NANO2ALL
SOCIETAL ENGAGEMENT ON RESPONSIBLE NANOTECHNOLOGY

ROADMAP

FOR A MORE INCLUSIVE NANOTECHNOLOGY DEVELOPMENT IN EUROPE

Short Version

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CONTEXT AND FINDINGS FROM NANO2ALL

Over the past decades, awareness has grown that the impact of technologies is not always predictable, and unintended or unforeseeable consequences might occur. This unpredictability is inherent in the increasing complexity of new and emerging technologies (including nanotechnology) and their development processes. Inclusive approaches implemented under the terms of responsible research and innovation (RRI) can enable the identification and integration of inputs from stakeholders and the public into decision-making on research and innovation (R&I), contributing to the development of socially acceptable and desirable research and products.

RRI approaches were introduced early in nanotechnology development in Europe, including a proactive and anticipatory approach to nanotechnology risk governance by the European Union (EU), and the involvement of key stakeholders (including civil society representatives) in the risk debate at the EU level and in some Member States.

Further, among others, the EU invested in a range of initiatives to explore uncertainty around nanotechnology development, raise public awareness of the latest nanotech advances, and engage societal actors in a dialogue.

NANO2ALL (www.nano2all.eu) was funded by the EU with the aim of fostering RRI in EU policy and governance of nanotechnologies. In particular, NANO2ALL aimed to drive discussions on the conditions and actions necessary to enhance inclusiveness / societal engagement in nanotechnology R&I. This is a specific dimension of RRI, requiring interactions between relevant stakeholders, including companies, research organizations, policy-makers, civil society organizations, consumers, affected citizens and others, with the aim to align research, development and innovation with the values, expectations and needs of society.

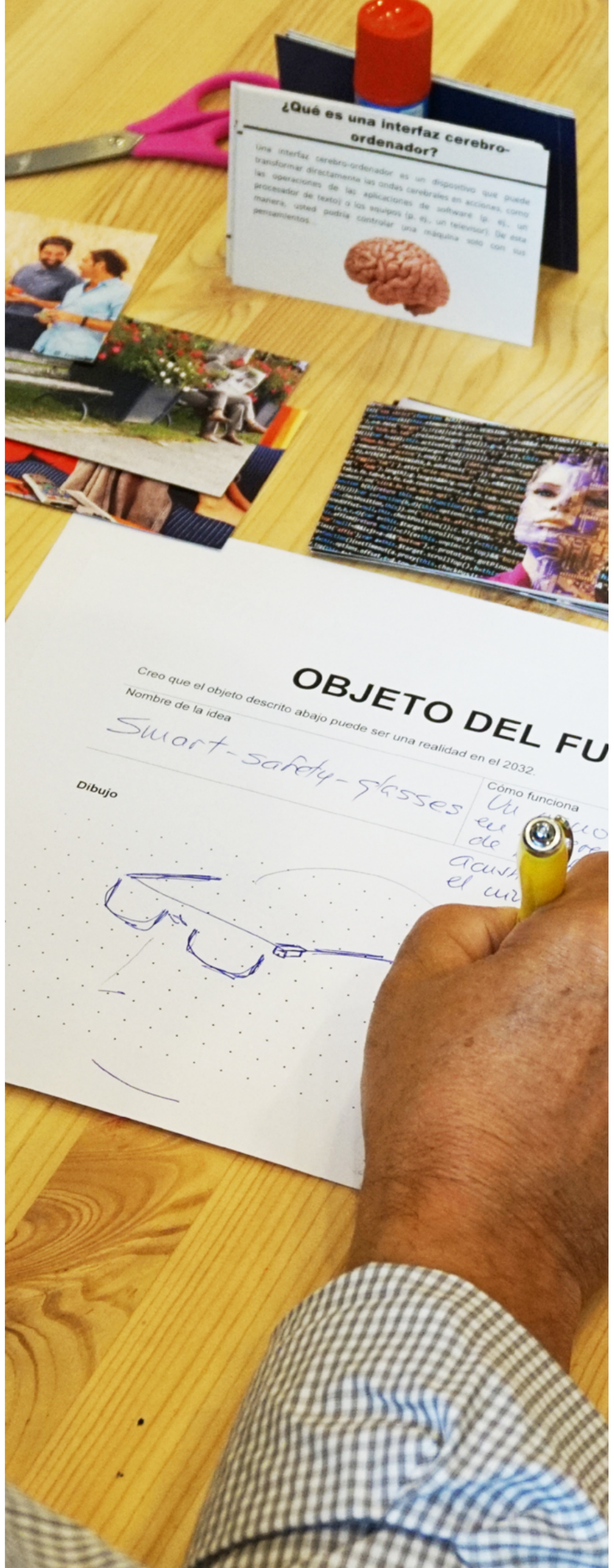
An output of NANO2ALL is a roadmap (the full version of the roadmap can be downloaded **here**) that integrates findings from the project's participatory and mapping activities. The roadmap also identifies specific actions that should be undertaken to increase societal engagement across the nanotechnology R&I value chains. The roadmap addresses primarily EU and national decision-makers in the Member States in areas of science and technology (with a focus on nanotechnology development).

Do we need to foster societal engagement in nanotechnology R&I?

NANO2ALL´s activities (including dialogues and case-studies) verified that there is a deeply-felt need for inclusiveness and integration of societal perspectives in the nanotechnology R&I ecosystem. Inclusive approaches have been implemented over the past 15 – 20 years in Europe to inform and enrich nanotechnology R&I. However, this has been mainly done at the EU level and in specific EU countries, and thus have not reached a full array of societal actors from different national, regional and local contexts in the EU.

Further, these initiatives often did not establish continuous interactions or trust-building between societal actors. There is, therefore, a need to set up frameworks for continuous interactions for the EU and Member States (including regional and local) levels with mechanisms to ensure that these feed directly into nanotechnology R&I decision-making across value chains.

There is also an expressed need to extrapolate lessons learned from the wide range of societal engagement initiatives that have been carried out in previous years to inform such future frameworks (that should preferably build on existing ones) for continuous societal engagement and RRI processes of other new and emerging technologies. The role of independent intermediaries (for instance science centres, professional moderators and science communicators) in the facilitation of interactions regarding responsible nanotechnology development should be reinforced.



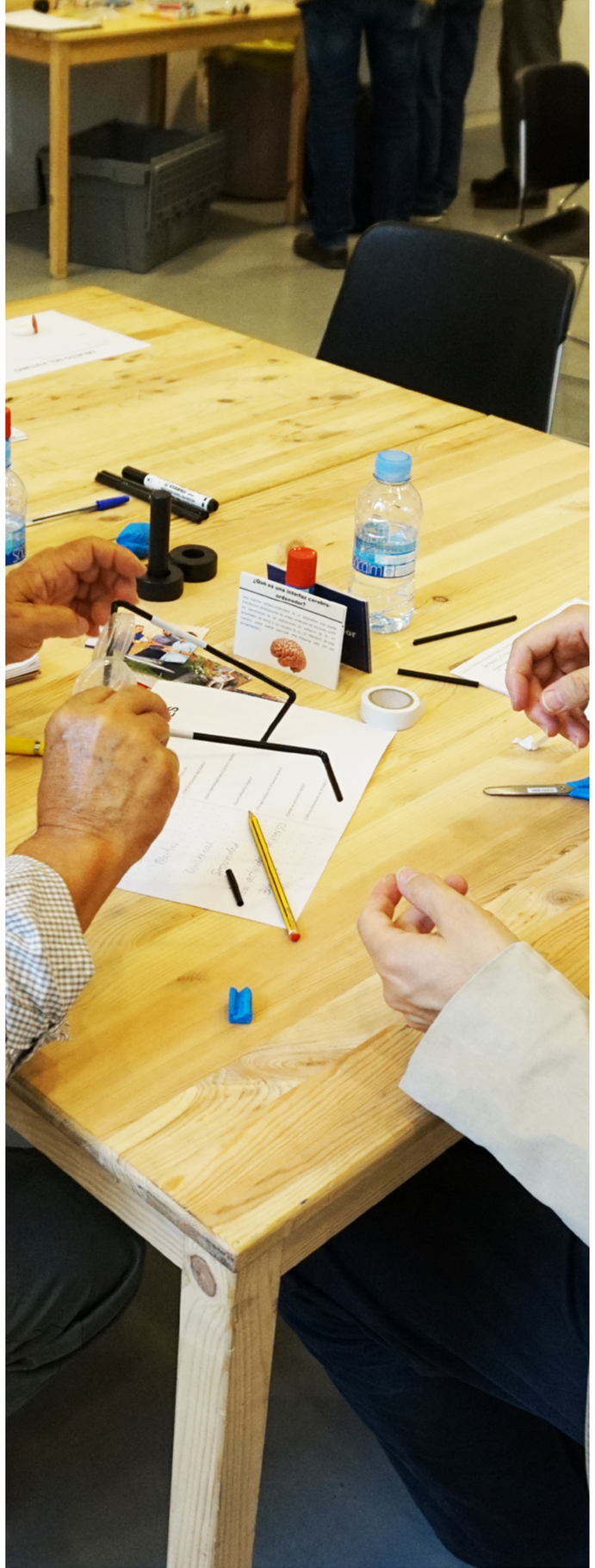
When and who do we need to engage and what should we discuss?

Findings from NANO2ALL suggest that societal actors (including citizens and their representatives) should be involved in the various stages of nanotechnology development. Consulted experts noted that interactions on more technical aspects should be left with scientists and innovators, and thus the inclusion of societal representatives and their views should be targeted at certain stages of decision-making. No consensus was found, though, on the 'best stages' for such engagement. The views on how society should be involved in nanotechnology R&I related issues, gathered through NANO2ALL´s activities, also differed.

These included, among others, the public consultation of citizens, the engagement of civil society to represent societal views, training selected citizens as mediators, and the nomination of trustworthy intermediaries. In addition, although it was not a specific focus of NANO2ALL, some expert feedback suggests that interactions should be established for tackling diverse topics.

The identified topics ranged from general societal needs (challenges) to allow priority setting for R&I, nanomaterial safety related issues (e.g. standards and labelling), broader ethical and societal impacts that nanotechnology developments may have (e.g. data privacy in nano-enabled brain-computer interfaces), as well as user / consumer feedback on nano-enabled products.

From the above list, it can be observed that many issues that require societal engagement approaches arise from both the development of nanotechnology (e.g. nanomaterial safety matters) and the ongoing intertwinement between nanotechnology and other fields (i.e. application fields of nanotechnology developments). Therefore, some of the aspects that require the inclusion of societal perspectives – such as right to privacy, human dignity and others – with regard to nanotechnology development may be of a more general character and not just "nano-specific".



What are the conditions to enhancing societal engagement in nanotechnology R&I?

NANO2ALL's analysis showed that several conditions have to be in place simultaneously in order to truly enhance societal engagement across nanotechnology R&I value chains. These conditions are broadly framed system-level pre-requisites, and thus can also be associated with other domains that belong under the same umbrella as nanotechnology (for instance new and emerging technologies), or even science and technology in general. Therefore, reference to other fields are often explicitly made within this roadmap.

A short description of the three main conditions, as well as the respective recommended trajectories and actions are presented below.

RECOMMENDED WAY FORWARD

Condition 1: Frameworks for systemised societal engagement in nanotechnology R&I

It is important to ensure the availability of dedicated frameworks (e.g. platforms and mechanisms) at EU and national levels – including regional and local, where relevant – that can facilitate systemised continuous interaction on a long-term basis between societal actors and R&I communities. In particular, concrete examples of possible types of frameworks can be identified, such as citizen consultations for nanotechnology R&I agenda setting, as well as government programmes for continuous interactions and trust-building.

TRAJECTORY 01

Evaluate past societal engagement activities in research and innovation in nanotechnology

Action 1.1

The European Commission supported by the Member States should **commission an evaluation study** (including impact assessment) of the societal engagement activities conducted in the past years in Europe and elsewhere at all stages of the nanotechnology R&I cycle - including policy-design, research agenda setting, research steering, R&I processes[1].

Action 1.2

The European Commission and the Member States should **use knowledge from such an evaluation** to elaborate a plan for the future promotion of societal engagement in nanotechnology development. This should identify and select existing frameworks or create new ones, and conceive mechanisms for implementing inclusive processes and their link / feed-into nanotechnology R&I decision-making at all stages in a systematic way. Knowledge from the evaluation should also inform processes in other emerging technology fields.

[1]Four levels of the research system where societal engagement is necessary, as recommended by the H2020 Advisory Group for Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing in its publication on the Outreach to newcomers and societal engagement in industrial technologies, 2018. **Available for download at**: https://publications.europa.eu/en/publication-detail/-/publication/5be04f7f-ff55-11e8-a96d-01aa75ed71a1

TRAJECTORY 02

Adapt existing frameworks (or create new ones where not existing) to increase the involvement of all actors, including citizens and their representatives in research and innovation decision-making at all stages

Action 2.1

Decision-makers at EU and Member States levels should **mandate and finance selected EU level and national platforms** to undertake systematic and continuous discussion and trust-building between societal actors – in a coordinated way between EU and national levels – informing EU and national nanotechnology policies and research and innovation agendas.

Action 2.2

Decision-makers at EU and Member States levels should **adapt current public consultations for setting R&I priorities** (covering nanotechnology and new and emerging technology fields) in a way that can allow the increased participation of citizens, through challenge-led forms of engagement / engagement starting from citizens´ life experiences, and using appropriate methodology to reach and involve them.

Action 2.3

Decision-makers at EU and Member States levels should **adapt existing EU, national and regional research and innovation funding programmes** to foster societal engagement in actual nanotechnology R&I processes (and of other new and emerging technologies) where such activities are linked with or build on each other.

Action 2.4

Decision-makers at EU and Member States levels should **set up advisory services to support the implementation of societal engagement in nanotechnology R&I** (and of other new and emerging technologies), including the identification of the most suitable approaches for interactions, considering the aims and available resources, as well as the moderation of such participatory activities.

Condition 2: Lifelong participatory culture in science and society matters

A participatory culture of the members of society (and of the representatives of their views) in scientific matters was frequently referred to in the NANO2ALL participatory activities as being a key a pre-requisite to increasing societal engagement in nanotechnology R&I. The recommendations have a wide scope and address the need for stimulating an open and inquisitive attitude among learners of all ages. Citizens should be able to gain awareness of the potential impacts of nano and other new and emerging technologies, and skills for contributing to the democratic governance of these technologies, through education and capacity-building about the state-of-the-art, potential benefits and risks that these technologies can bring to them. Citizens and society must be able to express their lifelong values, needs and concerns regarding science and technology from the outset and to participate in the co-design of policies and R&I which affect their lives. This will ensure that societal actors – including citizens – are willing, interested and able to engage.

TRAJECTORY 01

Promote capacity-building and reflections on nano- and other new and emerging technologies via the formal education system

Action 1.1

The European Commission and Ministries of Education in the Member States should **implement funding programmes for open nanoscience and nanotechnology (and other new and emerging technology) collaborative projects** – bringing schools in contact with universities and other stakeholders (similar to Nan-O-Style[2]). A bottom-up and inter-disciplinary approach should be promoted to allow different perspectives and the maximisation of entry points into the official curricula.

Action 1.2

Decision-makers at EU and Member States levels should **promote** the uptake, translation, adaptation – as well as the maintenance of existing and the development of new (where necessary) **nano- and other emerging technology related teaching materials** – by European, national and regional platforms offering lifelong learning to teachers and marketplaces of educational materials.

Action 1.3

The European Commission, relevant national ministries and regional authorities should ensure that publicly and privately funded R&I platforms equipped to engage with public audiences **provide a fast track framework for interaction between teachers and researchers** to allow information and knowledge provision. Examples of potential platforms include the EU NanoSafety Cluster and the NANOfutures Working Group on Societal Engagement.

[2] www.bionanonet.at/news/latest-news/723-project-nano-o-style

TRAJECTORY 02

Promote scientific culture and critical thinking on nano- and other new and emerging technologies among citizens via lifelong learning and science communication

Action 2.1

The European Commission and relevant national ministries should **fund** (including through a dedicated strand for science and society matters in Horizon Europe) **informal lifelong learning programmes** that increase the knowledge, skills, values and attitudes necessary for scientific citizenship, targeting defined audiences (for example considering age, ethnicity and economic disadvantages) in ways that recognise their unique needs. Creating a bi-directional loop of information in the everyday life of citizens and civil society should trigger the willingness and acceptance of people to learn more through inclusiveness, experimental courses and lifelong learning programmes. This could be complemented by interdisciplinary funding schemes supporting citizen-science projects. Lifelong learning programmes and funding schemes should be embedded into a unique standardised procedure to avoid fragmentation and risk of failure.

Action 2.2

The European Commission should **develop a clear set of criteria (performance indicators and guidelines) on the quality of science communication activities**, which can facilitate scientists and science communicators in designing communication activities and enable research funders to screen proposals and help determine the allocation of funds. EU-level funding frameworks could set the example and provide a blueprint for national policy-makers and research funders. Science communicators or non-academic stakeholders should be involved in peer-reviewing the scientific communication component of research proposals. Newly-created or existing regional, national and EU innovation ecosystems and Science Communication Offices should also use these guidelines to provide tailored advice to researchers.

Condition 3: Open research and innovation ecosystem towards societal perspectives

The increased openness and responsiveness of the R&I ecosystem as a condition for societal engagement was also found to be important. The recommendations received suggest that the opening up of the system should be promoted by decision-makers through generating genuine interest and motivation for RRI, rather than enforcement by top-down regulation. This is especially the case for the private sector. In addition, considering the cost, effort and time necessary to drive change, long-term measures should be considered over short-term ones.

TRAJECTORY 01

Foster RRI awareness and competence within the nanotechnology R&I community and incentivise the adoption of RRI by relevant institutions at regional, national and EU levels

Action 1.1

Decision-makers at EU and Member States levels should **develop a long-term plan for the promotion of awareness-raising and capacity building to members of the R&I community with regard to RRI** principles and practices. Dedicated training programmes should be coupled with structural changes to the education system resulting in the alignment of academic programmes with RRI goals. In addition, innovation ecosystems such as the European Institute of Innovation and Technology, Joint Technology Initiatives and the European Innovation Council should act as multipliers to foster engagement and provide evidence that RRI can be beneficial to industry.

Action 1.2

National and regional authorities should **induce structural and institutional changes within research organisations, including the adaptation of the evaluation frameworks** of these entities and researchers to RRI goals (such as consideration of public engagement criteria for professional advancement and awards), the involvement of societal engagement specialists in research projects and the institutionalisation of new profiles – such as a Responsible Research and Innovation Manager. This will enable RRI dimensions to become mainstream, and allow research players to recognise them as an important responsibility and value within their work. The elaboration of targets and key performance indicators (KPIs), as well as specific incentives, can facilitate the implementation of this process.

Action 1.3

Decision-makers at EU and Member States levels should **develop and continuously update EU and national level measures in order to incentivise the implementation of RRI**. This should build as much as possible on existing frameworks (for instance Corporate Social Responsibility in industry) and reward schemes that can be broaden by RRI aspects. A brief “RRI checklist” for companies (particularly start-ups) can encourage them to follow RRI principles. Moreover, the identification of RRI KPIs could facilitate the creation of a certification scheme with an “RRI label” and a ranking system for the most RRI-compliant companies, along with awards, prizes and incentives. This could encourage bottom-up and organic RRI practices while fostering a truly entrepreneurial RRI discovery process.

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