industry. The main focus is the integration of Responsible Research & Innovation (RRI) in the Corporate Social Responsibility (CSR) policies of 8 companies. They have some principles for stakeholder involvement "One of the main tasks of the project is to develop and carry out stakeholder dialogues with actors from areas that are important and influential for RRI. Stakeholder engagement and participation are essential in shaping technologies according to societal demands 'as an attempt to implement or step toward democratic governance of technology policy' (Hennen 2012: 30). One of the assumptions of RRI is that 'if technology could be designed according to social values […] problems of rejection or conflict would no longer occur at all' (Grunwald 2011: 14). Therefore, stakeholder dialogues are key to the PRISMA project. The engagement of the various stakeholders is not only important for the development of robust RRI methods and tools, but also for ensuring the exchange of best practices and further development of the foundation of RRI. This poses an essential step in reforming the research and innovation systems in Europe (objective of Innovation Union).

During the project, a total of five stakeholder dialogues will be organized, focusing different transformative technologies, and promoting the involvement of different stakeholders" (Report D 4.1).

The themes of the five stakeholder dialogues were the following: 'The future of technology: putting responsible innovation into practice', 'Setting the agenda of RRI in industry' (held twice), 'Envisioning the future of transformative technologies', 'Stakeholder Dialogue Case studies on automated vehicles and Internet of Things', and 'A roadmap to foster social value in business, research and innovation strategies'.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
Prisma appears to be a well-organized and interesting RRI project with an interesting take on CSR and stakeholder involvement. Even its relevance for the Go Nano mapping of online resources is weak and a bit unclear, it is demonstrating a possible "benchmark" for involvement of stakeholders in emerging technologies. In addition it works as a knowledge base and as an inventory of examples of RRI relevance

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED:
No relevance

NewHoRRIzon

Notice the 'RRI' emphasized in the project title. 1 grassroot organization and 1 NGO are members of the consortium The NewHoRRIzon project runs 19 Social Labs. Each Social Lab focuses on a different theme of H2020, for example, Future and Emerging Technologies (FET), Leadership in Enabling and Industrial Technologies (LEIT) and Smart, green, and integrated transport (TPT).
A Social Lab is a container of social experiments for addressing complex ground-breaking social challenges on a systemic level. In this project these are social challenges related to Responsible Research and Innovation (RRI) within the frame of Horizon 2020 (H2020) and beyond. "Stakeholders are societal actors that are involved in or are impacted by the R&I process addressed by the Social Lab. Their stake in the R&I process may be having a legitimate interest, a valuable resource, a risk to tackle or the combination thereof".

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
Again, we feel that this is more a case of stakeholders being valuable for projects, rather than projects being valuable for stakeholders. We do not know it the order of things might be changed, into one where stakeholders actively seek to be involved in a social lab

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED:
No relevance

Making Sense

Making Sense is an international project funded by the European Commission within the H2020 Call ICT2015 Research and Innovation, specifically under the *CAPS "Collective Awareness Platforms for Sustainability and Social Innovation"* programme (grant number 688620). The project was designed to show how open source software, open-source hardware, digital maker practices and open-source design could be used effectively by local communities to appropriate their own sensing tools to make sense of their environments and address pressing environmental problems. So, the project title is a wordplay on sense, in the common sense meaning, and "sensory", applying sensors to monitor local conditions. Based on nine pilots, Making Sense developed a toolkit for participatory sensing aimed at deepening the understanding of the processes which might enable collective awareness.

Even if the focus is on general environmental problems, and not on nano technologies, the toolkit for citizens approach might be a useful way of empowering citizens, by giving access to locally produced, relevant information. Urban participatory sensing become a more established pathway for citizens and communities to produce and interpret data themselves from air quality outdoor and indoor, odour nuisance to noise and water pollution. And the current DIY/DIT developments of low cost and open source sensing technologies are increasingly helping the support and enablement of such citizen and community-led interventions in environmental monitoring.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
This seems to be directed primarily at citizens, but that these tools and methods might be employed by local environmentally concerned CSOs as well.

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED:
Even if the use of sensors is not directly transferable to engagement in nanotechnology, the basic approach; to provide DIY tools to citizens seems very fruitful. It is the kind of resources that we can imagine citizens will be looking for when they seek to engage in controversial questions of emerging technologies. It might be a useful way of empowering citizens, but, like Citizen Sense (below) it probably suffers from a lack of relevant "nanosensors".

Framing Nano

The Framing Nano project was a EU FP7 project, led by GoNano partners AIRI.
The aim was to allow stakeholders in nanotechnology "to engage in an ongoing dialogue about the governance of nanotechnology development". It focused on risks, concerns, EHS (environment, health and safety) and ELSI (ethical, legal and societal implications). The project collected and analyzed the positions and need of stakeholders through Delphi exercises and an international workshop.
By analyzing present regulatory processes, contemporary governance etc., by consultation with all relevant stakeholders, Framing Nano worked to identify areas of consensus and conflicting views of the different stakeholders and to understanding existing stakeholders' positions.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
Framing Nano appears to be an impressing project, involving stakeholders in innovative ways. Analyzing and understanding stakeholders' positions at the start of an engagement process is obviously fruitful. For our present concerns, however, usefulness is reduced somewhat, since the perspective is that of the scientist/project trying to expand out into the "world" by engaging stakeholders, and not the other way.

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED:
No relevance

Nanocode

Nanocode is another EU FP7 project. Its stated aim was to provide stakeholder input into the implementation of the European Code of Conduct (CoC) for responsible nanoscience and nanotechnology research. It was designed as a multi stakeholder dialogue, after identifying approximately 400 stakeholders in the nanotechnology community worldwide. The stakeholder consultations were conducted through a series of methods, like an electronic survey, focus groups and structured interviews.
The project aimed at focusing on co-creation from the scientists' perspective.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
With its strong focus on the CoC, not the least on input to its implementation, the relevance of Nanocode for our purpose (online guides for eager stakeholders) appears to be rather limited. Stakeholders, however, might need to become aware of the existence of a CoC when they want to engage. And even at this, rather advanced level, Nanocode insists that it is important to avoid formal and difficult language, in order to facilitate an effective information flow and discussion.

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED:
No relevance

Nanoethics 2011

A rather small project, running from January 2011 to the end of February 2012, funded under EU FP 7-SIS and led by Polska Akademia Nauk.
The project objective was awareness raising among policy makers, experts, scientists, industry, third sector and citizens about the Code of Conduct. The chief tool was a conference in Warsaw on October 2011 on "Governance and ethics of nanoscience and nanotechnologies".
"The conference was held as an event included in the official calendar of the Polish Presidency of the EU Council, under the patronages granted by the Polish Minister of Science and Higher Education and the President of the Polish Academy of Sciences. The conference primary aimed at providing an overview of main issues concerning governance and ethics of nanoscience and nanotechnologies (N&N)".

The conference was attended by 120 participants from countries all over the world, representing various groups of stakeholders, including representatives of the European Commission, NGOs, policy makers from the EU Member States, scientists, experts, entrepreneurs, and the general public.

The 2-day event was divided into four sessions. The first one constituted an introduction to nanoscience and nanotechnologies, discussing their cross-disciplinary nature, tangible current and possible future applications and directions of development, and covering the general overview of the complexity of issues connected with this emerging field. The second one provided an overview of the current regulatory framework regarding nanoscale materials and technologies, forming the basis for discussions on further steps required and recommendations to be taken into account in order to achieve comprehensive and encompassing regulations to govern this demanding field. The third session focused on delivering a broader context to the conference subject matter fostering the confrontation of opinions of stakeholders coming from various backgrounds by involving them, apart from standard presentations, in a roundtable discussion. The last, fourth session was devoted specifically to the Code of Conduct for responsible nanoscience and nanotechnologies research as a non-regulatory tool enabling to address N&N governance also from an ambiguous, ethical perspective.

The conference helped to summarize current developments relating to the vast, emerging field of nanoscience and nanotechnologies, providing all stakeholders with an opportunity to share their standpoints, identifying hopes and fears connected with the field, as well as discussing problems absolutely needing to be resolved as soon as possible and specific challenges faced by regulators. In particular, the necessity to involve public dialogue and ethics in policy making was emphasized".
NANOETHICS 2011 engaged relevant stakeholders and citizens in dialogue in order to tackle N&N challenges. Realizing the full potential of R&D for N&N will help achieve sustainable growth, boost European competitiveness, create jobs, protect the environment and enhance quality of life.

USEFULNESS FOR CSOS WANTING TO GET INVOLVED:
The project claims that its website became "a valuable tool for promotion of knowledge about the governance and ethical aspects of nano sciences and nanotechnologies, as, since its launching on it has been visited more than 10,000 times". This might be one of the types of online resources that stakeholders who want to engage might look for, but there are quite a few of such websites and we have not evaluated their quality versus this one.

USEFULNESS FOR CITIZENS WANTING TO GET INVOLVED:
A possible educational relevance if citizens seek to engage, but we have not been able to compare the quality of the different online resources.

Analysis of the findings and insights from the project reviews

The resources (projects) have been valued as knowledge bases, as resources with suggestions for actions, plus as background knowledge of the subject matter. Based on the reviews of our selection of projects, we find a number of interesting and useful insights on how citizens and CSOs that want to get involved in research projects and agenda-setting may approach that task. Three resources from the PERARES project, the UKCPN-initiative and the consider project are listed earlier in this report, under 'Main resources'. These appear to potentially be very valuable first and foremost to CSOs. However, as we emphasised under that heading, parts of these resources are valuable even for individual citizens.

A striking feature from these projects is that there is much more available advice and more guidelines for CSOs than there is for individual citizens. This could be the result of an assumption that CSOs are representatives of individual citizens, and that interested individuals would join a CSO that is involved in the issues they are about. That citizens mainly express their concerns through CSOs. However, we did find some examples of projects that were more oriented towards individual citizens:

The main advice is to get in contact with your local science centre and to subscribe to newsletters and attend meetings there. This represents a good opportunity to establish contact with projects that could be interested in citizen participation. Ref "Useful resources identified for CSOs and citizens" above.
Then there are some tools or guidelines that could be relevant for both CSOs and citizens: That they should be open and transparent about what they as CSOs know of the subject matter, and what they would like to learn more about. The basis of co-creation and involvement is the ability to being open to other perspectives, to be willing to learn and listen. This goes for CSOs and citizens as well.

There are currently many different types of initiatives that civil society, as organisations or individuals can get involved with. What kind of interactions are interesting, and with what kind of actors does the CSO want to interact? In projects initiated by industry, there is often a value chain perspective. This implies that CSOs should reflect on where in a value chain they have stakes and might contribute.

There exist a number of ways that CSOs or citizens can come with inputs and reflections for a project. For less tangible issues that can be hard to articulate, one could use photography. This can assist in empowering CSOs or individuals to imagine what role they could play in a project, and possibly lower the threshold in the instant where one may be reluctant to speak to professional stakeholder.

More discussions and deliberations are now taking place online. This could be an effective way of getting involved in a project, and for CSOs or individual citizens to get their 'place at the table'.

Concepts like co-creation and inclusivity are used by more and more actors. One place to get in contact with projects that use this kind of approaches, is through not-for-profit agency or think-tanks like the Waag organisation in the Netherlands[21]. It often hosts open workshops where everyone is welcome. A similar scheme is the Living Knowledge Network[22] that aim to assist both individuals and CSOs that need research support to pursue their non-profit interest. The network has local partners in 23 European countries.

There are currently many different types of initiatives that you can get involved with. What kind of interactions and with what kind of actors does the CSO or individual want to interact? In projects initiated by industry, there is often a value chain perspective. This implies that CSOs should reflect on where in a value chain they have their stakes before signalling their willingness to participate. Further, it would be good for the participants to query the project coordinator on time-frames and what level of engagement that are expected.

For CSOs the option to initiate applications for research funding is mentioned specifically in the PERARES-project. This is a way that a CSO can be sure that research addresses its concerns, and that they would be included in all stages of the project. One could imagine that initiating and running a project with researchers or other stakeholders (industry, media representatives), may open up for future collaborations and invitations to new, future initiatives.

[21] https://waag.org/en/about-us
[22] https://www.livingknowledge.org/

One project also came up with lists for researchers on what to think of when defining participants that should be invited to co-creation sessions/meetings. One interesting and intriguing point was “Who will insist on being involved and cannot be excluded?”, but even question on “Who will be affected by the issue now – and in the future?”. Turning from pull to push, this can give some inspiration on how to think and argue when making contact with researchers or research institutions.

Further, it is interesting and valuable for the CSO to be aware of the existence of a stakeholder engagement standard, even if this mainly is a tool for the target group “owners of the engagement”. Read carefully, the standard might contribute to a professionalization of the CSOs, influencing their ways to operate, increasing their chances of success when they try to engage.

The UNEP Handbook has a more limited interest. The target group is stakeholders wanting to be involved with UNEP, and the relevance for publics or CSOs wanting to be involved with nanotechnology appears to be very limited, except perhaps for a general emphasis on the desirability of a broader engagement in environmental (and possibly also nanotechnological) issues. And the listing of major groups/stakeholders might be interesting. With its strong focus on the Code of Conduct, not the least on input to its implementation, the relevance of Nanocode for our strictly defined purpose (online guides for eager stakeholders) appears to be rather limited, too. Stakeholders, however, might need to become aware of the existence of a Code of Conduct when they want to engage. Even at this rather advanced level of engagement, Nanocode insists that it is important to avoid formal and difficult language, in order to facilitate an effective information flow and discussion.

Finally, we have presented statistics from the CONSIDER-project that pointed to the importance on clarifying conditions for participation, clarification of roles and expectations for projects were CSOs want to get involved.

ANNEX B: SCREENSHOTS OF THE PUBLIC ENGAGEMENT DATABASE

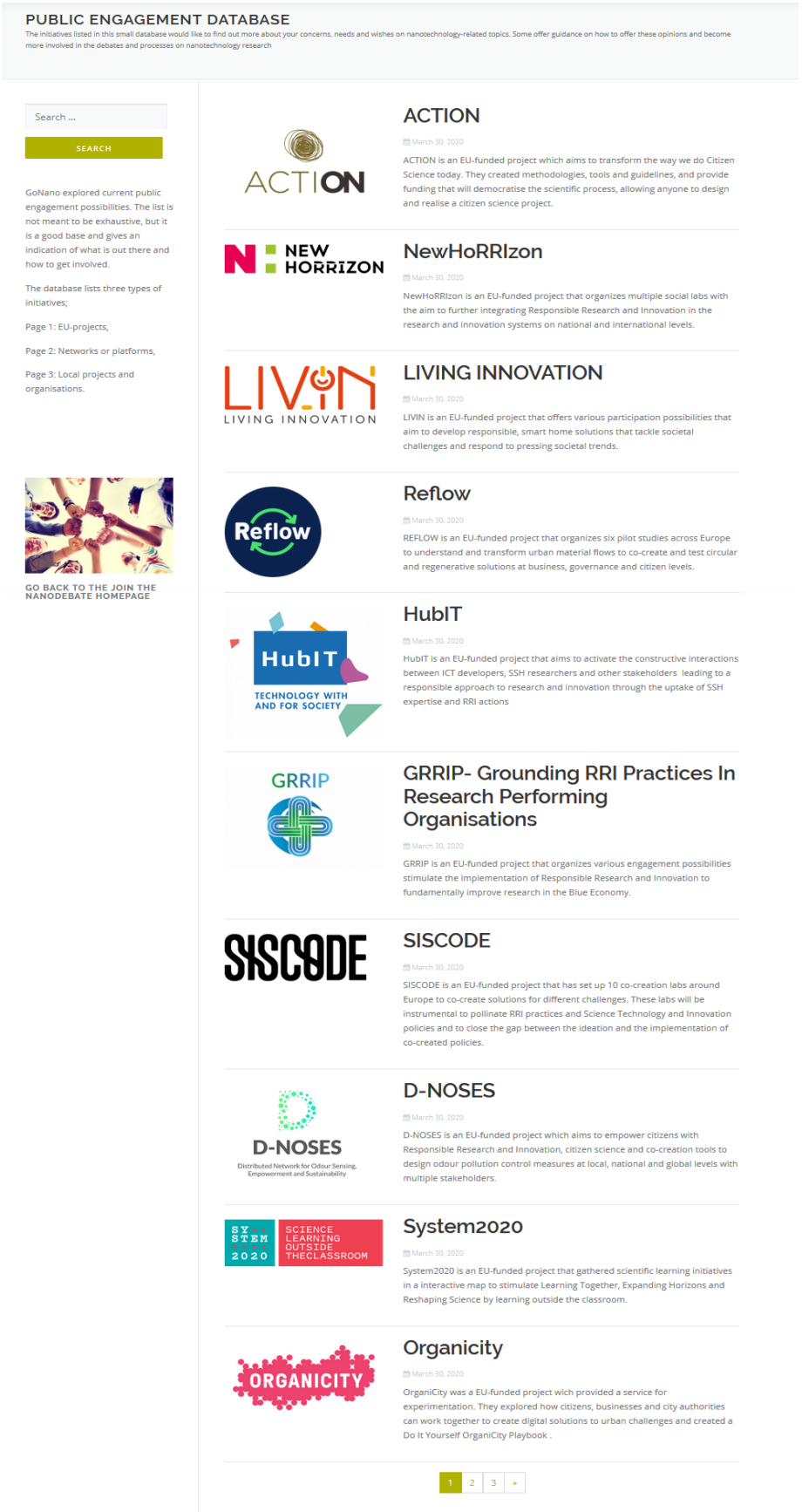


Figure 10: Page 1 of the public engagement database

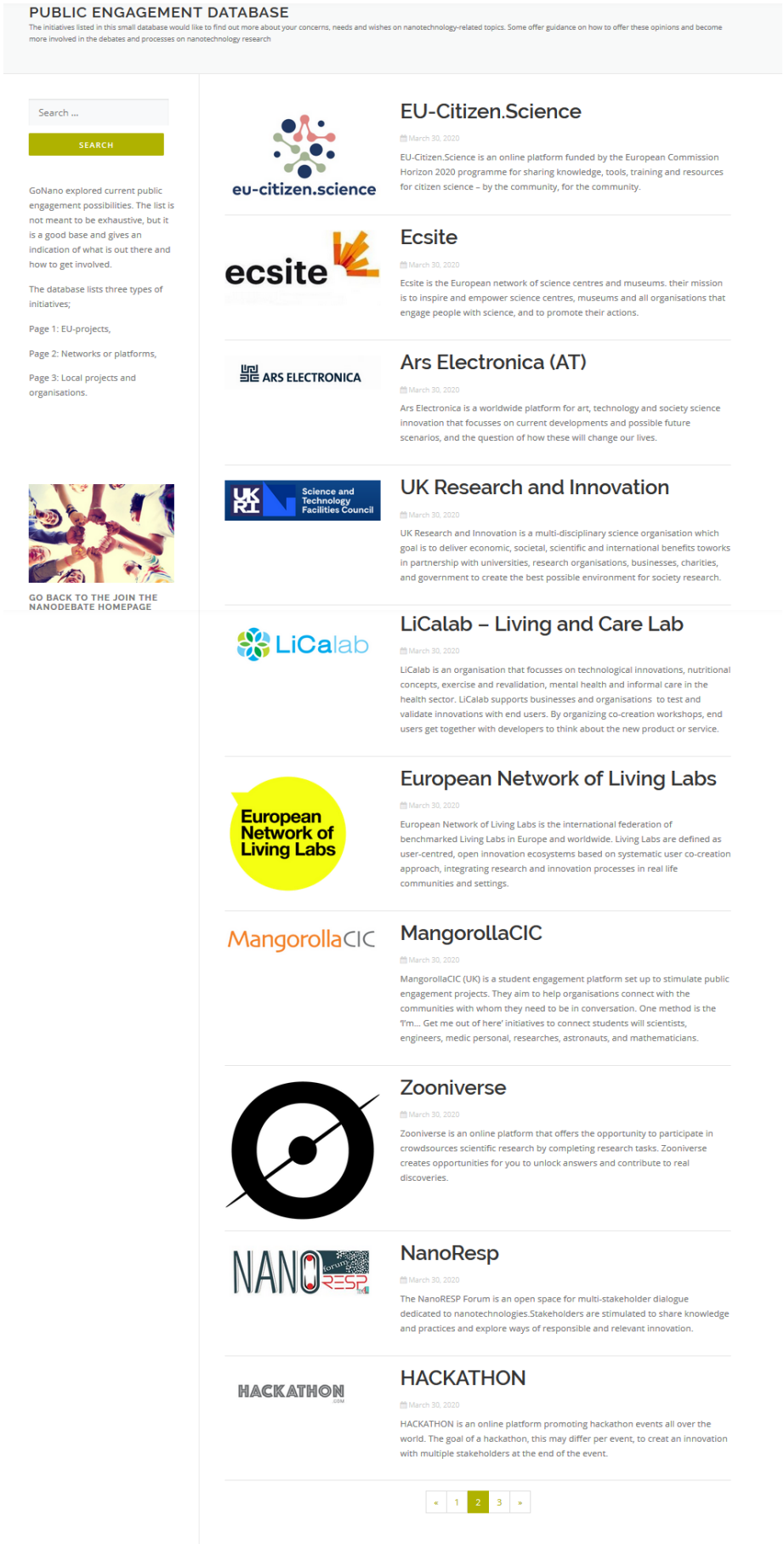


Figure 11: Page 2 of the public engagement database

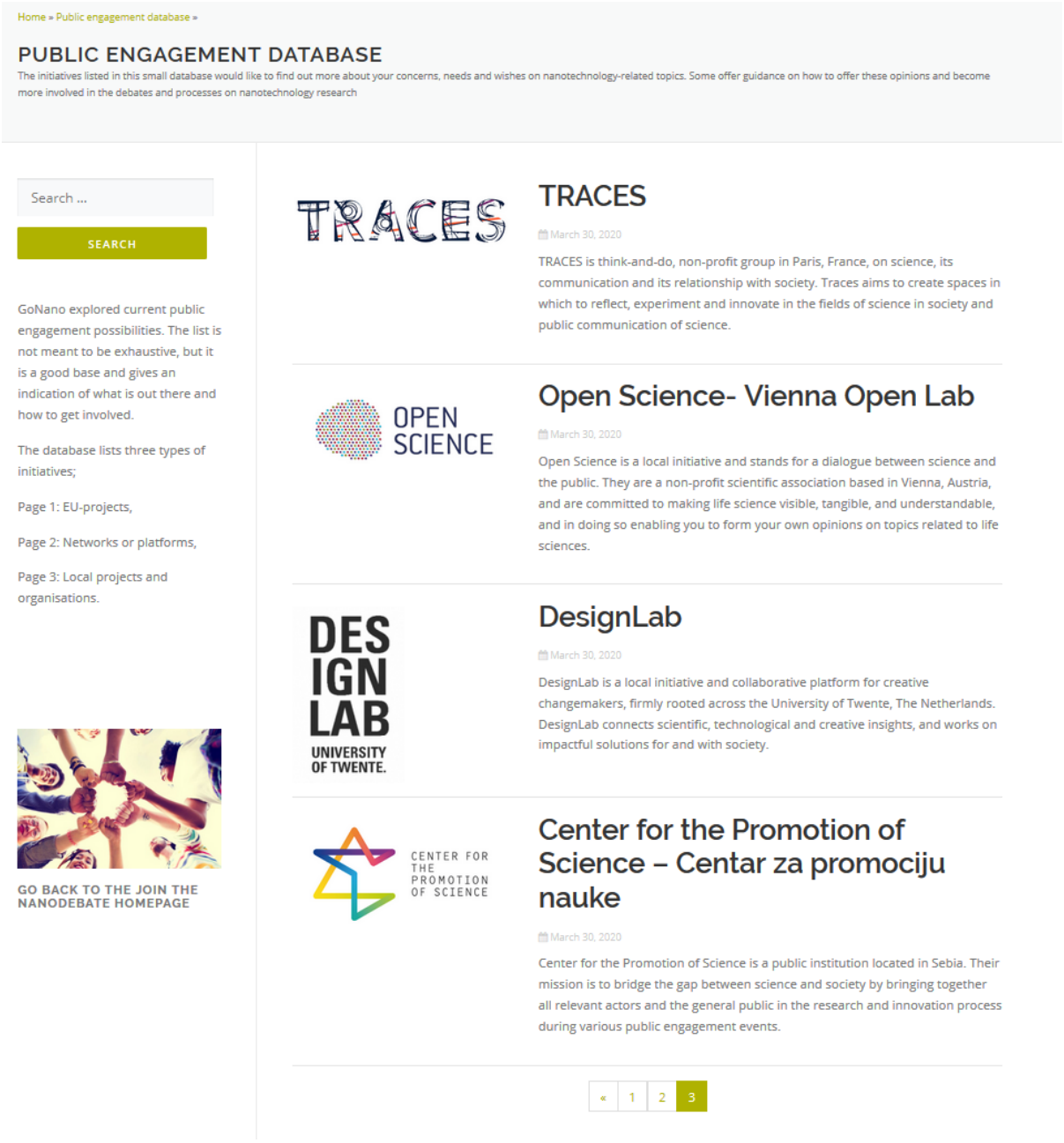


Figure 12: Page 3 of the public engagement database

ANNEX C: '*HOW TO..*' GUIDE

Joining the debate on nanotechnologies

A citizens' guide

GoNano

Why this guide?

The EU-funded GoNano project aimed to enable co-creation between citizens, researchers, industry, civil society organisations and policy makers across Europe to align future nanotechnologies with societal needs and concerns. GoNano developed pilot projects in the areas of food, health and energy to explore how researchers can work with publics and professional stakeholders to create novel suggestions for future nanotechnology products. The outcomes of the GoNano co creation process suggest that citizens and civil society can help nanotechnology research and innovation to become more responsive to societal needs and values.

With this guide, we would like to share our lessons learned. We hope it will support citizens who would like to engage with nanotechnologies to express their own needs and concerns and ensure that their thoughts are taken into account in future developments.

The guide offers a five step approach which aims to help you define your interests, identify the right opportunity and become involved in nanotechnology research and development. With the support of this guide, we invite citizens to express their own needs and concerns and help shape the future directions of nanotechnologies.

For whom is this guide?
This guide is a brief introduction for anyone who has a personal interest in emerging technologies and would like to share their thoughts with researchers and engineers. This may also include those who are using new technologies and want to participate in their development; and those who want to contribute to a more sustainable future.

> "I like giving my input to the developers of the medical device that I am using, as the final product may better suit my needs."
> *Participant stakeholder workshop Enschede on health applications.*

Why would nanotechnology matter to you?

Nanotechnology is defined not by its subject matter, but by the scale at which it operates: the nanometer, or one billionth of a meter. Nanotechnology seeks to manipulate and control matter in a size range of 100 nanometers (nms) down to the size of atoms (approximately 0.2nm).

In recent years, sophisticated tools have been developed to investigate and manipulate matter at the nanoscale. By rearranging or restructuring the atoms and molecules of a particle, the properties and behaviour (such as melting point, conductivity or chemical reactivity) of the particle change. For instance, gold particles at the nanoscale are not yellow as we know them, but can appear red or purple. Because of these changes in their optical properties, gold nanoparticles can be used for medical imaging. Nanomaterials open doors to new technological opportunities.

Nanotechnology is already a part of our lives. Nanomaterials are used to enhance the properties of consumer products like toothpaste, sunscreen, food packaging and smartphones. Proponents of nanotechnology claim that this is just a glimpse of the possible future benefits for consumers. But others are concerned that nanomaterials may harm human and environmental health.

To what extent can we anticipate the future impacts of nanomaterials? How should the potential benefits of nanotechnology be weighed against the possible unforeseen consequences? What products do we want? What risks are we prepared to take? And who gets to decide? These are questions which affect us all. As a stakeholder, you may also want to become involved in what happens next.

This guide presents an approach to getting involved in the debate. In five steps we offer suggestions on how to become involved, where to find the right opportunities, how to prepare yourself, what to expect, how to reflect and how to share your experiences.

Five steps

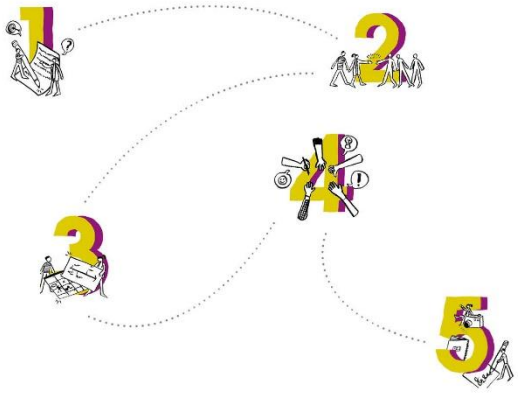
Based on our experiences in the GoNano project we have identified the following five steps to getting involved in the research and innovation processes of your interest:

1. Define your purpose
2. Find the place and community
3. Get prepared
4. Create together
5. Reflect on the process and results

Each step in this guide is illustrated by a brief summary of the step, followed by an example or exercise to help you visualize and guide you through the step. For each step we present a hint or advice based on the experience gained during the GoNano project, including links to background information, tools or inspiring ideas.

tip or advice

example or exercise



Enabling co-creation: terms of engagement

Co-creation usually involves collaboration between individuals with very different backgrounds. To work together effectively, participants have to be aware of others' perspectives and what they would like to achieve. The 'symmetry of ignorance' is a key principle here: this means that we are all knowledgeable in some fields, but have lay knowledge in most others. In other words, all participants are equal and have something unique to bring to the table. The challenge is to build a shared language that allows each participant to meaningfully discuss the 'value' of their contribution to the other participants.

Building shared understanding between participants also implies that clear ground rules for discussion should be in place: everyone should be allowed to speak; participants should actively listen to what the others have to say; treat each other as equals; explore what new ideas might contribute to the overall aim, rather than simply dismissing them. Overall, differences in opinion are valued, not suppressed.

1. Define your purpose

The first step is to define your own motivation and expectations: why would you want to become involved in research and what do you expect to get out of your involvement in return?

You may be personally motivated by a topic you have been following in the news and would like to learn more about it, or would like to share your own knowledge and insights. Or you may want to contribute to a more sustainable society. Or you may want to meet other people with the same interest and expand your personal network.

Selecting the topic you're interested in will facilitate an initial selection of suitable engagement initiatives. It will also kick-start your own thoughts about your personal goals for involvement. Based on your motivation, you can try to formulate a corresponding expectation: what do you expect to gain from the experience? Do you simply want to know more about a topic, or do you want to contribute to or influence the direction of research and policies?

Guiding task: map your interest
Use an A4 paper and draw yourself in the middle. Think about topics that you find interesting and write them around your sketch. Draw a line from each topic to your photo (these are the first branches). Think about what and how you would like to contribute to these topics. Ask yourself questions that start with: who, what, where, when, why, how. Write the answers close to the topic. Do the same exercise for each branch. Use keywords, not full sentences. Determine which contributions are most relevant for further elaboration, based on creativity, enthusiasm, feasibility etc.

20-30 min — coloured pencils & paper

Use the mindmap you created to define your goals and expectations.

7

2. Find the place and community

Once you have defined your own motivation and expectations and have found the topic you would like to explore and formulated a suitable goal, you have to find the right place and community to pursue this.

Various public engagement processes are organized on both a local and international level. Some engagement initiatives occur only once; others, like Science Days, are recurring events. There are various aims and methods for public engagement. The aim can be to inform, consult or involve you in research and innovation processes. Engagement initiatives can be organised in the form of an online community or as offline face-to-face workshops.

Online participation can easily be done in your own time and often from home, but interaction with other participants may be limited. If you prefer meeting people in person or having a dialogue with organisers over a longer period of time, you can look for organizations in your area in which engagement processes are organized. These events can last from half a day to weekly or monthly workshops over a longer timeframe. Most local organisations have extensive experience in citizen engagement and can guide you in the search for a suitable engagement process in your own community.

Explore online engagement initiatives
Browse the web for organisations that work on the topics that you have identified in step 1, and find out how you might become involved. Use #co-creation, #living lab, #social lab, #science center or #science museum as search terms. You can also make use of the GoNano public engagement database.

GoNano has built a public engagement database, listing organizations and projects that are currently looking for feedback from citizens and societal stakeholders.

20-30 min — browse http://gonano-project.eu/

In recent years, many living labs have been developed to integrate research and innovation processes in real life communities and settings. Browse the ENOLL website for more information on this concept and to find one in your own region.

9

3. Get prepared

Once you have found a suitable engagement opportunity, it helps to prepare beforehand. This makes it easier to establish common ground and to engage in productive dialogue.

You will generally find more information about the activity on the relevant webpages of the initiative. You can read about the background of the organization and the purpose of the event. It also helps to know what the organisers expect from you, how they plan to use the results (including your contribution) and how your personal information will be handled (privacy). If you cannot find this information, you may want to request it in advance to avoid misunderstandings afterwards.

You may also want to think about your own expectations for this event: what contributions would you like to make to this topic? And what would you want to get out of it: what are the questions that you want to have answered, what worries you or makes you happy?

Prepare, but don't prepare too much. Keep an open mind to fully appreciate the workshop experience. It should be fun and should never feel like you are taking an exam.

Background information on nanotechnologies
The GoNano project website features further background information about nanotechnologies. You can download the brochure (s) and read about what nanotechnologies entail, how it is used and what future applications are currently being developed.

20-25 min — download from website http://gonano-project.eu/

Key principles for a good discussion: keep an open mind, remember that everyone has a different background, speak openly and honestly, treat everyone with respect, listen carefully, do not interrupt each other, keep comments short and to the point.

11

4. Create together

There are many kinds of methodologies to facilitate a co-creation workshop, but they are mainly designed around the following four pillars: exploration, ideation, prototyping and reflection. During these sessions you will work with other participants, discuss and create new ideas. The length of the workshops can differ from half a day to several workshops over a period of time (in a living lab setting).

In the GoNano project, we structured our collaborative workshops around these four main pillars of co-creation.
In the **exploration** session, participants get to know each other and share their wishes, needs and values.
In the **ideation** session, participants imagine and co-create responses to these wishes, needs and values, building on the varied expertise around the table.
In the **prototyping** session, participants generate an action plan that visualizes in discrete steps how the wishes, needs and values will be integrated in product suggestions.
The concluding **reflection** session aims to consider broader reflective questions about the feasibility of the action plan and the overall outcomes.

Co -creation sessions
There are many tools developed to facilitate these sessions. If you want to be prepared and get already some ideas about what you can expect take a look at the videos from the GoNano citizen workshops in the Netherlands, Spain and Czech Republic.

15-20 min — Video clips online http://gonano-project.eu/

Another inspiring example of citizen engagement is the Making Sense project. In this project, citizens have developed methodologies and technologies to tackle different types of pollution. http://making-sense.eu/

13

5. Reflect on the process and results

After the workshop or other activity, it's time to reflect on the process and the results. It is very likely that a reflection session will be part of the engagement process, but it is also nice to reflect yourself.

In step 2 you described the efforts you must make and the benefits you will receive. Ask yourself - have the activities met your expectations? Why (not)? What you have learned from the process? What kinds of results have been achieved? What have you concretely added to the initiative? How will these results be useful for the initiative and for others. And did the process bring up any unexpected result for yourself or your environment?

These reflections are valuable for yourself in order to get a better understanding of your expectations and how they were matched to your experiences. What would you like to do different next time? Would you like to have more/less impact or be involved in a longer/shorter period of time? Such reflection can help you choose other suitable future workshops. And sharing these impressions with the organizers can also be valuable for them so they can better tailor their program to the needs of the participants next time.

Evaluation sheet
Prepare a questionnaire for yourself and your fellow participants on a sheet of paper. Include questions like: How did you experience this event? To what extent did your experience meet your expectations? Which part of the process did you like most and why? Would you participate next time? Why (not)? Do you have any suggestions for the participants or organisers? Discuss the answers among yourselves.

15-20 min

pencil & paper

In the GoNano project, we sent around short questionnaires after each co-creation activity and conducted follow-up interviews with different kinds of stakeholders after all co-creation activities were completed. (http://gonano-project.eu/)

15

Joining the debate on nanotechnologies

A citizens' guide

The EU-funded GoNano project has organised a series of co-creation workshops to explore how the needs and values of citizens and societal stakeholders could be taken into account in early stages of nanotechnology research and innovation.

This guide is an invitation to all citizens with an interest in emerging technologies to express their own needs and concerns and help shape the future directions of technology. The guide offers a five-step approach to help you define your interests, identify the right opportunity and become involved in nanotechnology research and development.

GoNano

www.gonano-project.eu

GoNano is a Coordination and Support Action funded by the European Union under the NMBP Programme of Horizon 2020, Grant Agreement n° 768622.

ANNEX D: SCREENSHOTS OF THE 'JOIN THE NANODEBATE' WEBPAGES

Figure 13: Screenshot of the Join the nanodebate page

NANOTECHNOLOGY IN A NUTSHELL

WATCH THE YOUTUBE VIDEOS;

What is nanotechnology (4:41)

Nanotechnology explained (1:19)

DOWNLOAD THREE BOOKLETS ABOUT NANOTECHNOLOGIES IN THE AREAS;

Food, Energy and Health

GO BACK TO THE JOIN THE NANODEBATE HOMEPAGE

What is nanotechnology?*

Nanotechnology is defined as the purposeful engineering of matter on the atomic or molecular scale. Nanotechnology and nanoscience (the study of nanoscale phenomena) happen between the range of 100 nm down to the atomic level (approximately 0.2 nm), and it is only in recent years that sophisticated tools have been developed to investigate and manipulate matter in this range. New insights have greatly affected our understanding of the nanoscale world, including the change in behavior compared with the same materials at a larger size.

Two main reasons for the difference in properties is that nanomaterials have an increase in relative surface area and a dominance of quantum effects. These factors can change or enhance properties such as strength and electrical characteristics. As a material shrinks to nano-size, there is an increase in the surface area to volume ratio (a greater portion of the atoms are found at the surface area compared to those inside). As catalytic chemical reactions occur at the surface, nanoparticles will be much more reactive than the same mass of the material made up of larger particles. So, for nanomaterials, surface reactions become dominant. In tandem with the surface-area effects, quantum effects begin to dominate. This can significantly change a material's optical, magnetic or electrical properties.

These size-dependent properties have been known for centuries; gold and silver nanoparticles have been used as colored pigments in stained glass and ceramics. Depending on the size, gold particles can appear in red, blue or gold color. It was later discovered, as explained by Nano.gov, that the motion of gold's ecectrons is confined. Because this movement is restricted, gold nanoparticles react differently with light compared to larger-scale gold particles. Their size and optical properties can be put to practical use in medical imaging.

Nanomaterials in commercial products

Nanotechnology encompasses a wide range of technological developments in areas as diverse as healthcare, manufacturing and agriculture. Nanomaterials can nowadays be found in many commercial products. Think about certain sunscreens, paints, rubber tires, medical implants, computer chips and many more. Nanoparticles in products are not fixed (such as sunscreens), be used to form composites from which they might later be released (nanoparticles in paint), or be created if nanomaterials are damaged or break down (rubber tires). In sunscreens, nanosized titanium dioxide and zinc oxide are used to absorb and reflect ultraviolet rays while still occurring transparent to the visible light. This is a nice technology to protect consumers from sunburn, but as the nanoparticles are not fixed they could penetrate the skin. although suncreen reduces the risk of sunburn, skin penetration of nanoparticles may also not be without consequences. Also, some other nanoparticles or fibres (asbestos and quartz) have shown to cause harm to humans or the environment when released into the air. For this reason, the safety of ingredients in new emerging technologies is increasingly included in safety assessments. For more information about nanotechnologies please see the three booklets on food, energy and health.

*Information was derived from Royal Society and Royal Academy of Engineering (2004) Nanoscience and nanotechnologies: opportunities and uncertainties

Public engagement in nanotechnology.

As nanotechnology aims to exploit the effects of nanomaterials to create new structures and devices with innovative properties and functions, novel applications of nanotechnologies have been introduced. Whereas beneficial innovations have been welcomed, we just explained it may not be without consequences. Some novel nanotechnologies have raised social and ethical concerns with society and contributed to a wider societal debate. Interested in joining the debate? Search in our *snapshot public engagement database* to find out how you can participate.

Figure 14: Screenshot of the Nano in a Nutshell webpage

Basic information about nanotechnologies for food

What is nanotechnology?

Nanotechnology is generally referred to as 'the science of the very small'. The prefix nano actually derives from the Greek νᾶνος (nanus in Latin), meaning dwarf.

A human hair can be used to illustrate size at the nanoscale. A human hair is approximately 80,000-100,000 nanometres wide. Another way to illustrate how small this is could be to say that comparing a nanoparticle to a basketball is roughly the same as comparing a basketball to planet earth. Nanomaterials can be found to occur "naturally" e.g. in dust or volcanic ash, in car exhaust fumes or in the smoke produced by a burning candle, or can be designed and fabricated artificially.

Nanotechnology today

Water-repellent fabrics

Some water-proof fabrics are not actually water-proof. In fact, the natural fabric may not repel water at all; however, nanotechnology can be used to create tiny patterns or nanostructures, or to add very thin layers, that then make the surface water-repellent.

Nano-cure for nail fungus

A new treatment for nail fungus is under development that combines nanoparticles with anti-fungal medication to deliver the drugs more effectively to affected area of the nail.

Nano-robots clear away bacteria and toxins

Researchers are developing tiny nano-robots (made from gold nanowires) that can be controlled with ultrasound. The nano-robots can be used to quickly clear bacteria and toxins from biological fluids like blood.

Risks and regulations nanotechnology, human and environmental health

There are many types of engineered nanomaterials; some are potentially hazardous but can be used safely under controlled circumstances. Most concerns relate to nanoparticles in free form, where they are harder to control and are not particles bound up in solid materials or fluids. But even then, are we able to control them?
Are they toxic? Do they evade the natural defences of the body, and what are the implications of this? Do they damage cells? Could nanotechnologies have different effects on men than women, and could there be differences in effects across ethnicities?

Some people argue that we already use many dangerous technologies and substances in our everyday life (e.g. gasoline). They think we should talk about how we regulate and use dangerous technologies and substances, instead of talking about if we should use them. Others worry that the very properties that make nanomaterials desirable, are the very properties that make them hard to control and regulate. They therefore think that we should talk about whether or not we should be developing nanotechnologies as all.

Your sunblock could contain nanoparticles

Many products already contain nanoparticles. E.g. A sunblock that rubs in clear on your skin could contain nanoparticles. Producers of sunblock are obliged to indicate on the label if your sunblock contains nanoparticles.

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5

Nanotechnology and food: what are the visions?

Novel foods

Imagine if we could optimise our food, so that we would be sure to get all the nutrients we need for a healthy body. Imagine if we could offer healthy, cheap and nutritious food to the global population, ending malnutrition, hunger and disease caused by a lack of (good) food and water. Researchers imagine it will be possible to encapsulate vitamins and other nutrients in nanoparticles, add it to our food, and thereby improve the nutritional value in everyday food. Nanoscale approaches could also be used to develop low fat foods or to change how certain foods taste or how they look like.

6

Smart food packaging

Today, plastic is widely used for food packaging. Plastic presents a threat to the environment in the form of greenhouse gas emissions, and micro plastic in our oceans. Scientist imagine nanotechnology will lead to smart food packaging in biodegradable materials with e.g. anti-microbial, anti-fouling, stain-resistant, water repellent properties. In addition, nanosensors in the food packaging may in the future detect contaminated food and warn you by showing a red dot on the package. Overall, these properties could be used to realize so called "customer specific" packaging solutions. Benefits include: extended self-life, improvement of food security, and reduction of the environmental impact from production and degradation of food packaging.

Nano filters

Water pollution is a global societal issue. Nanofiltering for purification of drinking water is already providing low-cost solution for water purification in some developing countries. Nanofilters can remove bacteria, viruses, heavy metals and organic materials from water.

7

How should we design nanotechnologies?

Will nanotechnology lead to differences in treatment and access to treatment?

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How could nanotechnologies be developed to suit your needs?

How do we make sure that

- We design nanotechnologies that fit with the wishes of citizens across the world?
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Research has also shown that religious beliefs and differences in culture can play a role in how we judge the potential of nanotechnologies, as well as how we believe nanotechnologies should or should not be used.

What do you think?

- **Do you think culture, gender or religion influence how you think about using nanotechnologies for applications in healthcare and to support healthy living?**
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Basic information about nanotechnologies for energy

What is nanotechnology?

Nanotechnology is generally referred to as 'the science of the very small'. The prefix nano actually derives from the Greek νᾶνος (nanus in Latin), meaning dwarf.

A human hair can be used to illustrate size at the nanoscale. A human hair is approximately 80,000-100,000 nanometres wide. Another way to illustrate how small this is could be to say that comparing a nanoparticle to a basketball is roughly the same as comparing a basketball to planet earth. Nanomaterials can be found to occur "naturally" e.g. in dust or volcanic ash, in car exhaust fumes or in the smoke produced by a burning candle, or can be designed and fabricated artificially.

Nanotechnology today

Water-repellent fabrics

Some water-proof fabrics are not actually water-proof. In fact, the natural fabric may not repel water at all; however, nanotechnology can be used to create tiny patterns or nanostructures, or to add very thin layers, that then make the surface water-repellent.

Nano-cure for nail fungus

A new treatment for nail fungus is under development that combines nanoparticles with anti-fungal medication to deliver the drugs more effectively to affected area of the nail.

Nano-robots clear away bacteria and toxins

Researchers are developing tiny nano-robots (made from gold nanowires) that can be controlled with ultrasound. The nano-robots can be used to quickly clear bacteria and toxins from biological fluids like blood.

Risks and regulations nanotechnology, human and environmental health

There are many types of engineered nanomaterials; some are potentially hazardous but can be used safely under controlled circumstances. Most concerns relate to nanoparticles in free form, where they are harder to control and are not particles bound up in solid materials or fluids. But even then, are we able to control them?
Are they toxic? Do they evade the natural defences of the body, and what are the implications of this? Do they damage cells? Could nanotechnologies have different effects on men than women, and could there be differences in effects across ethnicities?

Some people argue that we already use many dangerous technologies and substances in our everyday life (e.g. gasoline). They think we should talk about how we regulate and use dangerous technologies and substances, instead of talking about if we should use them. Others worry that the very properties that make nanomaterials desirable, are the very properties that make them hard to control and regulate. They therefore think that we should talk about whether or not we should be developing nanotechnologies as all.

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Nanotechnology and energy: what are the visions?

Green energy production

Imagine a future with flexible solar panels, which were only possible to manufacture due to the incorporation of ultra-thin layers (nanolayers) of light absorbers, or a paint full of semiconductor nanoparticles that could convert any surface into a photovoltaic panel. The widespread use of such technologies could help reduce our dependence on fossil fuels, and thus help reduce the emission of CO_2 and other greenhouse gases.

Portable energy devices

What if we could harvest the energy we produce when we walk and drive around every day? You could, for example, have nanofibers integrated into your clothes. The clothes would transform the energy produced by walking into electrical energy for powering your cell phone or smart watch. And what if the batteries in your cell phone had a higher storage capacity, a shorter charging time, or a longer shelf-life? More efficient batteries could prolong the useable life of our electronic devices, and therefore reduce the waste coming from them.

Energy in the home

Today you can harvest and store your own electrical energy at home, using solar panels and large batteries like the Tesla Powerwall, but nano-technology could make it possible to create and store energy in places you never imagined. You could install "smart windows" with a special nano-coating that would keep your house cool in Summer and warm in Winter – and generate electricity at the same time. The electricity could be stored in the structure of your house: the bricks in the walls, in wireless charging coils on the floor, on the kitchen worktop and in the furniture. Your smartphone and laptop could then be charged automatically no matter where you left them.

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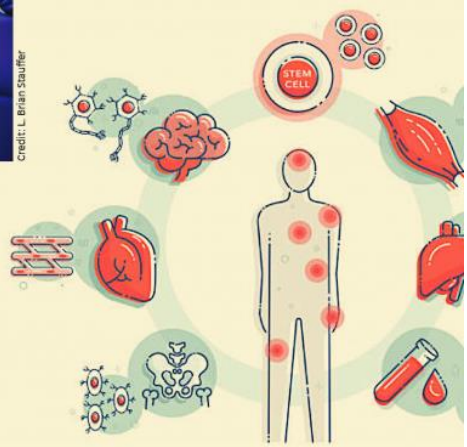
Nanotechnology and health: what are the visions?

Credit: L. Brian Stauffer

Early detection of disease

Nanotechnologies are imagined to provide new opportunities for diagnosis and prevention: for example the possibility of early and more accurate detection of disease. Researchers are developing sensors that for example measure your urine or breath. Imagine you would carry such a sensor you with you all the time. The sensors would collect data about our health condition throughout the day and night. In the future, they might even allow people to monitor their own health without the need of a doctor.



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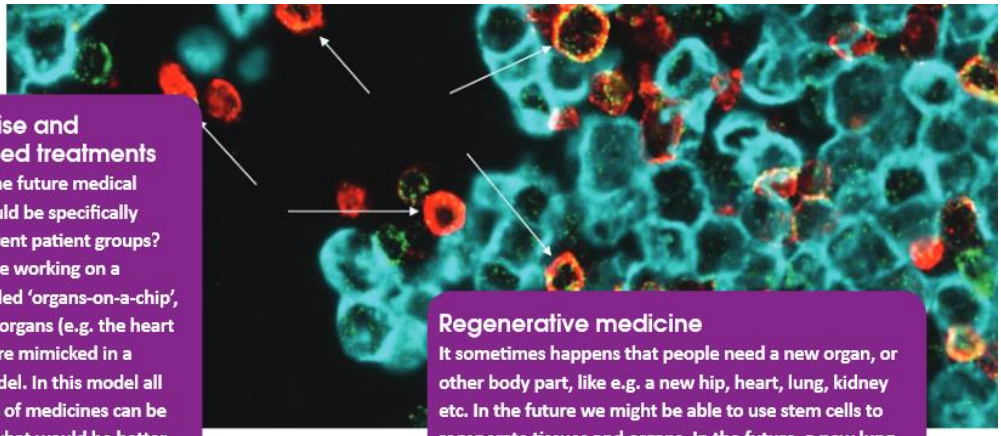

More precise and personalised treatments

Imagine if in the future medical treatment would be specifically suited to different patient groups? Researchers are working on a technology called 'organs-on-a-chip', where human organs (e.g. the heart or the lungs) are mimicked in a laboratory model. In this model all different types of medicines can be tested to see what would be better for what group of patients. Other examples include nano-robots that could be made to trace down e.g. cancer cells and release medication in the diseased area of your body. The mechanism is for example promising in cancer treatment.

Regenerative medicine

It sometimes happens that people need a new organ, or other body part, like e.g. a new hip, heart, lung, kidney etc. In the future we might be able to use stem cells to regenerate tissues and organs. In the future, a new lung or hip, or skin-patches for wound healing could be made from your own cells. Organs or skin patches made from your own cells could help to ensure the body accepts the new replacement better.

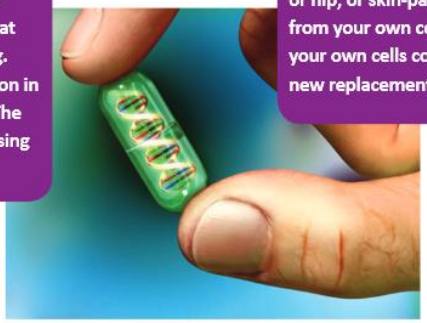

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Figure 15: Basic information about nanotechnology on Food, Energy and Health that are accessible on the 'Nano in a nutshell webpage'

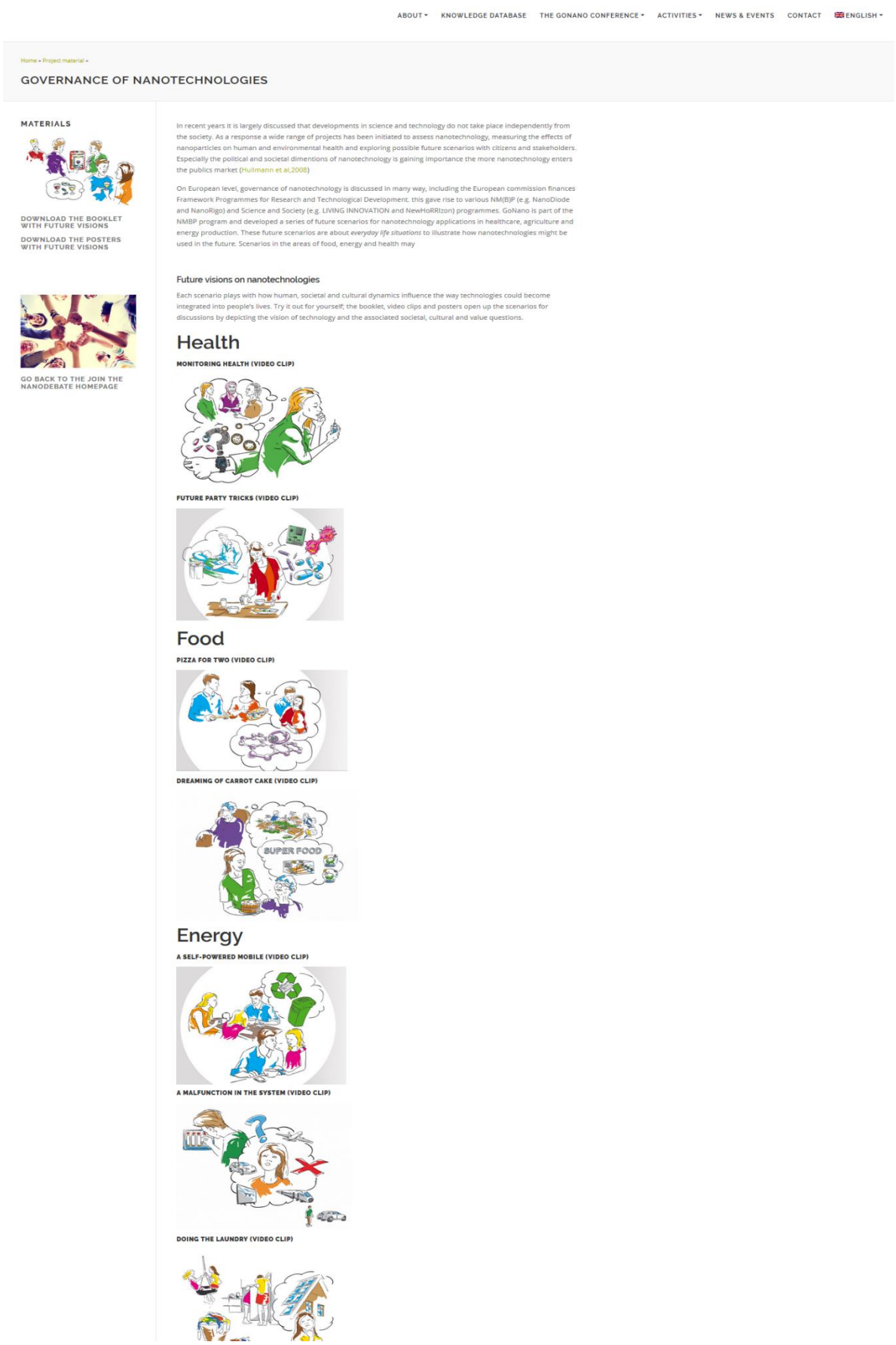

Figure 16: Screenshot of the Governance of nanotechnologies webpage

Future visions of nanotechnology and health in 2030

Monitoring for (un)healthy control?

Sofia turns off the alarm clock, yawns and finally sits up. Time to get up. She turns off the flight mode on her phone, turns on the Bodysensor app and holds her breath for a few seconds as it updates. Then she sighs. No signs of cancer. Yet. Time to wake up the kids.

Since they installed nanorobot sensors in her breasts it has become a daily routine for Sofia to check the Bodysensor app first thing in the morning. Her mother died of breast cancer seven years ago. Apparently Sofia is also genetically predisposed to develop breast cancer. The nanorobot sensors were offered to her in order to detect eventual cancer cells as early as possible. As Sofia sets the table for breakfast, she thinks of her mother. If only her cancer had developed five years later, she would most likely have survived. Since the development of cancer treatments enhanced with nanotechnology, very few die from breast cancer, and no-one has to suffer from the terrible side effects of the out-dated chemotherapies and radiotherapies of the past. Today, they use tiny nanorobots to transport the therapeutic agents directly to the tumour, so that patients do not need to have their entire body bombarded with chemicals and radiation. Tiny nanosensors are installed in the breast tissue of cancer patients that kept track of how they react to the treatment. In this way doctors can make adjustments as soon as it is needed – and monitor any recurrence of tumour cells.

Peter is getting the kids ready. Sofia sits down with a cup of coffee. She looks at her phone and fights the temptation to check the Bodysensor app. The app is her safety net, but also a daily reminder that one day the figures might not be as she hoped. And what if the app doesn't detect everything? What if someone hacks into her phone and changes the settings or reads her data? Before the nanosensors were installed, Sofia didn't think much about cancer. Now she thinks about it all the time. Peter comes in with the kids, and they all sit down to have breakfast. Sofia is grateful to be alive.

The questions that are introduced include:

- Distribution of responsibility: Should Sofia be able to monitor herself?
- Appropriation: Will Sofia get used to the BodySensor app and possibly forget about after a while?
- Trust and privacy: Could the sensors break down or need replacement? How is the data shared? How does the app look like? Can others see or hear it?

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Future visions of nanotechnology and health in 2030

Smelling disease

John is sitting in front of a computer at the pharmacy for his yearly health check-up. The yearly check-up is mandatory for everyone above the age of 30. On the computer screen in front of him, he has a view of a doctor sitting in front of a desk looking into a computer screen. On John's side of the screen there is a mechanical device that looks a bit like a nose. An assistant cleans the noselike device and asks John to open his mouth and take the device into it and blow his breath back and forth for a minute. The artificial nose can detect many types of disease. It takes 15 minutes for the doctor to return with the test results.

As he waits, John speculates about all the different types of diseases he might have – hasn't he been a bit more tired lately, and what about the other day when he suddenly couldn't remember the name of one of his colleagues? He is scared be might be developing a mental health disorder like dementia or Alzheimer's disease, or neurological disease like ALS where your muscles slowly die. Imagine not knowing when or how the disease would develop. John knows that medications today are much better than they used to be – but what was it he read the other day, about some medications only working well for some people and not for others? Was it that people of African descent who had the worst coverage with the new medications? The doctor returns to the screen. John's stomach is twisted up in a hard uneasy knot as he waits for the news. John is fine.

The questions that are introduced include:

- Societal and cultural implementation: What could the psychological effect of an increased focus on health and health control individually, and at a societal and cultural level be?
- Responsibility and trust: Would it be ok to have a diagnosis given at a distance? Where should a yearly-health check-up take place? Should everyone go to the pharmacy, or e.g. buy a 'smelling nose', would a nurse travel around with the "nose"?
- Justice and equality: Would it be ok to have medications that are only available for some ethnic groups (or genders)? How should health insurance look like in 2030?
- Privacy: how is data shared and protected?

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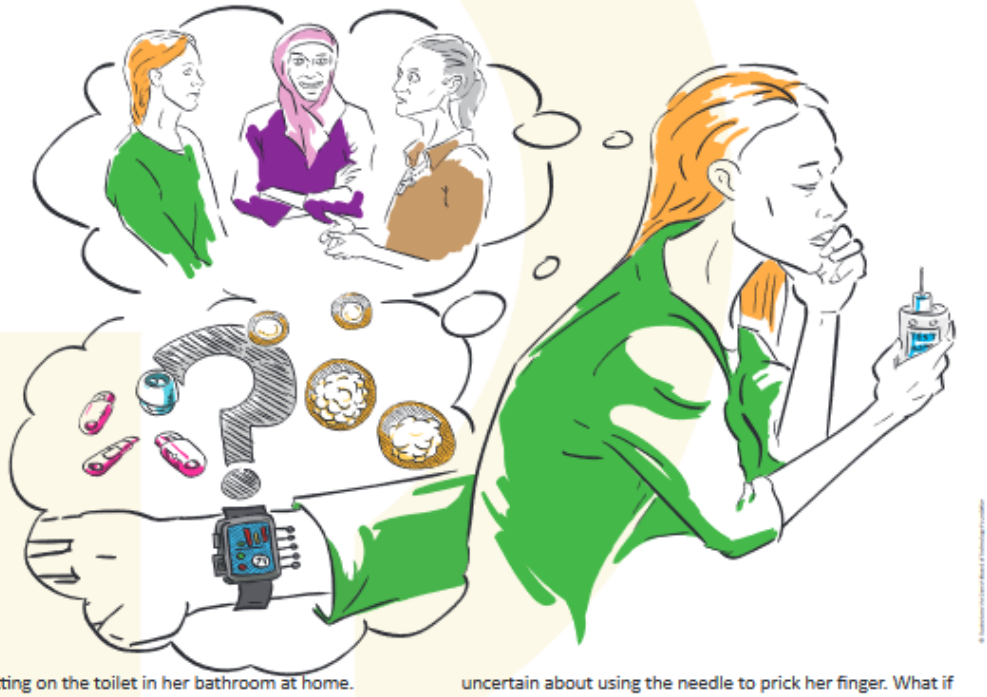
Doctor at home



Sofia is sitting on the toilet in her bathroom at home. She is opening the package of a new home test for diabetes. The test is a needle with a nanochip. She will need to prick her finger to provide a blood drop for analysis on the nanochip. The chip can immediately detect if Sofia suffers from diabetes 1 or 2.

Recently, Sofia has felt very tired and thirsty and she constantly had to go the toilet. She searched online to check her symptoms and ended up on a webpage about diabetes. The website also described different treatment options. One option is a small wearable device developed using nanotechnology. This device constantly measures the level of insulin, and injects extra insulin when needed. Another option is to create new beta cells in the body. With diabetes type 1, beta cells in the body stop working. Using nanotechnology, doctors are able to create new beta cells from stem cells, and place those in the body. No other medication is needed.

Sofia considers her situation. She is already happy the home test for diabetes was cheap and easy to buy. Since health insurance does not cover check-ups at the general practitioner anymore, home tests are very useful. She is a little uncertain about using the needle to prick her finger. What if she has diabetes? What treatment option would she choose? She imagines having to carry around a small device for the rest of her life. What if it breaks down or has errors? How would she know she was getting the right amount of insulin? The beta cells created from her own stem cells would cure her diabetes. She would never need to think about it again.

But her insurance does not cover the treatment, and it is very expensive. She also wonders how her religious community would feel about such a treatment. Would it be allowed? She takes a deep breath and pricks her finger with the needle.

In addition to questions already introduced by the two previous scenarios, the question that is introduced is:

- Culture and religion: How could and should culture and religion influence the implementation of nanotechnology enabled devices?

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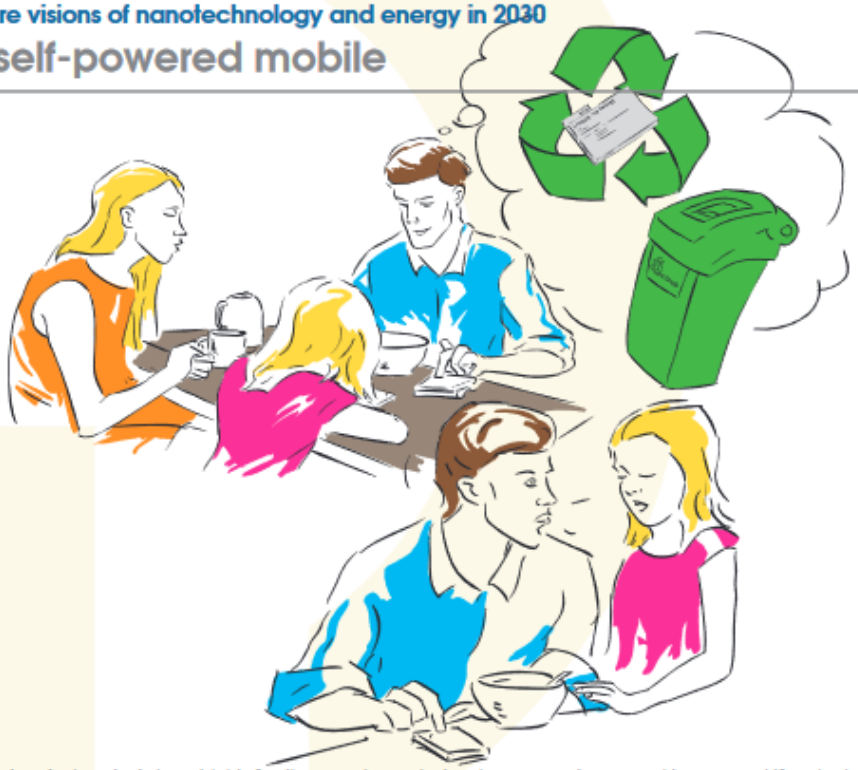
Future visions of nanotechnology and energy in 2030

A self-powered mobile



It's Sunday Morning. Andrew is sitting with his family around the breakfast table. An article on his news feed catches his eye; it's another piece about the latest trends in mobile phone technology. Six months ago, Andrew bought two new, self-powered, mobile phones; one for himself and the other for his daughter Emma. The mobile is coated with a nanomaterial that generates an electrical current when it interacts with common clothing materials – for example the lining of your pocket.

Andrew thinks about some of the other news articles he has read recently about the different nanotechnologies used in mobile phones these days. Most of the articles emphasise how the mobiles use much less energy and last much longer than they used to. However, a number of articles have raised questions about the environmental impact of the manufacturing process of the nanomaterials like the one used in the power-generating coating on his phone. An additional problem is that many of today's self-powered portable devices end up in the wrong bin at recycling centres because, at the moment, recycling centres are still not sure how to treat the waste from portable devices coated with nanomaterials. Andrew is not sure what to think. After all, many electrical devices have an environmental impact, and if we had to consider the environment at every turn we would still be living in the Stone Age.

Andrew's thoughts are interrupted by Emma, who announces that she needs a new mobile phone. Andrew is surprised. He asks her if her mobile has stopped working. Emma explains that the mobile works perfectly, and the battery is never a problem. The problem is that there is new model on the market, and she needs it because all her friends already have it!

Questions introduced by the scenario include:

- Environmental impact: How will self-powered electronic devices enter into environmental recycling circuits? What broader environmental impacts could be imagined? How should the environmental lifecycle of nano-enabled devices look like?
- Culture and appropriation: Can business and consumer culture adapt to a future where devices will last (much) longer?

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Future visions of nanotechnology and energy in 2030

Doing the laundry

Anna and Emma are playing outside in the sun. The girls are playing in Anna's parents' garden. After a while they are hungry and go inside the house. As they search for food, Emma looks around. She sees laundry piled high around the house. It is very warm in the house. Emma cannot help but compare the house to that of her parents. Their house is always very comfortable to be in, and they can do laundry whenever they want. Emma knows she is lucky. Her family makes some money by selling energy to larger distributers, and they are able to produce much of their own energy as well. Her parents were able to buy new nano-windows that regulate the temperature in the house, and they also have nano-enhanced solar panels for producing their own electricity.

Emma thinks about how her dad complains about the bullying tactics of the larger energy distributors. They pay almost nothing for his electricity, but they ask for twice the amount when they want to sell it back. Her mom is advocating for the right of small energy distributors, like her parents, to be allowed to sell their electricity directly to consumers. Emma knows that Anna's parents cannot afford the new nanotechnologies that her family are so fortunate to have, which is why she never complains about the temperature in the house whenever she goes to visit Anna.

Questions introduced by the scenario include:

- Justice and equality: Should energy production be de-centralised and how should such a system work? Could nano-enabled energy production systems be designed to favour small energy producers? Should we make sure everyone would have access to nanoenabled energy production, or must we accept inequalities in access?

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A malfunction in the system

It is 6.15 am on Monday morning. As usual, Andrew is awake before the alarm clock rings. He needs to get ready to go to work. He goes into the kitchen to get a cup of coffee and check the news. He looks around to see if his daughter, Emma, is already awake. She isn't. He will have to go and wake her up soon. As he picks up his laptop from the kitchen counter, he notices the red light for low battery is still on. That's strange. The laptop should have charged itself overnight through contact with the kitchen worktop, one of the multiple wireless charging stations they have around the house. He probably just needs a new battery for his ancient laptop but he walks out to the hallway to check the house's system control panel. All the lights on the panel are flashing red. Great! He can forget about that cup of coffee before work. Emma has heard him in the hallway and comes out to see what is happening.

Andrew tries to call the maintenance service to arrange for someone to come and fix the installations in the house but there is no signal. Emma thinks the whole situation is very exciting. It's the first time she has experienced a malfunction in the control system for the house. Maybe it's a cyberattack! She looks at her dad and tells him that one of her friends told her that if the country's energy control system were hacked, then everything would stop working. There would be no trains, no gas, no power, no TV, no air conditioning. Andrew looks at her and tells her to calm down and stop being so dramatic, as he makes his way toward the garage to check if the car has enough charge left to get him to work..

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- Security and (inter) dependency: What are the trade-offs in an increasingly interconnected house and societal infrastructure? How should we develop and protect our infrastructure in our homes and societies in the future?

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Future visions of nanotechnology and food in 2030

Pizza for two

Peter and Sofia are in the supermarket to shop for dinner. It's a little late, and they are both already starting to feel hungry. They decide on pizza. Neither of them have any interest in or patience for cooking tonight. They see some freshly made pizza - ready for the oven. Perfect. As they grab for two pizza's Sofia notices there is something different about the packaging. It must be the new smart nano packaging that they have heard so much about on the news!

Sofia reads aloud the text written on the packaging. Apparently, it is a new smart packaging that extends the shelf life of the pizza. It contains antibacterial nanoparticles, in-built sensors that warn you if the food is contaminated or has been exposed to harmful bacteria, and it is made of biodegradable plastic. Peter thinks it sounds great but Sofia is not convinced. She has just read that recent studies have shown that the nanoparticles can migrate into the food and contaminate it. The exact health related risks associated with the nanoparticles is still uncertain, but some researchers suspect that exposure to the nanoparticles might be related to infertility in women. The scientific community and the regulatory authorities are not in agreement on how to deal with this uncertainty.
Sofia and Peter stare at each other in silence. They were planning to start trying for a baby soon, so they are not sure whether to eat the pizza or not. Glurg, glurg glurg, rumbles Peter's tummy. They start laughing hysterically. They are both very hungry and they decide to eat the pizza. As they walk out the supermarket they continue to discuss the smart packaging. They both agree it is good to have food that can stay fresher for longer, but Sofia doubts that it is really necessary. She thinks she would always be able to see or smell if food is fresh. Peter wonders how it was possible for the packaging to be in the supermarket when there is still uncertainty surrounding the health effects of the nanoparticles. Sofia has to laugh a bit about Peter's concerns. She points out to him that we often accept health risks in relation to food, reminding him of the countless beers and cigarettes he had at the party last Saturday night.

Questions introduced by the scenario include:

- Risk and uncertainty: How should the benefits and uncertainties of new food packaging be managed in the future? Are they more or less than other health- related uncertainties we expose ourselves to?
- Distribution of risk, fairness: Would it be ok if uncertainty on possible health risks of nano-packaging only affected some groups (e.g. women or children) and how should that we managed?
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Future visions of nanotechnology and food in 2030

Dreaming of carrot cake

Theresa is 80 years old. She is living in a nursing home. Her family visit her often. She particularly likes the visits of her daughter, Sofia. She always brings a carrot cake, made from old-fashioned carrots and covered in thick sugary icing. The nurses at the home have told Sofia to stop bringing the cake. It's unhealthy. Luckily for Theresa, Sofia refuses to listen to the nurses. It makes Theresa happy to eat the cake. It reminds her of her own mother and her childhood in the countryside. She looks outside the window and dreams about when she was a young girl. She lived with her parents in a small village. She would spend her Saturdays at the local market with her mother, shopping for the best vegetables and meat. They would then take the rest of the afternoon to prepare the family meal for the Saturday evening. They would always make a carrot cake for desert.

Today, very few people cook a meal like she and her mother used to. Instead, most people eat the new super foods, made using nanotechnology and fancy processing techniques. The new super foods are a huge success. Everyone loves them. There are so many choices available: any flavour, any texture, any colour; ready to eat, hot or cold. And none of them are unhealthy! Even the triple chocolate hamburgers contain all the main vitamins and minerals you need. You can even buy the food tailor-made for different age groups and genders to make sure all your nutritional needs are meet. Sofia is always telling Theresa how difficult it is these days to buy old-fashioned vegetables. They are very expensive, and only found is small exclusive shops. Theresa's daydreaming is interrupted as a nurse knocks on her door to tell her Sofia has arrived. She smiles. She can already smell the carrot cake as Sofia makes her way down the hallway.

Questions introduced by the scenario include:

- The meaning of food: How would we like our relationship with food to develop in the future?
- Equality: Will nano-enhanced food be a luxury product or the opposite?

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Future visions of nanotechnology and food in 2030

Future party tricks

John looks around the room on the guest for his 35th birthday. Everyone seems to be having a good time. He walks over to the corner to speak to Peter and Andrew. They are busy trying to determine their next drink. For his party John has bought a lot of the new nano liquids. The nano liquids can be programmed to many different colours, tastes, nutrient and alcohol levels. All you have to do is decide the drink you would like to make, and then zap the nano liquid with a microwave transmitter. This will activate nano-capsules in the liquid that then turn the drink into your desired choice. John is relieved that no one has mentioned any concerns over the nano capsules in the liquid. The producer of the nano liquid writes the capsules are excreted out the body during normal digestion processes.

Peter is arguing for enhancing the wood smoke flavour of the next drink, while Andrew is more in favour of enhancing the taste of green pepper – maybe adding a bit of omega-3 oil to get a little bit of a health effect. Sofia comes over to join the conversation. She hands Peter a glass of white wine to ask for his opinion. Peter tries a sip, and almost spits it out as he discovers it is actually red wine. Sofia explains the wine was made using nano filters that can remove the red colour.

John laughs at them all, and suggests they set up a competition for the craziest combination of ingredients in a drink that still has to taste good.

Questions introduced by the scenario include:

- Desirability: What are desirable applications of novel nano food technologies?
- Justice and equality: If we have nano-enabled liquids (or super foods), how should they be distributed in our societies? Should everyone have access to them?

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Figure 17: Posters on Future visions on nanotechnology and health, food and energy.

Developing scenarios of use for food, health and energy in 2030

GoNano

Future visions of nanotechnology and health in 2030

Monitoring for (un)healthy control?

Sofia turns off the alarm clock, yawns and finally sits up. Time to get up. She turns off the flight mode on her phone, turns on the Bodysensor app and holds her breath for a few seconds as it updates. Then she sighs. No signs of cancer. Yet. Time to wake up the kids.

Since they installed nanorobot sensors in her breasts it has become a daily routine for Sofia to check the Bodysensor app first thing in the morning. Her mother died of breast cancer seven years ago. Apparently Sofia is also genetically predisposed to develop breast cancer. The nanorobot sensors were offered to her in order to detect eventual cancer cells as early as possible. As Sofia sets the table for breakfast, she thinks of her mother. If only her cancer had developed five years later, she would most likely have survived. Since the development of cancer treatments enhanced with nanotechnology, very few die from breast cancer, and no-one has to suffer from the terrible side effects of the out-dated chemotherapies and radiotherapies of the past. Today, they use tiny nanorobots to transport the therapeutic agents directly to the tumour, so that patients do not need to have their entire body bombarded with chemicals and radiation. Tiny nanosensors are installed in the breast tissue of cancer patients that kept track of how they react to the treatment. In this way doctors can make adjustments as soon as it is needed – and monitor any recurrence of tumour cells.

Peter is getting the kids ready. Sofia sits down with a cup of coffee. She looks at her phone and fights the temptation to check the Bodysensor app. The app is her safety net, but also a daily reminder that one day the figures might not be as she hoped. And what if the app doesn't detect everything? What if someone hacks into her phone and changes the settings or reads her data? Before the nanosensors were installed, Sofia didn't think much about cancer. Now she thinks about it all the time. Peter comes in with the kids, and they all sit down to have breakfast. Sofia is grateful to be alive.

The questions that are introduced include:

- Distribution of responsibility: Should Sofia be able to monitor herself?
- Appropriation: Will Sofia get used to the BodySensor app and possibly forget about after a while?
- Trust and privacy: Could the sensors break down or need replacement? How is the data shared? How does the app look like? Can others see or hear it?

3

Future visions of nanotechnology and health in 2030

Smelling disease

4

John is sitting in front of a computer at the pharmacy for his yearly health check-up. The yearly check-up is mandatory for everyone above the age of 30. On the computer screen in front of him, he has a view of a doctor sitting in front of a desk looking into a computer screen. On John's side of the screen there is a mechanical device that looks a bit like a nose. An assistant cleans the noselike device and asks John to open his mouth and take the device into it and blow his breath back and forth for a minute. The artificial nose can detect many types of disease. It takes 15 minutes for the doctor to return with the test results.

As he waits, John speculates about all the different types of diseases he might have – hasn't he been a bit more tired lately, and what about the other day when he suddenly couldn't remember the name of one of his colleagues? He is scared be might be developing a mental health disorder like dementia or Alzheimer's disease, or neurological disease like ALS where your muscles slowly die. Imagine not knowing when or how the disease would develop. John knows that medications today are much better than they used to be – but what was it he read the other day, about some medications only working well for some people and not for others? Was it that people of African descent who had the worst coverage with the new medications? The doctor returns to the screen. John's stomach is twisted up in a hard uneasy knot as he waits for the news. John is fine.

The questions that are introduced include:

- Societal and cultural implementation: What could the psychological effect of an increased focus on health and health control individually, and at a societal and cultural level be?
- Responsibility and trust: Would it be ok to have a diagnosis given at a distance? Where should a yearly-health check-up take place? Should everyone go to the pharmacy, or e.g. buy a 'smelling nose', would a nurse travel around with the "nose"?
- Justice and equality: Would it be ok to have medications that are only available for some ethnic groups (or genders)? How should health insurance look like in 2030?
- Privacy: how is data shared and protected?

5

Future visions of nanotechnology and health in 2030

Doctor at home

6

Sofia is sitting on the toilet in her bathroom at home. She is opening the package of a new home test for diabetes. The test is a needle with a nanochip. She will need to prick her finger to provide a blood drop for analysis on the nanochip. The chip can immediately detect if Sofia suffers from diabetes 1 or 2.

Recently, Sofia has felt very tired and thirsty and she constantly had to go the toilet. She searched online to check her symptoms and ended up on a webpage about diabetes. The website also described different treatment options. One option is a small wearable device developed using nanotechnology. This device constantly measures the level of insulin, and injects extra insulin when needed. Another option is to create new beta cells in the body. With diabetes type 1, beta cells in the body stop working. Using nanotechnology, doctors are able to create new beta cells from stem cells, and place those in the body. No other medication is needed.

Sofia considers her situation. She is already happy the home test for diabetes was cheap and easy to buy. Since health insurance does not cover check-ups at the general practitioner anymore, home tests are very useful. She is a little uncertain about using the needle to prick her finger. What if she has diabetes? What treatment option would she choose? She imagines having to carry around a small device for the rest of her life. What if it breaks down or has errors? How would she know she was getting the right amount of insulin? The beta cells created from her own stem cells would cure her diabetes. She would never need to think about it again.

But her insurance does not cover the treatment, and it is very expensive. She also wonders how her religious community would feel about such a treatment. Would it be allowed? She takes a deep breath and pricks her finger with the needle.

In addition to questions already introduced by the two previous scenarios, the question that is introduced is:

- Culture and religion: How could and should culture and religion influence the implementation of nanotechnology enabled devices?

7

Future visions of nanotechnology and energy in 2030

A self-powered mobile

8

It's Sunday Morning. Andrew is sitting with his family around the breakfast table. An article on his news feed catches his eye; it's another piece about the latest trends in mobile phone technology. Six months ago, Andrew bought two new, self-powered, mobile phones; one for himself and the other for his daughter Emma. The mobile is coated with a nanomaterial that generates an electrical current when it interacts with common clothing materials – for example the lining of your pocket.

Andrew thinks about some of the other news articles he has read recently about the different nanotechnologies used in mobile phones these days. Most of the articles emphasise how the mobiles use much less energy and last much longer than they used to. However, a number of articles have raised questions about the environmental impact of the manufacturing process of the nanomaterials like the one used in the power-generating coating on his phone. An additional problem is that many of today's self-powered portable devices end up in the wrong bin at recycling centres because, at the moment, recycling centres are still not sure how to treat the waste from portable devices coated with nanomaterials. Andrew is not sure what to think. After all, many electrical devices have an environmental impact, and if we had to consider the environment at every turn we would still be living in the Stone Age.

Andrew's thoughts are interrupted by Emma, who announces that she needs a new mobile phone. Andrew is surprised. He asks her if her mobile has stopped working. Emma explains that the mobile works perfectly, and the battery is never a problem. The problem is that there is new model on the market, and she needs it because all her friends already have it!

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Future visions of nanotechnology and energy in 2030

Doing the laundry

Anna and Emma are playing outside in the sun. The girls are playing in Anna's parents' garden. After a while they are hungry and go inside the house. As they search for food, Emma looks around. She sees laundry piled high around the house. It is very warm in the house. Emma cannot help but compare the house to that of her parents. Their house is always very comfortable to be in, and they can do laundry whenever they want. Emma knows she is lucky. Her family makes some money by selling energy to larger distributers, and they are able to produce much of their own energy as well. Her parents were able to buy new nano-windows that regulate the temperature in the house, and they also have nano-enhanced solar panels for producing their own electricity.

Emma thinks about how her dad complains about the bullying tactics of the larger energy distributors. They pay almost nothing for his electricity, but they ask for twice the amount when they want to sell it back. Her mom is advocating for the right of small energy distributors, like her parents, to be allowed to sell their electricity directly to consumers. Emma knows that Anna's parents cannot afford the new nanotechnologies that her family are so fortunate to have, which is why she never complains about the temperature in the house whenever she goes to visit Anna.

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11

Future visions of nanotechnology and energy in 2030

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12

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Future visions of nanotechnology and food in 2030

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Future visions of nanotechnology and food in 2030

Dreaming of carrot cake

16

Theresa is 80 years old. She is living in a nursing home. Her family visit her often. She particularly likes the visits of her daughter, Sofia. She always brings a carrot cake, made from old-fashioned carrots and covered in thick sugary icing. The nurses at the home have told Sofia to stop bringing the cake. It's unhealthy. Luckily for Theresa, Sofia refuses to listen to the nurses. It makes Theresa happy to eat the cake. It reminds her of her own mother and her childhood in the countryside. She looks outside the window and dreams about when she was a young girl. She lived with her parents in a small village. She would spend her Saturdays at the local market with her mother, shopping for the best vegetables and meat. They would then take the rest of the afternoon to prepare the family meal for the Saturday evening. They would always make a carrot cake for desert.

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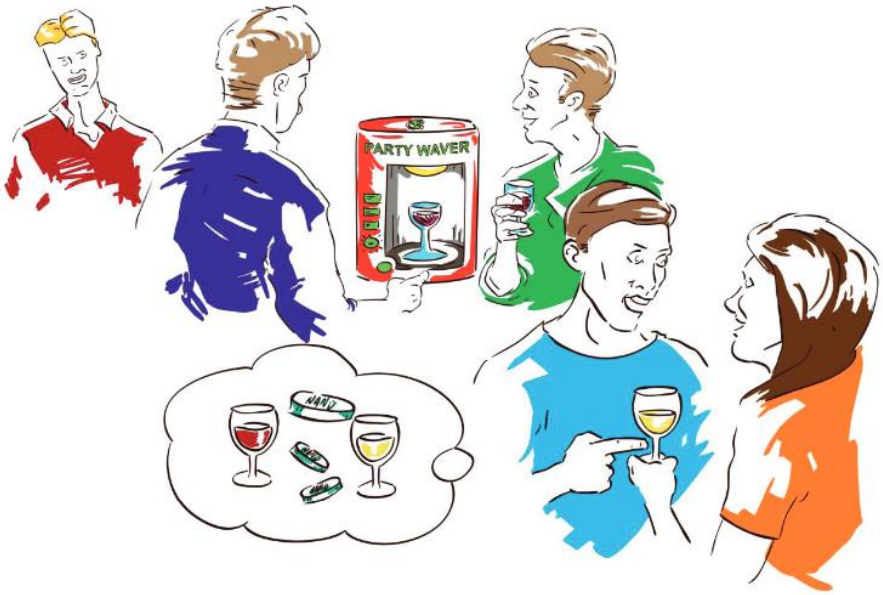
17

Future visions of nanotechnology and food in 2030

Future party tricks



18

John looks around the room on the guest for his 35th birthday. Everyone seems to be having a good time. He walks over to the corner to speak to Peter and Andrew. They are busy trying to determine their next drink. For his party John has bought a lot of the new nano liquids. The nano liquids can be programmed to many different colours, tastes, nutrient and alcohol levels. All you have to do is decide the drink you would like to make, and then zap the nano liquid with a microwave transmitter. This will activate nano-capsules in the liquid that then turn the drink into your desired choice. John is relieved that no one has mentioned any concerns over the nano capsules in the liquid. The producer of the nano liquid writes the capsules are excreted out the body during normal digestion processes.

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- Justice and equality: If we have nano-enabled liquids (or super foods), how should they be distributed in our societies? Should everyone have access to them?

Developing scenarios of use for food, health and energy in 2030

The scenarios of use collect up on the analysis of future visions of nanotechnology application, questions on acceptability and sustainability (cultural appropriation, societal implementation) and desirability (gender and values). The scenarios take an everyday life situation as a starting point to illustrate how nanotechnologies could be implanted in the future.

The scenarios take the promise of the technology vision for granted. To introduce questions of desirability, sustainability and acceptability each of the scenarios play with how human, societal and cultural dynamics influence the way technologies become integrated in and part of people's lives.

In this booklet you will find twelve scenarios, the technology vision it depicts, and the societal, cultural and value questions it tries to open up for discussion.

This material was developed for the GoNano citizen meetings in fall of 2018 on future nanotechnolgy for health, energy, and food. The aim of the information material was to: present the citizen participants with short and easy-to-understand information about nanotechnology; align the discussion in the meetings with the research and innovation priorities with professional stakeholders; introduce visions of future nanotechnology in Health; and to introduce societal, cultural, legal and ethical questions and uncertainties.

GoNano

www.gonano-project.eu

GoNano is a Coordination and Support Action funded by the European Union under the NMBP Programme of Horizon 2020, Grant Agreement n° 768622.

Figure 18: The booklet with future visions

THE GONANO CO-CREATION APPROACH

GONANO DELIVERABLES

VIDEOS- BEST PRACTICES IN CO-CREATION

VIDEOS- ANIMATED PRODUCT SUGGESTIONS

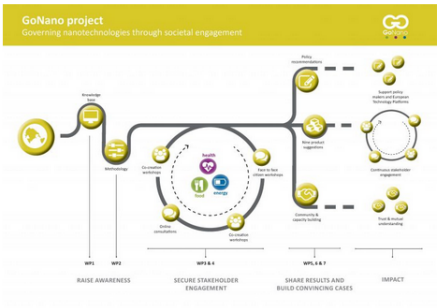
GO BACK TO THE JOIN THE NANODEBATE HOMEPAGE

Governing nanotechnologies through societal engagement

Nanotechnologies – the purposeful engineering of matter on the atomic or molecular scale – have given rise to great expectations in recent years, unlocking new research opportunities in areas as diverse as energy, healthcare, electronics, food, and construction. At the same time, concerns have been raised about possible unintended consequences of the use of nanomaterials.

GoNano believes that research and innovation can benefit from being more open to societal needs and concerns (the process of making research and innovation more transparent, reflective and open to societal needs and concerns has become known as responsible research and innovation). Over the course of three years, GoNano enabled collaborative development (co-creation) between citizens, civil society organizations, industry, researchers and policy-makers across Europe to align future nanotechnologies with societal needs and concerns. With the GoNano approach, we aimed to demonstrate how researchers can work with publics and professional stakeholders to create novel suggestions for future nanotechnology products the nanotechnological application areas of food, health and energy.

OUR APPROACH



Raise Awareness

Work package (WP) 1 & 2 focussed on creating a knowledge database and develop a backbone for the pilot studies.

In WP1 GoNano first performed some exploratory research on how to facilitate and pursue a co-creation process. First, key findings from previous and ongoing EU and national engagement projects and relevant academic literature was reviewed and summarized (please see *D1.1- Building on the state-of-the-art: ex-post evaluation on mutual learning)*. Next, interviews with RRI experts, co-creation practitioners, risk communication experts and societal engagement experts regarding stakeholder engagement in nanotechnology were used as input for the development of the pilot studies (please see D1.3 Stakeholders engagement in nanotechnologies: areas and issues for a dialogue). The role of values and culture in societal debased is described in *D1.2- Understanding the role of culture, gender and communication traditions, and their implications for engagement methodologies, communication and dissemination*.

WP2 describes the methodology behind the GoNano co-creation approache (please see *D2.1.- The development and thoughts behind the co-creation approach)*. The aim for the pilot methodology development is to on the one hand design a process of co-creation through which citizens and professional stakeholders are facilitated to become responsive to each other' s needs and concerns. On the other, to support mutual learning and increased understanding among the stakeholder groups. To support interaction between project partners and broader audiences throughout the different co-creation stages, an online co-creation platform was launched (please see *D2.2- The co-creation platform*).

Secure stakeholder engagement

WP 3 & 4 aimed to implement the GoNano co-creation process.

WP 3 focussed on envisioning and deliberating with citizens (please see *D3.1-Background material as input for the citizen workshop*). The background material was developed to 1) educate the participants about nanotechnologies, 2) introduce questions of risk, regulations, societal implementation, ethics, culture and the role of values, and 3) illustrate and situate, through future everyday use scenarios of nanotechnologies applications, visions of future nanotechnology applications in a context of use where the citizens can draw on their lay expertise to address the desirability, acceptability and sustainability of the nanotechnology applications. The background materials are translated to Dutch, Czech and Spanish. WP3 is designed to be implemented in parallel and close interaction with WP4, which is about co-creation with professional stakeholders. As part of the co-creation pilot studies in The Netherlands (health), Spain (energy) and Czech Republic (food), citizens were consulted about their wishes, needs and concerns regarding future nanotechnology applications (please see *D3.2- citizens needs and values in relation to nanotechnology in food, health and energy*). This output was used as input for the first and second stakeholder workshops (video), stimulating citizens, civil society organizations, industry, researchers and policy-makers across Europe to co-create research aims and think about concrete (product) suggestions for future nanotechnologies. The aim of the first round of stakeholder workshops was to come up with concrete 'responsive' design suggestions that can be fed back in ongoing research and innovation activities, building on the outcomes of the citizen workshops (please see *D4.2a- working papers on the designs and outcomes of first stakeholder workshops)*. The suggestions resulting from the workshops were shared and discussed more widely via an online citizen consultation (please see *D3.3- Briefing report on the outcomes of the online consultation)*. The results from the citizen consultation were in turn fed back into the second round of stakeholder workshops, focusing on the uptake of the responsive design suggestions of the previous round (please see *D4.2.b – Outcomes of co-creation workshops round 2*). The output of each co-creation session are multiple concrete (product) suggestions within the areas of food, health and energy that illustrate new opportunities for innovation and develop policy recommendations (To be submitted D4.5– product suggestions).

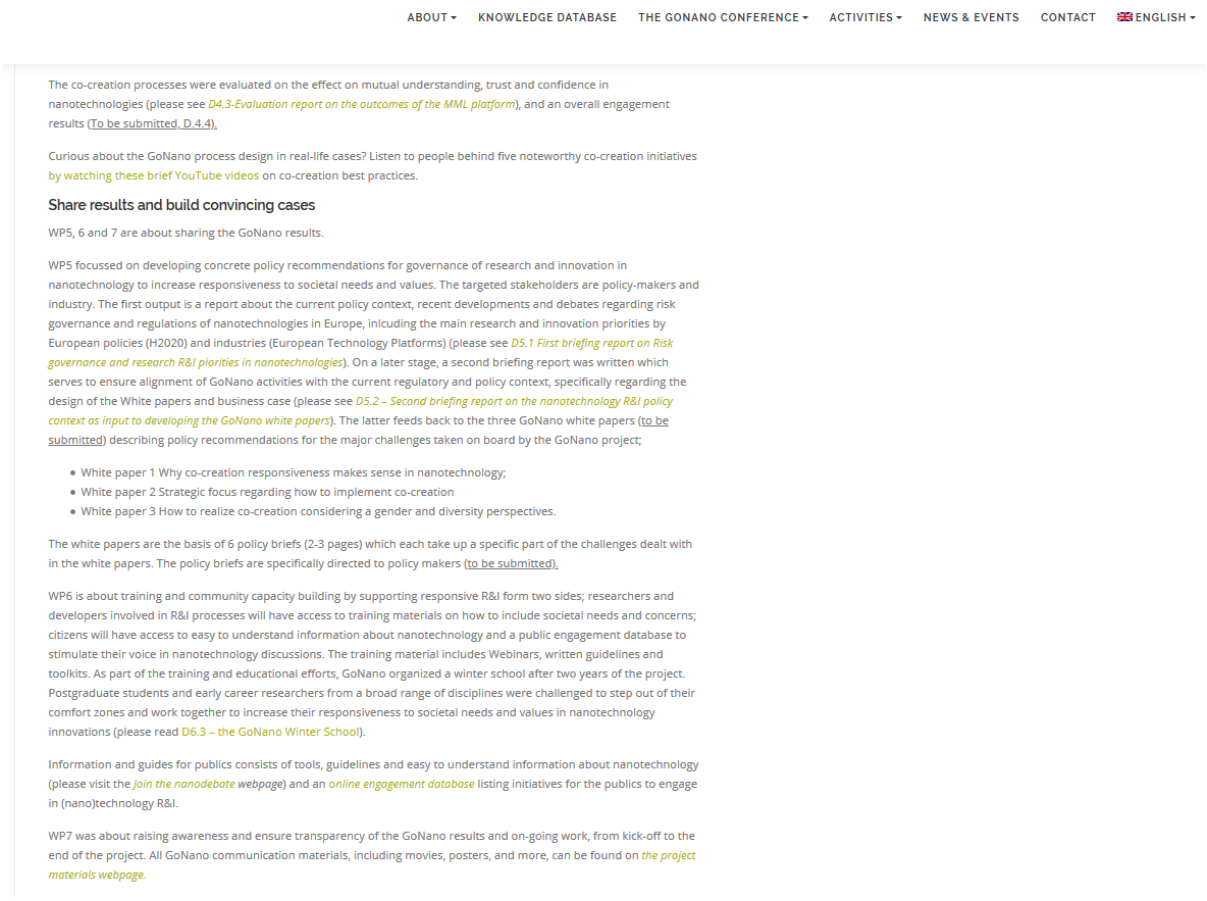


Figure 19: Screenshot of the GoNano co-creation approach webpage

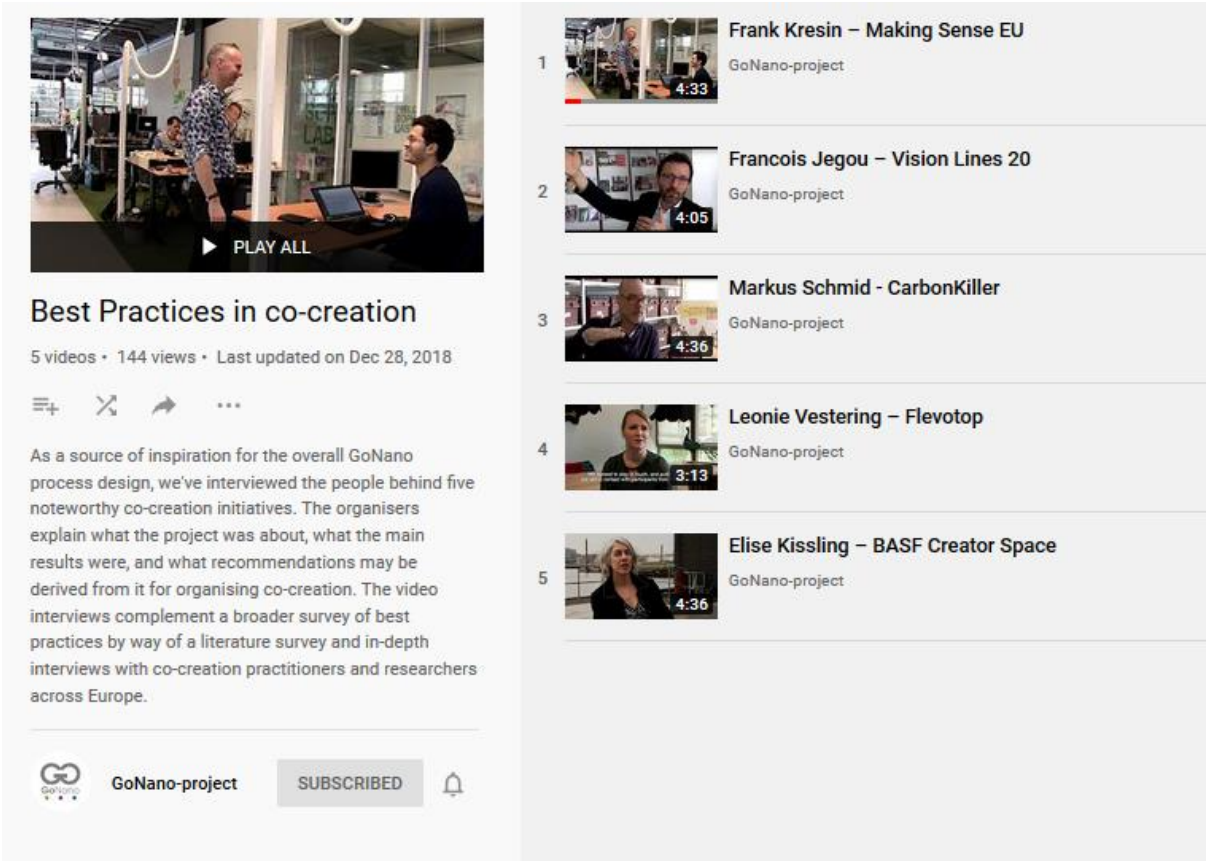


Figure 20 : Overview of 'the Best practices' section on the GoNano YouTube channel.