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DELIVERABLE

5.4

Is there a business case for co-creation in nanotechnology research and innovation?

GoNANO DELIVERABLE 5.4



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EXECUTIVE SUMMARY

This report explores the potential for a 'business case' for co-creation in nanotechnology research and innovation, building on the findings of the co-creation activities in the European project GoNano (Governing Nanotechnologies through Societal Engagement). The overall objective of the GoNano project was to improve the responsiveness of research and innovation processes to public values and concerns. GoNano brought together citizens, researchers, professional users, civil society organisations, industry and policy makers in a process of deliberative workshops and online consultations around three nanotechnology application areas (health, energy and food) to co-create concrete suggestions for future nanotechnologies. This final GoNano report reviews to what extent GoNano has inspired and encouraged innovation actors to adopt co-creation in research and innovation, working in an inclusive way to align product development to societal values needs and expectations.

The report explores the business case for co-creation both in the narrow and in the broader sense of the term, where, at its narrowest, the business case would be the *monetary value* it offers to *commercial companies*, and, in the broader sense, the business case would include *non-monetary value* (such as reputation, innovation potential, or access to markets) to *innovation actors* (i.e. including researchers, funding organisations, etc. as well) as adopters of co-creation processes. It reviews the GoNano experiences, considering feedback received from companies and other innovation actors on the GoNano co-creation activities, and reflects on the findings of a workshop with external stakeholders in October 2020 which aimed to explore the business case for co-creation in the context of three EU-projects funded under the NMBP-13-2018 call on risk governance in nanotechnology: NANORIGO, GOV4NANO and RISKGONE.

The report concludes that there may well be a business case for co-creation, both in the narrow and broader sense of the term. The GoNano experience in itself does not provide sufficient evidence to suggest that there is a business case for co-creation in the narrow sense. To argue for co-creation as a purely commercial activity for companies, more straightforward and convincing examples are needed that demonstrate the commercial benefit of co-creation. Still, co-creation may offer opportunities to operationalise the commitment of companies towards their stakeholders. There are some indications from other initiatives like PRISMA and LIVING INNOVATION that companies may adopt co-creation as part of their Corporate Social Responsibility strategies. However, the successful adoption of co-creation does seem to be limited to those cases where 'doing good' and 'doing well' coincide.

The business case for co-creation seems to look stronger if it is interpreted broadly, as the potential to realise value in the broader sense for all innovation actors. For researchers, co-creation could help to define new inroads for research, gain access to future technology users and attract new sources of funding. For policy makers, co-creation could offer solutions to wicked problems that carry broader stakeholder support. The GoNano experiences provides some initial clues to the potential added value for producers, researchers and policy makers. However, to make a convincing business case for co-creation, many more compelling examples are needed of the added value of adopting iterative, product-focused, transdisciplinary collaborations as part of innovation processes in research, innovation and policy making. As the GoNano project draws to a close, the search for the business case for co-creation continues.

1. INTRODUCTION

This report explores the ‘business case’ for co-creation in nanotechnology research and innovation, building on the findings of the co-creation activities in the European project GoNano (Governing Nanotechnologies through Societal Engagement).¹ The overall objective of the GoNano project was to improve the responsiveness of research and innovation processes to public values and concerns.² GoNano brought together citizens, researchers, professional users, civil society organisations, industry and policy makers in a process of deliberative workshops and online consultations around three nanotechnology application areas (health, energy and food) to co-create concrete suggestions for future nanotechnologies (see Figure 1).

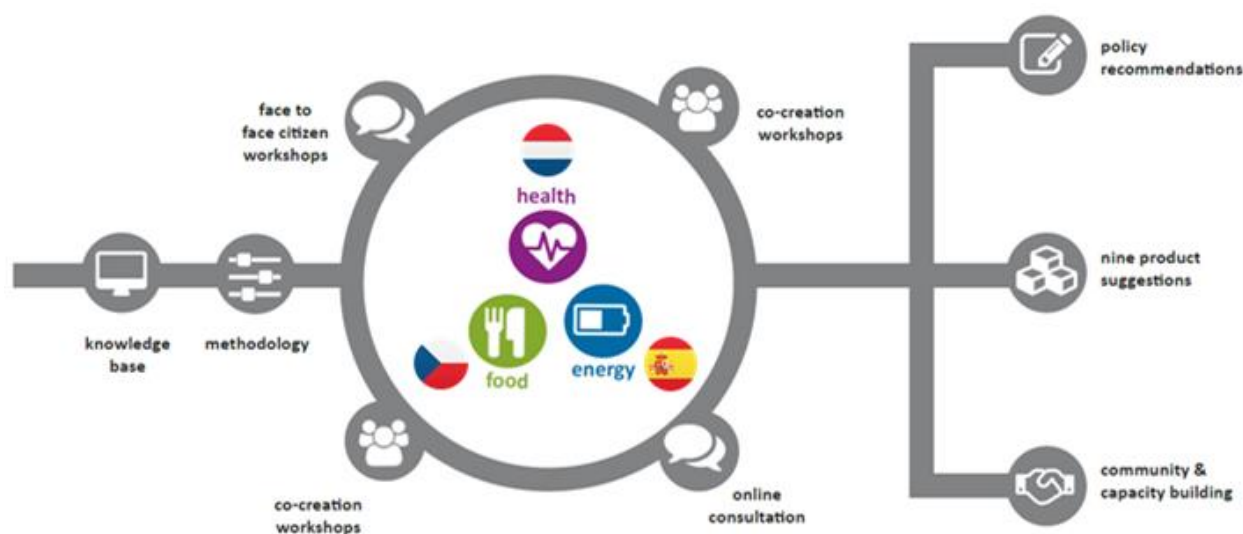


Figure 1 – Overall design of the co-creation process in GoNano

Previous GoNano reports have considered the design and outcomes of the citizen³ and stakeholder workshops,⁴ analysed feedback from participants in the co-creation activities,⁵ assessed the overall co-creation process,⁶ and reviewed the resulting product suggestions for future nanotechnologies.⁷ This final GoNano report considers one of the specific objectives of the project that has not been analysed yet in the previous reports, namely ‘to make companies convinced of co-creation and broad inclusion of stakeholders for alignment with societal values as a valuable business case for

¹ See: <http://gonano-project.eu/>

² GoNano Part B, version 27-11-2018, p.5

³ See: [GoNano D3.2 – Citizen needs and values in relation to nanotechnology in food, energy and health: A report from citizen workshops in the Czech Republic, Spain and the Netherlands](#) and [Deliverable D3.3: Briefing report on the outcomes of the online consultation](#).

⁴ See the working paper on the design and outcomes of the first round of stakeholder workshops: http://gonano-project.eu/wp-content/uploads/2019/07/GoNano_D4.2_Working_paper_on_the_designs_and_outcomes_of_round_1.pdf and the report on the outcomes of the second round of stakeholder workshops: <http://gonano-project.eu/d4-2-b-outcomes-of-co-creation-workshops-round-2/>.

⁵ See the [evaluation report on the outcomes of the MML platform \(D4.3\)](#).

⁶ See Deliverable D4.4 on the [insights and lessons from the engagement activities](#).

⁷ See deliverable D4.5 on [concrete product suggestions for future nanotechnologies](#).

their portfolios'.⁸ It reviews to what extent GoNano has inspired and encouraged innovation actors to engage society in the co-creation of new research and innovation, working in an inclusive way to align product development to societal values needs and expectations.⁹

The next chapter will explain in further detail what is meant by the 'business case for co-creation' and will highlight requirements and preconditions for commercial uptake of co-creation processes based on earlier studies and EU-projects. Chapter 3 will review the findings of earlier GoNano reports to assess the extent to which industrial participants have been encouraged to engage in co-creation by the project activities. Chapter 4 presents the findings of a combined GoNano/NANORIGO webinar that aimed to explore the business case for co-creation in the specific context of three European projects funded under the European Commission's NMBP-13 call for risk governance in nanotechnology: NANORIGO, GOV4NANO and RISKGONE. Chapter 5 reflects whether there is a 'business case' for co-creation in nanotechnology research and innovation.

⁸ GoNano Part B, version 27-11-2018, p.7.

⁹ See GoNano Part B, version 27-11-2018, p.19

2. THE 'BUSINESS CASE' FOR CO-CREATION - REQUIREMENTS AND PRECONDITIONS

To answer the question whether there is a business case for co-creation in nanotechnology research and innovation, it must first become clear what is meant by 'the business case for co-creation'. Indeed, there has been much discussion in the GoNano project on the meaning of both 'co-creation' and 'the business case'. The following sections will explore both terms in further detail.

2.1 WHAT IS 'CO-CREATION'?

Since this question has been discussed extensively in other GoNano reports,¹⁰ a brief summary of the most important elements of co-creation may suffice here. Generally speaking, co-creation is defined as the practice of collaborative product or service development, as developers and different kinds of societal stakeholders work together; or the joint creation of value by the company and the customer; or as allowing the customer to co-construct the service experience to suit their context.¹¹ Co-creation as a method has been applied to research and innovation to achieve very different aims and objectives. Companies have used co-creation to encourage user-led innovation. Their aim is to put the needs of users at the heart of innovation. The Creator Space initiative launched by BASF, for example, aims to foster open innovation within the company.¹² Others have used co-creation to enable more democratic decision-making in research and innovation. The EU project Making Sense EU, for example, helped citizens to use academic technologies to make sense of their own environments.¹³

GoNano has defined co-creation as *"activities [that] enable productive collaborations between researchers and societal stakeholders over longer timeframes, focusing on specific nanotechnology research lines, leading to tangible outcomes such as a new research avenue, proposal, product or prototype"*.¹⁴ Co-creation was used in the GoNano project to strengthen the ability of research and innovation processes to respond and adapt to changing demands. The underlying assumption is that research and innovation will be more socially robust if societal needs and values are considered in the early stages of innovation.

An important finding from the GoNano experience is that co-creation is a *tool* that can be used to reach different goals. Each type of co-creation involves different types of actors, with different expected outputs in different stages of innovation. The *purpose* of the co-creation process

¹⁰ See for example the report on the method and manuals for the pilot studies (D2.1): <http://gonano-project.eu/wp-content/uploads/2018/08/2.1.pdf> and the report on the [insights and lessons from the engagement activities](#) (D4.4).

¹¹ For further information see GoNano D2.1(2018), for an illustrative example, see this introduction from Frontier: https://www.youtube.com/watch?v=VID2EyW5W_k.

¹² The Creator Space initiative brings together stakeholders with varying experience from within and outside of the company to develop concrete, challenge-based business outcomes. Originally developed as a one-time initiative to celebrate the 150th anniversary of BASF, the Creator Space now forms an integral part of the company's approach to innovation (in this YouTube video, Elise Kissling, Director of the Creator Space frontend innovation program at BASF, reports on Creator Space: <https://www.youtube.com/watch?v=Y0JuOWO0hB8>).

¹⁴ For further information, see this earlier report on the co-creation methodology for GoNano: D2.1(2018)

prescribes the actors that should be involved, and the ways in which they contribute. Different possible functions of co-creation were observed as the GoNano project unfolded:

- Co-creation as *user-led innovation*, where prospective users of new technological applications provide feedback on prototype designs in early stages of development. In this type of co-creation, there is already a clear idea of the product or application to be developed. User-led innovation has been used widely in the commercial sector to improve consumer goods and services. Examples within the GoNano project included discussions and collaboration on the way data is visualised in the user interface for the artificial pancreas, and the review of technological design of the biosensor for cancer detection.
- Co-creation as the *creation of shared value through product design*, where different stakeholders come together to co-create innovative solutions to shared problems. This type of co-creation is different from user-led innovation as there is no pre-existing idea of the product to be developed yet. Defining both the problem and possible solutions are part of the co-creation process. BASF's Creator Space (see footnote 12 above) offers an example of this type of co-creation. The first round of stakeholder workshops offers an example from within the GoNano project.
- Co-creation as *envisioning technological futures*, where a diverse group of stakeholders explores the potential societal impacts of new technologies. This type of co-creation does not necessarily lead to a marketable product, but to design concepts, initial demonstrators or development strategies and roadmaps (e.g. illustrated with sketches, drawings, storylines, , briefings, , etc.) that can serve as input for policy making. The GoNano citizen workshops offer an example of this type of co-creation, considering potential applications of nanotechnology that would respond to the values, needs and concerns of citizens. Examples from other areas are the NANOPLAT project and Vision Lines 2020.¹⁵

2.2 WHAT IS A 'BUSINESS CASE'?

Like co-creation, the term 'business case' can be interpreted in different ways. The Oxford English dictionary for example defines the term as: "*a justification for a proposed project or undertaking on the basis of its expected commercial benefit.*" A 'business case', then, describes how to 'do business' (i.e. make money) with a given product or process. Indeed, many connect the term with value creation in the narrow sense of the word: the business case justifies the commercial potential of an activity by way of client portfolios, cost-benefit analyses, financial prognoses and so forth.

This report suggests that in addition to this narrow interpretation (direct economic benefits), a 'business case' can also be interpreted as a more general justification of the 'added value' of a product, system or process. Does the product or process have sufficient potential to be adopted as a valuable activity in its own right (e.g. without relying on EU-funding, for example)? The aim of this report is to explore the business case for co-creation both in the narrow and in the broader sense of the term. To appreciate the overall conclusions in this report, two important distinctions therefore need to be made here:

¹⁵ See this [interview with François Jégou, Director of Strategic Design Scenarios \(SDS\)](#), for further information about the EU project NANOPLAT and the Vision Lines 20 project.

1. Distinguishing between *commercial companies* and *innovation actors* more broadly (i.e. including nanotechnology researchers, nanotechnology funding organisations, etc.) as adopters of co-creation processes;
2. Distinguishing between *monetary* and *non-monetary* value (such as reputation, innovation potential, or access to markets) in the assessment of the '*added value*' of co-creation.

2.3 MONETARY AND NON-MONETARY VALUE CREATION

Apart from offering direct commercial benefits, there may be 'added value' in a broader sense that can motivate companies to consider co-creation as part of their innovation strategies:

- Enhance innovation potential:
 - User-producer interactions in early stages of innovation can support incremental product improvement.
 - Exploring unmet needs with prospective users can serve to identify new avenues of inquiry for research and development.
 - Envisioning products with user groups can suggest unmet needs and unlock new markets.
- Improve reputation:
 - Taking stakeholder concerns seriously can enhance a company's 'license to operate', reducing possible opposition from customers, shareholders or regulators.
 - Developing products that address urgent societal needs enhances trust and increases societal acceptance, desirability and accessibility of innovation outcomes.
 - Increased trustworthiness translates into higher brand value, customer attraction and, as a result, investor demand.
- Save costs:
 - Involving stakeholders can improve operational efficiency, which can in turn reduce production costs.
 - Regulatory preparedness can help to lower the costs of control measures, regulatory approval procedures and reduce fines and penalties.

2.4 FOUR SPECIFIC QUESTIONS ON THE BUSINESS CASE

Applying these distinctions, the general question whether there is a business case for co-creation thus translates into four specific questions:

1. Are there examples showing how *companies* may reap *direct commercial benefit* from applying co-creation processes to their nanotechnology innovation processes?
2. Are there examples showing how *companies* may realise *added value in the broader sense* from applying co-creation processes to their nanotechnology innovation processes?

3. Are there examples showing how *innovation actors* more broadly may reap *direct commercial benefit* from applying co-creation processes to their nanotechnology innovation processes?
4. Are there examples showing how *innovation actors* more broadly may realise *added value in the broader sense* from applying co-creation processes to their nanotechnology innovation processes?

Chapter 5 will revisit these four questions based on a review of the findings from the GoNano co-creation activities in Chapter 3, and the results of a co-creation webinar on risk governance in Chapter 4.

2.5 THE ADDED VALUE OF CO-CREATION: SOME EXAMPLES FROM OTHER INITIATIVES

Co-creation is increasingly being used as a collaborative tool to design solutions to shared problems. Some examples are provided below.

The BASF Creator Space

The BASF Creator Space¹⁶ offers an example of how co-creation could be applied in a commercial setting. Creator Space brings together stakeholders with varying experience from within and outside of the company to develop concrete, challenge-based business outcomes. Creator Space takes a design approach, facilitating creative, insight-driven multidisciplinary collaborations in four phases:

1. Exploration: identifying key challenges, market and regulatory trends, and the network required to tackle these challenges;
2. Ideation: working with the network to develop initial ideas and turn them into feasible concepts;
3. Incubation: refining the concepts, testing assumptions and reducing uncertainties to create a clear business case.
4. Testing models with customers and value chain partners.

This initiative has produced several indications of how co-creation makes good business sense. Around 500 innovative ideas were generated during the anniversary edition of the BASF programme in 2015, leading to 76 concrete proposals for disruptive innovation. 16 of these were selected for funding by the board of directors. Two projects were funded as corporate citizenship projects (not-for-profit); nine others were funded immediately, the remaining five were put on the waiting list. By testing market assumptions early, several project teams were able to stop or redesign their concepts before making major investments. Several others are still in incubation: these projects include a business model for greenhouses in urban environments using multiple BASF technologies; a bio-based recyclable monomer; and the novel use of materials to create minimally invasive underground water storage capacities.

¹⁶ <https://www.basf.com/nl/nl/media/magazine/archive/issue-4/creating-space-for-innovative-ideas-for-the-future.html>

Two projects have recently been launched on the market: one is a digital platform, preventing food loss in the potato value chain in Brazil, the other is a business model for a bio-compostable polymer launched in South America. A third project, LUX, brings daylight deep into windowless spaces in buildings. These considerations suggest a number of recommendations for the 'business case' for co-creation:

- Use a design-approach to foster co-creation: practical, solution-oriented, creative, multidisciplinary, iterative;
- Seek out the shared goal that drives collaboration between stakeholders (selecting partners on real mutual interest, define challenges that can only be addressed through shared involvement).
- Reverse the order of innovation: start from the challenge, and then look at how technology can address that challenge, rather than the other way around;
- Heed the triple bottom line: in a commercial environment, solutions to social and environmental problems must be economically viable, too.
- Involve decision makers from the start to ensure ownership and involvement within your company. To ensure that the results are supported by the company and are not without obligation.

PRISMA

The EU-funded PRISMA-project¹⁷ offers several examples of how the application of Responsible Research and Innovation (RRI) potentially adds value in a commercial context. The goal of the PRISMA-project was to propose and test specific strategies to implement RRI in industry, with a focus on inclusive approaches (e.g. stakeholder engagement, co-creation). The project worked with 8 different research and innovation companies, both large and SMEs, in the field of automated cars, Internet of Things, drones, synthetic biology, and nanotechnology. These pilots provide case studies of good practices in RRI.

The PRISMA experience helped companies to evaluate with project partners and stakeholders the most significant ethical, legal and social impacts expected by the development of their products and to identify operative actions to address them.

Ethical, legal and social implications addressed across pilots included privacy, data ownership, safety, efficacy and reliability, transparency and open access, democratic participation and consent (on technological decisions), distribution of benefits, risk and harm, and sustainability and social responsibility.

Early identification of societal needs and concerns helped in designing products that will be better aligned with societal expectations and thus could gain more acceptability by the end-users. Engagement with R&I partners, supply chain actors, regulators, authorities, certification bodies, market operators, clients and end-users (e.g. patients, local communities, consumers, etc.) has been

¹⁷ <https://www.rri-prisma.eu/>

essential to identify in the early stages of the development research opportunities, product design improvements and solutions, ways to address potential regulatory barriers.

Companies recognized that responsible innovation can be helpful to anticipate social or market trends or requirements, technological scenarios, possible regulatory changes and thus inform the overall business strategy and help to save money and time. RRI is considered crucial also to build trust and legitimacy.

LIV-IN

LIVING INNOVATION (LIV_IN)¹⁸ aims to develop responsible, smart home solutions that tackle societal challenges and respond to pressing societal trends. The initiative involves industry leaders that engage with lead users in co-creation processes to create solutions that meet user needs and leverage collective creativity to uncover new business opportunities. The project aims to give lead users and citizens the chance to be involved in the design of the technology that will shape their future lives, and to give industry the possibility to respond directly to changes and needs of users and society. In doing so, the initiative aims to demonstrate to industry and the public what Responsible Innovation is, and how citizens can be involved in developing innovations. LIVING INNOVATION is coordinated by the Institute for Managing Sustainability at Vienna University of Economics and Business. The project unites 14 partners from 10 European countries, including nine leading companies in the areas of smart homes and smart health.

¹⁸ <https://www.living-innovation.net/explore>

3. THE GONANO EXPERIENCE: HAVE INNOVATION ACTORS BEEN ENCOURAGED TO ENGAGE IN CO-CREATION?

This chapter will review the GoNano experience, considering feedback received from companies and other innovation actors on the GoNano co-creation activities. Most of the direct interactions with innovation actors occurred in the two consecutive rounds of stakeholder workshops.¹⁹ The stakeholder workshops brought together citizens, researchers, engineers, producers, civil society and policy makers to co-create concrete suggestions for future nanotechnologies.

All workshops followed a similar structure, featuring four interrelated co-creation sessions:

- An exploration phase: where participants got to know each other and explored the needs and values expressed by citizens as well as their own needs and interests;
- An ideation session: where participants imagined and co-created responses to the needs and values expressed by the citizens by imagining revisions of ongoing research and innovation trajectories;
- A prototyping session: where participants generated a storyboard that visualized how the resulting research lines and product suggestions could be designed in relation to the needs and values expressed by the citizens and suggested concrete actions to be taken to realise this vision;
- A concluding reflection: where participants presented their visions and reflected on the overall workshop outcomes.

The workshops aimed for a balanced participation of stakeholders, involving all types of expertise (including lay expertise) in more or less equal numbers. In the Netherlands, 28 participants joined the first round of stakeholder workshops (consisting of three smaller workshops: a workshop on diabetes on 12 February 2019 (with 11 participants), a workshop on sensors on 5 March 2019 (8 participants) and a workshop on health policy on 7 March 2019 (9 participants)).²⁰ Participants included 11 researchers, 6 business representatives, 4 people from a civil society organisation (CSO), 4 stakeholders connected to policy making, and 3 citizens who attended the citizen workshops of GoNano in November 2018.

The second workshop in the Netherlands, on 7 November 2019, had 16 participants: 6 researchers, 3 stakeholders connected to policy making, 3 representatives from businesses, 1 person from a civil society organization (CSO) and 3 citizens who attended both the citizen consultation of GoNano in November 2018 and the first stakeholder workshops in February and March 2019.²¹

In first stakeholder workshop on food organised by TC CAS in the Czech Republic on 28 February, 34 participants took part, with 19 participants joining in the co-creation activities, including 9 representatives of universities (technical and chemical research), 8 representatives of private

¹⁹ For further details on the overall, four-phase iterative co-creation process process to integrate societal considerations in nanotechnologies, please see the report on the [insights and lessons from the engagement activities](#) (D4.4).

²⁰ For further details, please see the working paper on the design and outcomes of the first round of stakeholder workshops: http://gonano-project.eu/wp-content/uploads/2019/07/GoNano_D4.2_Working_paper_on_the_designs_and_outcomes_of_round_1.pdf.

²¹ See the report on the outcomes of the second round of stakeholder workshops: <http://gonano-project.eu/d4-2-b-outcomes-of-co-creation-workshops-round-2/>.

companies, 7 representatives of research institutes, and several others including representatives from the Ministries of Agriculture and Environment, representatives of non-governmental organizations (NGOs), the media and citizens.

In the second workshop on 22 October 2019, there were 16 participants from state authorities, businesses, researchers and NGOs. Business representatives from a packaging company and a company producing biodegradable biopolymers were involved, as well as a representative of the Ministry of Agriculture, the chief researcher of the Department of food preservation of the University of Chemistry and Technology in Prague, and two representatives of a local food bank.

In the first workshops on energy organised by RMIT in Spain on 7 March 2019 there were 27 participants, including 21 researchers from science and engineering backgrounds, 2 researchers in design, 2 CSO representatives, a teacher, and a researcher in social sciences. Although a good balance of stakeholder diversity was desired it was unfortunately not achieved, despite actively inviting a diverse mix of stakeholders. In total, 16 CSOs, such as energy cooperatives, foundations, and living labs; 25 companies, including (inter)national enterprises, SMEs, and business networks; 20 research institutes and universities; 10 European projects, networks, and consortia; and 14 organisations that support technology transfer such as start-up hubs and investment funds; were contacted via email in the months before the workshop, but many of these invites received negative or no responses. In the second workshop on 30 October, 2019 there were 9 participants, including 1 from industry and 8 researchers from different fields.

Table 1 – Participants in the stakeholder workshops, by stakeholder type

Stakeholder type	NL 1	NL2	CZ1	CZ2	ES1	ES2	TOTAL	%
Industry	6	3	8	4	0	1	22	17%
Research	11	6	16	6	24	8	71	54%
Policy	4	3	2	3	0	0	12	9%
Civil society	4	1	6	3	2	0	16	12%
Citizens	3	3	4	0	1	0	11	8%
TOTAL	28	16	36	16	27	9	132	

3.1 APPRECIATION OF THE STAKEHOLDER WORKSHOPS

The co-creation events provided productive spaces for engagement and mutual learning between the participants. The evaluation report on the outcomes of the MML platform indicates that workshop participants appreciated these events: more than 75% of respondents agreed or strongly agreed that the group discussions were of good quality, and around 65% thought the citizens' messages were relevant for the workshop.²² Particularly in the Netherlands and in Spain, the majority of respondents thought it made sense to consider the needs and values of citizens and

²² See the [evaluation report on the outcomes of the MML platform \(D4.3\)](#).

societal stakeholders in an early stage. Stakeholders agreed that bringing their perspectives together offers insights in what is important to consider when developing nanotechnology applications.

The overall workshop approach of enabling carefully moderated, highly focused, interest-driven discussions in a four-step process (exploration, ideation, prototyping, reflection) seems to have worked well in the stakeholder workshops. An earlier analysis of the product suggestions furthermore concludes that the focused, guided interactions in the stakeholder workshops can lead to innovative suggestions on how to integrate broader considerations in research and innovation decisions.²³ For instance, a discussion between producers, policy makers, civil society, researchers and a diabetes patient around the artificial pancreas (a monitoring device for diabetes type 1 patients that continuously measures glucose levels of the patients and adds insulin and glucagon when needed) in the first stakeholder workshop on health at the University of Twente led to data management considerations that may be relevant for future data sharing agreements between the producer and users of the device. And the discussions around the Harvestore project in the second stakeholder workshop on energy in Barcelona suggested how societal considerations can be productively integrated in the development of the wireless sensor nodes. These examples suggest that ‘exposure’ to use considerations further down the line can attune research design to future use contexts. The brief videos and surveys with responses from workshop participants at the various events confirm these findings. They suggest how the different participants involved in the co-creation process each had something specific to contribute to the process, and how each of them took something away from it.²⁴

3.2 SIGNS OF A BUSINESS CASE FOR CO-CREATION?

The co-creation workshops provided insights on how broader societal considerations could enhance research and innovation outcomes. In the case of the artificial pancreas, the discussion led to data management considerations that may be relevant for future data sharing agreements between the producer and users of the device. For the post-doc researcher working on a biosensor for cancer diagnostics, interactions with prospective users helped shape future research directions. The proposal for a packaging system for perishable foods can be seen as a concrete suggestion for demand-driven innovation. The suggested safety measures for the use of nanomaterials in food are an example of how multi-stakeholder interactions can serve to provide advice to policy makers on the governance of nanotechnologies. And the discussions on energy capture and storage suggested how societal considerations can be productively integrated in the development of the wireless sensor nodes.

Yet there were challenges to the uptake of societal considerations in research and innovation decisions, too. For example, the suggestions from citizens were often formulated at a high level of abstraction: for instance, citizens emphasized the importance of values like sustainability, respect for nature and transparency as design considerations. While the participants of the stakeholder workshop acknowledged the importance of these social needs and values, it was not always clear

²³ See deliverable D4.5 on [concrete product suggestions for future nanotechnologies](#).

²⁴ See the [interviews with workshop participants on the Youtube channel](#).

how to derive concrete design recommendations from these high-level considerations. Moreover, the timelines of the suggested activities did not always correspond to the timelines of the innovation process. Considering the question of data management for the artificial pancreas for instance, the developer of the artificial pancreas did acknowledge that a data management plan may become relevant at some point in the innovation process, but the company was at the time engaged in important market approval procedures. As a small business, it had to prioritize, and the question of data management therefore had to be put on hold.

In summary, the overall GoNano experience suggests that co-creation may have the potential to influence one or more of the business factors identified in Chapter 2. The co-creation processes within the GoNano pilot studies did in some cases suggest how the process could make 'business sense'. User-producer interactions on the artificial pancreas identified data management and visualization considerations that might be relevant for the future design of the device. The co-creation sessions on the biosensor for cancer diagnostics helped shape future research directions for the post-doc. And the discussions on energy capture and storage suggested how societal considerations can help envision new applications for wireless sensor nodes. Still, these outcomes are mostly tentative and whether or not they will have a demonstrable impact on the decisions of the innovators remains to be seen.

4. EXPLORING THE BUSINESS CASE FOR CO-CREATION IN RISK GOVERNANCE – RESULTS OF A GoNano/NANORIGO WEBINAR

To further explore the business case for co-creation and test the GoNano co-creation approach in a practical setting, DPF organised a webinar with external stakeholders on 28 October 2020. The webinar focused on the activities of three EU-projects funded under the NMBP-13-2018 call on risk governance in nanotechnology: NANORIGO,²⁵ GOV4NANO²⁶ and RISKGONE.²⁷ Due to the COVID-19 pandemic, the workshop was organised as an online event.

Stakeholder engagement is an important element in the NMBP-13-2018 call. As the call text notes: *“Significant progress has been achieved in relation to research regarding the safety of engineered nanomaterials and the transfer of this knowledge into regulation. Still, more needs to be done as nanotechnology reaches the market. To fill this gap, **transdisciplinary risk governance is required based on a clear understanding of risk, its management practices and the societal risk perception by all stakeholders**”* (emphasis added).²⁸

Indeed, earlier NANORIGO-documents have noted that the successful integration of broader societal considerations in risk governance would constitute a highly innovative and much needed contribution to the advancement of risk governance in general.²⁹ This was why the NMBP-13 projects were considered an excellent test bed to further explore the business case for co-creation.

NANORIGO partners had already expressed an interest in exploring co-creation as a way to facilitate stakeholder interactions in the project. To ensure that the workshop would address the specific needs of the NMBP-13 projects, the workshop programme was discussed with key partners in NANORIGO during online consortium meetings, including a dedicated brainstorm session on 27 August 2020. In consultation with the NANORIGO partners, it was decided to offer a programme that would first present the main insights of GoNano in greater detail, and subsequently discuss how co-creation could play a role in three specific NANORIGO activities: the web-based platform, the Multi-Criteria Decision Support Tool (MCDA) and the Risk Governance Framework (RGF). The workshop programme and presentations can be found in the appendix below.

The workshop was presented as a combined GoNano/NANORIGO webinar, to emphasize continuity with the ongoing series of NANORIGO webinars (these webinars focus on cross-cutting issues that merit further discussion within the consortium. Earlier webinars were organised on 2 April 2020, discussing *‘Everything you always wanted to know about the Risk Governance Council and Framework but were afraid to ask’*, on 23 April, considering *‘How (on earth) to integrate ‘other issues’ alongside risks in the Risk Governance Framework’*, and on 23 June, focusing on the design of the web-based platform).

In total, 41 participants attended the workshop. Most participants were from the NANORIGO project, but several partners from GOV4NANO and RISKGONE attended as well. The meeting was

²⁵ <https://nanorigo.eu/>

²⁶ <https://www.gov4nano.eu/>

²⁷ <https://riskgone.wp.nilu.no/>

²⁸ <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/nmbp-13-2018>

²⁹ See also NANORIGO D1.8 - Critical evaluation of governance frameworks - considering the current integration of ethical, environmental, social, economic, legal and/or regulatory considerations.

chaired by Dr Kees Le Blansch from Bureau KLB in the Netherlands. After brief introductions on the findings of the GoNano project by Daan Schuurbijs (DPF) and a presentation on trust, co-creation and nano-risk governance by guest speaker Hilary Sutcliffe (from SocietyInside, a non-profit consultancy), participants discussed concrete opportunities to apply co-creation in concrete project activities. The details of this discussion cannot be published in this document due to non-disclosure agreements in force, but have been made available to all partners who have signed the non-disclosure agreement.

The attendance numbers and ensuing discussions suggest that there is a real interest in co-creation among participants - although there was also some scepticism towards stakeholder involvement alongside the enthusiasm. Particularly the 'abstract' discussions on the relevance and importance of co-creation in general were very fruitful. However, translating this into practical actions within the consortium proved challenging. These outcomes reconfirm the findings in D4.4 about timing, identifying concrete interests from participants, and drilling down to the level of individual actions: participants do consider broader stakeholder involvement as a prerequisite for the success of the future Nanotechnology Risk Governance Framework and Council, but realising that commitment in the day-to-day activities of the project proves challenging.

Some quotes from the chat log of the GoNano / NANORIGO co-creation webinar:

"I like to be involved in the future discussions. This is what we need!"

"Very interesting, you should probably continue this discussion in the joint NMBP-13 portal core group"

"Inspiring presentation! Challenging, though needed, to use the tool of co-creation within the NMBP-13 development work. Even more challenging to transfer and integrate it in developing the council and framework."

That said, both the developers of the Risk Governance Framework and the web-based platform in NANORIGO have begun to seriously consider integrating co-creative elements in their activities. These commitments are expected to be worked out in consultation with DPF in the coming months. The realisation of these plans may fall outside the lifetime of the GoNano project, but the eventual integration of co-creative elements in the NANORIGO activities would imply that there may indeed be a 'business case' for co-creation, at least in NMBP-13. The possible uptake of insight on co-creation from GoNano in concrete NANORIO activities would also constitute practical 'exploitation' of the results of the GoNano project.

5. REFLECTION: IS THERE A BUSINESS CASE FOR CO-CREATION IN NANOTECHNOLOGY RESEARCH AND INNOVATION?

This concluding chapter will review the questions identified in Chapter 2 on the 'business case for co-creation':

1. Are there examples showing how *companies* may reap *direct commercial benefit* from applying co-creation processes to their nanotechnology innovation processes?
2. Are there examples showing how *companies* may realise *added value in the broader sense* from applying co-creation processes to their nanotechnology innovation processes?
3. Are there examples showing how *innovation actors* more broadly may reap *direct commercial benefit* from applying co-creation processes to their nanotechnology innovation processes?
4. Are there examples showing how *innovation actors* more broadly may realise *added value in the broader sense* from applying co-creation processes to their nanotechnology innovation processes?

5.1 ARE THERE EXAMPLES SHOWING HOW COMPANIES MAY REAP DIRECT COMMERCIAL BENEFIT FROM APPLYING CO-CREATION PROCESSES TO THEIR NANOTECHNOLOGY INNOVATION PROCESSES?

The GoNano stakeholder workshops do not provide examples of a business case for GoNano in the narrow sense of the word. As chapter 3 suggests, there are some very preliminary indications that the co-creation workshops could add value to commercial product development (specifically the discussion on data management and the user interface of the artificial pancreas in the workshop on health in the Netherlands, and the collaborative exploration of future applications of the wireless sensor nodes developed in the Harvestore project in the workshop on energy in Spain), but there is no evidence that these suggestions are currently being taken up or have produced significant commercial benefit for the companies involved.

However, it should be noted that the timeline for product development (time to market) of the innovation actors participating in the GoNano exercise was, quite inevitably, completely different by the timeline of the GoNano co-creation process. This makes almost impossible to collect such evidence.

The Description of Action for the GoNano project included a Key Performance Indicator to measure the expected impact of the project on the increased confidence of companies to invest in new technologies. The KPI would have been met if 80% of the industry representatives participating in the pilot studies would agree that the GoNano RRI business case is relevant, shows potential for profit and increases their confidence to invest in nanotechnologies.³⁰ In retrospect, this KPI may have been rather optimistic towards the commercial potential of the GoNano co-creation process. While the workshops did result in interesting product suggestions and provided some hints of

³⁰ GoNano Part B, version 27-11-2018, p.19

potential added value for innovation processes, there is still a long way to go from these initial suggestions to a co-creation method that offers obvious commercial benefit to companies.

To convince companies of the value of co-creation for their innovation processes, more examples and a much more focused proposition are needed. Companies require examples that clearly demonstrate the potential added value for them before they will embrace co-creation. The proposition also needs to state exactly what the co-creation process will look like, who will be involved and to what end, what the expected result is, and what companies stand to gain from it if they do decide to invest in the process. How will the intervention contribute to the bottom line? Will it save costs, spur innovation or enhance the reputation of participating companies? It is these sorts of questions that will ultimately determine whether there is business case for co-creation in the commercial setting.

A business case (in the narrow sense of the word) is built on business logic

Moreover, a business case needs to be built on business logic. The GoNano project combined various ambitious objectives. The co-creation process was not only meant to make companies convinced of co-creation as a valuable business case for their portfolios (the primary subject area of this report). It was also meant to showcase an early-stage state-of-the-art continuous citizen and stakeholder engagement process which takes into account gender and differences in culture and communication traditions across the EU and to establish a community of citizens, consumer and interest organisations, researchers, engineers, and policy-makers working as change agents for the development of RRI conditions in nanotechnology research and innovation.

In other words, the project aimed to ‘empower’ citizens and societal stakeholders to participate in the debate on nanotechnologies and demonstrate the added value of doing so to nanotechnology enactors (nanotechnology researchers, producers and policy makers) at the same time. Now there may well be instances where broader stakeholder engagement *does* add value to innovation processes (improved product design through early user involvement is a case in point). In some cases, ‘doing good’ and ‘doing well’ will coincide (e.g. the development of a new fabric that opens up a new consumer base, adds to the perceived ‘greenness’ of the company and is less harmful for the environment). In many cases however, these two objectives will not be so perfectly aligned or may even be contradictory. If such trade-offs occur, commercial companies can be expected to (and, some will argue, have the responsibility toward their shareholders to) choose the most commercially advantageous option unless benefits beyond profitability are also considered, as we do in the next section. For a purely commercial business case, profitability will ultimately trump democratization of research and innovation. Simply put: without profitability there is no business case – in the narrow sense of the word, that is.

5.2 ARE THERE EXAMPLES SHOWING HOW COMPANIES MAY REALISE ADDED VALUE IN THE BROADER SENSE FROM APPLYING CO-CREATION PROCESSES TO THEIR NANOTECHNOLOGY INNOVATION PROCESSES?

As Chapter 2 suggests, there may be non-monetary values that encourage companies to engage in co-creation. Such non-monetary values may be directly or indirectly related to the profitability of the company, as they will improve the company's reputation, enhance its innovation potential, or save costs. Indeed, there may be a stronger business case for co-creation once these non-monetary values are considered as being in scope.

There is a growing awareness that the long-term sustainability of companies depends on effective responses to social and environmental pressures. Whereas in the 1960s Milton Friedman could count on broad support for his argument that making profit is the only social responsibility incumbent upon companies,³¹ few companies would today openly claim that the social impact of the company has no effect on the bottom line. This is certainly the case for business sectors with a longer history of public resistance such as the chemical and textile industries. The ability of companies to retain their 'licence to operate' plays an important role. The UN Global Compact states: *'society expects businesses to be good actors in the community.'*³² BizNGO, a collaborative framework of companies, environmental organisations, government entities, and universities established in 2006 to focus on the use of safer chemicals in the economy, points to the benefits offered by socially responsible business operations: *"businesses are under increasing pressure from governments and consumers to reduce the environmental and human health impacts of their products. [...] They recognize that reducing their reliance on chemicals of concern to human health and the environment meets market demands, keeps them ahead of regulations, reduces costs, and creates innovative and inherently safer products."*

The business sector has launched various initiatives to strengthen their licence to operate.³³ In 2010, Unilever launched the Sustainable Living Plan, which aimed to reduce the ecological footprint by half by 2020 (although the future course of the company is uncertain after Paul Polman stepped down).³⁴ The Shell oil company recently announced that it aims to reduce its carbon footprint by half by 2050.³⁵ And 2017 saw the launch of Climate Action 100+, an investors' initiative that aims to convince major global companies to accelerate the energy transition and to realise the goals of the Paris climate agreement.³⁶ Other examples include *Together for Sustainability*, a collective initiative by chemical companies in 2011 aimed at making the value chains of the chemical industry more sustainable,³⁷ Fashion for Good, an initiative of the C&A Foundation in which various companies (Adidas, C&A, Galeries Lafayette Group, Kering, Target and Zalando) and sustainability consultants (Cradle to Cradle Products Innovation Institute, the Ellen MacArthur Foundation, IDH—the Sustainable Trade Initiative, Impact Hub Amsterdam, McDonough Innovation, Plug and Play, and the Sustainable Apparel Coalition) cooperate with the goal of making fashion 'good' again, and the Zero Discharge of Hazardous Chemicals (ZDHC) programme, which unites 27 major clothing brands, 81 chain partners, and 17 associates in an effort to completely eliminate the emission of hazardous substances in the textile, leather, and footwear value chains.³⁸

The Responsible Care® initiative offers another example. This programme was developed in the early 1980s by the Chemistry Industry Association of Canada (CIAC) after the 1984 toxic waste

³¹ Friedman, M. (1962). *Capitalism and Freedom*. University of Chicago Press.

³² UN Global Compact, Principle 8: Environment: <https://www.unglobalcompact.org/what-is-gc/mission/principles/principle-8>

³³ Also see Vision 2050 of the World Business Council for Sustainable Development (WBCSD).

³⁴ See: <https://www.unilever.com/sustainable-living/>

³⁵ See: *Staring down the barrel: royal Dutch Shell tries to reckon with climate change* in *The Economist* of 8 Dec. 2018: <https://www.economist.com/business/2018/12/08/royal-dutch-shell-tries-to-reckon-with-climate-change>.

³⁶ <http://www.climateaction100.org/>

³⁷ <https://tfs-initiative.com/>

³⁸ <https://www.roadmapzero.com/about/>

disaster in Bhopal, in which thousands of people died after large quantities of methyl isocyanate were released from a pesticides plant of Union Carbide. As Jean M. Bélanger, former chair of the Canadian Chemical Producers' Association (CCPA) and founder of the Responsible Care programme writes: *"In accordance with the findings of public opinion polls, industry leaders recognized that the public's concern is one of trust (Schmitt, 2002; Moffet et. al, 2004). The industry leaders chose a path that is anchored in gaining the trust of the affected communities and society in general. Trust has become the key driver of Responsible Care, which cannot be imposed, but rather requires the application of three fundamental principles, forming the cornerstones of Responsible Care: 1. Doing the right thing; 2. Being open and responsive to public concerns; 3. Caring about products from cradle to grave to cradle again."*³⁹ Responsible Care is explicitly positioned as an ethic, a framework of moral ground principles, with management encouraging all participants of the organisation to act accordingly. The Canadian CIAC describes The Responsible Care® ethic and principles for sustainability as follows: *"We dedicate ourselves, our technology and our business practices to sustainability – the betterment of society, the environment and the economy."*⁴⁰

A business case for co-creation after all?

Considering these developments, the 'business case for co-creation' need not be defined in purely monetary terms. The examples above suggest that there is growing need for companies to engage their broader stakeholder base. If co-creation can offer companies a viable approach to productive stakeholder engagement, business may well decide to include it in their stakeholder management portfolio – especially if it strengthens stakeholder relations and simultaneously increases innovation potential, enhances reputation or saves costs.

Co-creation could for example offer insights that the company had not thought of before, as with the diabetes workshop in the Netherlands, or could serve as the basis for proactive discussions with regulators on the approval of new products. This has been described in risk governance as 'regulatory preparedness'. Stakeholder interactions may also support companies in defining their 'moral compass': making explicit the normative commitments of the company, and acknowledging and addressing possible social and ethical impacts of new applications at early stages of innovation and preventing more significant costs due to resistance later down the line.

A distinction needs to be made here between large companies and small- and medium-sized businesses. Small businesses cannot always afford to focus on non-monetary values: with comparatively little resources in terms of money and personnel, they often need to concentrate on their core business to survive. For large companies, economies of scale allow for investments in reputation management, long-term relations with regulators or cost saving measures that pay dividends in the longer term. On the other hand, disruptive approaches may be adopted more easily by start-ups, because they are less constrained by rigid management structures and often have more flexible operating procedures than incumbents.

³⁹ Bélanger, J., Topalovic, P., Krantzberg, G. & West, J. (2009) Responsible Care: History & Development.

⁴⁰ <https://canadianchemistry.ca/responsible-care/about-responsible-care/the-ethic-principles-of-sustainability-for-responsible-care/>

But as the report on the insights and lessons from the engagement activities (D4.4) also notes, co-creation is not a panacea. It presents opportunities *and* drawbacks. Working together with different types of stakeholders increases the ‘transaction costs’ of the collaboration. Developing a shared language takes time. In fact, many ‘ordinary’, straightforward, technical problems may best be solved by traditional, monodisciplinary teams. It’s the ‘wicked problems’ (problems that are impossible to solve and have no single solution because of incomplete, contradictory and changing requirements that are often difficult to recognize) that require collaboration between stakeholders.⁴¹ Co-creation can be a particularly effective tool to approach these types of problems. Nanotechnology governance is such a wicked problem: the challenges do not only reside in the development of the technology itself, but also in the required alignment between working practices, responsibilities, knowledge levels, expectations and concerns across widely divergent fields of expertise. As Rittel and Webber (1973) note: *"in a pluralistic society there is nothing like the undisputable public good; there is no objective definition of equity; policies that respond to social problems cannot be meaningfully correct or false; and it makes no sense to talk about "optimal solutions" to social problems unless severe qualifications are imposed first."*

Still, whether one focuses on monetary or non-monetary values to make the business case for co-creation, it is imperative to focus on the added value of these interactions in relation to the company’s own goals and objectives’, as D1.1 also argued in the early stages of the GoNano project: *"It is our responsibility [as social researchers and engagement practitioners] to demonstrate that it does make sense to look at the broader dimensions: this can be achieved by highlighting that such reflection can help them to achieve their own goals (this is first-order learning). In order to achieve this, social sciences and humanities communities need to strengthen their ‘consultancy’ skills, and their ability to understand the context and “DNA” of the actors involved: from product-driven (“here’s my theory, what do you think?”) to demand-driven: “how can I help you?”, and offering clear and compelling examples, presented in a way that non-experts can understand.”⁴²*

The GoNano pilot studies have offered some early indications of added value, but not quite the clear-cut examples that may be needed to encourage companies to invest in these types of processes.

5.3 ARE THERE EXAMPLES SHOWING HOW INNOVATION ACTORS MORE BROADLY MAY REAP DIRECT COMMERCIAL BENEFIT FROM APPLYING CO-CREATION PROCESSES TO THEIR NANOTECHNOLOGY INNOVATION PROCESSES?

Looking at innovation actors beyond companies, there may be further opportunities to find ‘the business case for co-creation’. Nanotechnology researchers for example are often less focused on direct commercial benefit or cost-saving measures than companies and may be interested in collaborations that broaden their research horizon or offer new funding opportunities.

Like the movement towards Corporate Social Responsibility in the business context, there seems to be a growing interest in new forms of collaboration in research and innovation contexts. In an

⁴¹ Rittel, H.W. J. & M.M. Webber (1973). Dilemmas in a General Theory of Planning. *Policy Sciences* 4: 155–169.

⁴² See the earlier [GoNano report on the requirements for a productive and effective co-creation exercise \(D1.1\)](#).

article in Science, titled 'Toward designing safer chemicals', Julie Zimmerman and Paul Anastas (2015) write: *"to design more benign products, processes, and systems, [...] one area perhaps requires primary focus: transdisciplinarity. Research institutes, universities, industry, and funding and regulatory agencies (among other stakeholders) must cultivate a research ecosystem in which efforts are collaborative and knowledge is shared across disciplines, including pharmacology, (eco)toxicology, chemistry, modeling, and biostatistics."*⁴³ And the report LAB-FAB-APP, summarising the recommendations of an independent high level group led by Pascal Lamy on maximising the impact of EU research and innovation programme, states: *"the future EU R&I programme should aim to become the biggest co-created and co-creation programme in the world. ... Fully mobilising and involving stakeholders, end-users and citizens in the post-2020 EU R&I programme, for instance in defining its missions, will not only increase the degree of co-creation, it will also maximise its impact and stimulate a stronger demand for innovative products and services as well as a better grasp of social changes. The EU R&I programme should provide incentives for stakeholders and end-users to participate more widely in its multi-annual programming, for example through identifying, debating and possibly even deciding which EU-level missions to choose. The same goes for the programme's implementation through co-designing research and innovation agendas and taking part in developing and testing new solutions."*⁴⁴

Social scientists and engagement practitioners have sought to capitalise on this growing interest in broader stakeholder involvement in research and innovation. In many ways the European Commission's decision to include Responsible Research and Innovation as a cross-cutting issue in Horizon 2020 supports the business case for co-creation: it is now in the financial interest of researchers to include broader ethical and social expertise in their consortia. In some cases, this has led to new forms of knowledge co-creation and new, inherently interdisciplinary insights (in other cases, it has led to the 'commodification' of ethical and social deliberation, where RRI-consultants are included in consortia as 'token ethicists', with limited impacts on the direction of research).

The GoNano experience offers several suggestions that co-creation may add value to research and innovation processes. In the first GoNano stakeholder workshop in the Netherlands that explored future research directions for the biosensor for cancer diagnostics, interactions with prospective users helped the post-doc identify new research avenues.⁴⁵ These types of collaborative explorations can clearly offer benefits for the researchers involved, and could eventually lead to future funding.

As D4.4 also suggested, co-creation could help to enhance creativity at different Technology Readiness Levels (TRLs).⁴⁶ GoNano originally targeted TRL 2-5 as the level at which feedback from citizens could generate design suggestions to align research and innovation with the values, needs and expectations of society. Indeed, the suggestion made at the stakeholder workshop in food in the Czech Republic to design a packaging system for perishable foods could be situated at TRL 2

⁴³ <https://science.sciencemag.org/content/347/6219/215.long>

⁴⁴

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjdvK63ovjsAhVGOBoKHanDDr8QFjAAegQIAxAC&url=http%3A%2F%2Fec.europa.eu%2Fresearch%2Fevaluations%2Fpdf%2Farchive%2Fother_reports_studies_and_documents%2Fhlg_2017_report.pdf&usq=AOvVaw1tGBSSiYFpOUL9YF62LEBk

⁴⁵ See this [brief reflection from the post-doc on the workshop discussions on Youtube](#).

⁴⁶ [Annex G of the General Annexes of the Horizon 2020 Work Programme](#) provides the European Commission's definition of TRLs.

(formulating a technology concept). The wireless sensor nodes developed in the Harvestore project are also at TRL 2, and the sensor for cancer detection developed at the University of Twente is at TRL 2-3. However, the artificial pancreas is closer to TRL 7 (prototype is demonstrated in an operational environment), and in this case the suggestions raised in the workshops proved also to be potentially relevant. Societal inputs can therefore be sought at different TRLs but one should remain conscious that the malleability of a technology proposal will tend to decrease as the TRL increases.

But here, too, addressing the interests of the researchers will be a vital prerequisite to making a convincing business case for co-creation. The interest of researchers to adopt co-creation processes will proceed through 'first-order learning': „*the improvement of the technology and the improved achievement of one's own interests in the network*”.⁴⁷ A compelling story is needed as to why the integration of societal considerations in research and innovation *matters*, along with a clear overview of which tools and techniques are available, and examples of what they can bring for those researchers who wish to engage with the broader societal dimensions of their work.

5.4 ARE THERE EXAMPLES SHOWING HOW INNOVATION ACTORS MORE BROADLY MAY REALISE ADDED VALUE IN THE BROADER SENSE FROM APPLYING CO-CREATION PROCESSES TO THEIR NANOTECHNOLOGY INNOVATION PROCESSES?

The business case for co-creation may be strongest when 'the business case' is given the widest possible interpretation (i.e. the realisation of value in the broader sense for all innovation actors). possible. We covered the commercial benefits for innovation actors and alluded to the added value of co-creation in the preceding section. Expanding on this further, co-creation could also offer benefits to policy makers, for example. The UN Global compact, a voluntary multi-stakeholder initiative for implementing the UN sustainability principles, emphasises the importance of collaboration between government entities, businesses, and NGOs.⁴⁸ And the European Chemicals agency (ECHA) views coordination and collaboration among the many stakeholders as one of the focal areas of its new substitutionary strategy (ECHA, 2018): “*Collaborative networks for innovation and substitution can play an important role in coordinating and advancing the practice of informed substitution. They can also support innovation through the development, evaluation and adoption of safer alternatives.*” The same emphasis on collaborative relationships between government entities can also be found in the Strategic Approach for International Chemicals Management (SAICM) and in the Global Chemicals Outlook.

Similarly, the NMBP-13-2018 call topic on risk governance in nanotechnology affirms a growing awareness that a more integrative approach is needed that involves key stakeholders from the outset. Stone et al (2018) view the development of 'tools to assess the needs of users regarding risk assessment, mitigation and transfer' as an essential requirement of a risk governance framework for nanomaterials.⁴⁹ And Clahsen et al (2018) suggest: *'risk management in democratic societies*

⁴⁷ See: Schuurbiens, D. (2011). What happens in the lab – Applying midstream modulation to enhance critical reflection in the laboratory. *Science & Engineering Ethics* 17(4): 769-788.

⁴⁸ <https://www.unglobalcompact.org/>

⁴⁹ Stone, V. et al (2018). The Essential Elements of a Risk Governance Framework for Current and Future Nanotechnologies. *Risk Analysis* 38(7): 1321-331.

*requires the involvement of interested and affected parties in the various steps of risk assessment and risk management, and explicit and continuous attention to their risk perceptions, including concerns, interests, and needs.*⁵⁰

In these new collaborative frameworks, the role of NGOs changes from a role as outsiders to a role as collaborative partners. SustainAbility, a sustainability consultancy, already described the changing role of NGOs in 2003 in 'the 21st Century NGO'. According to this report, NGOs in the 20th century operated primarily as outsiders who criticised the system from the outside. They were focused primarily on identifying problems, and their message was primarily viewed as the expression of public dissatisfaction. In the 21st century, NGOs position themselves more often as partners, focusing primarily on searching for constructive solutions with added value for the target group. Although this characterisation can be debated, the transition from traditional roles to newer ones is reflected in the role played by organisations such as ChemSec and IPEN within the framework of large-scale initiatives such as SAICM. NGOs such as The Nature Conservancy⁵¹ and the Environmental Defence Fund (EDF) also position themselves primarily as partners.⁵² For example, the EDF worked closely together with DuPont on the development of a risk assessment framework for nanomaterials (see Krabbenborg, 2013).

The potential benefits of better collaboration are clear: collaboration between risk researchers and producers can promote 'Safe-by-Design' approaches; transdisciplinary collaboration between researchers and developers can ensure that harmful effects are already reduced as much as possible in the research phase or even eliminated entirely; collaboration between producers, regulators, and NGOs can lead to regulations that are better aligned with the wishes and concerns of society.

Indeed, the exploration of the business case for co-creation in the GoNano/NANORIGO webinar (see Chapter 4) suggests that co-creation may be the only way to effectively approach the 'wicked problems' involved in nanotechnology risk governance. Even though these multi-stakeholder interactions may be messy and slow, it may be the only way to propose ways forward that will carry broad support from all stakeholders. Solutions that bypass the concerns of relevant stakeholders will, at some point, be met with resistance.

However, there are new challenges, too. New roles for stakeholders can conflict with traditional role assignments. For example, the reputation of NGOs as protectors of the public interest can become endangered as a result of excessively close collaboration with the business sector. The collaboration mentioned above between the EDF and DuPont in the formulation of a risk assessment framework for nanomaterials led to strong criticism. Critical NGOs such as Greenpeace, Friends of the Earth and the ETC group are opposed to: *'any process in which public participation in government oversight of nanotechnology policy is usurped by industry and its allies'* (Krabbenborg, 2013). Out of concern that their reputation will be put at risk, NGOs are therefore cautious when it comes to accepting invitations for closer cooperation. In addition, the asymmetric power position of NGOs relative to the business sector can create an uneven playing field. When NGOs and companies

⁵⁰ Clahsen S.C.S. et al (2018). Why Do Countries Regulate Environmental Health Risks Differently? A Theoretical Perspective. Risk Analysis 39(2):439-461.

⁵¹ <https://www.nature.org/en-us/>

⁵² <https://www.edf.org/>

are invited to the negotiating table as equal partners, NGOs often suffer from capacity problems. In some cases, they are not at the table at the deciding moments.

Another issue of concern for NGOs is that the broader innovation framework is left out of the discussion. For many NGOs, the dominant model of economic growth, competitiveness, commercialisation, and jobs is the main issue of concern.⁵³ After all, reducing production and consumption is the simplest way to combat the harmful effects of chemical substances (also see the discussion on Responsible Stagnation by De Saille & Medvecky (2016) regarding the implicit assumption of economic growth in Responsible Research and Innovation). However, this approach is not in line with the focus of the business sector on economic growth.

The need to bring in wider political and economic worldviews is underlined by Patenaude et al. (2014), who argue that technological development based solely on the law of the marketplace and State protection against serious risks to health and safety is no longer a warrant of ethical acceptability. Instead, they propose an analytic framework that seeks to make explicit those various operations required in preparing a judgement about the acceptability of technologies that have been implicit in the classical analysis of toxicological risk:

"in order to establish a dialogue between all the actors, including consumers, there must be a shift in our approach to risk governance. Not only the toxicological impacts of nanotechnologies must be considered but also the social impacts of the various uses of nanoproducts. Moreover, such a shift also implies re-examining the role of values and value judgements in the process of ethical assessment and understanding how they operate in decision-making. Finally, it challenges democratic societies to open up to public debate the social choices involved in developing a specific technology.

[...]

Broadly speaking, legal authorities enact regulations as a mode of intervention in social practices. The regulatory process can ban certain practices, such as human cloning; set conditions for the use of certain products, such as dangerous materials; or not regulate at all. Since regulation implies the use of social force to attain its aim, there must be a justification for intervention. Any state regulation is a limit to the free market, and the EHS/ELS distinction is consistent with the priority given to the free market over other values. Technological development is free-market driven: the constant search for a "killer app", that is, of a powerfully marketable use, is the principal aim of the creation of technological products. This is why researchers in the fields of nanotechnology, like researchers in biotechnology before them, declare without hesitation that these technologies will save the world by solving all its main problems (Gordijn 2005). In this perspective, State action can only be justified if and only if harm to the environment, health, and safety is so great that it tilts the scales when weighed against economic gain. This is what currently constitutes 'risk assessment'."

⁵³ See, for example, the Green Nanotech Action Agenda of the ACS Green Chemistry Institute and the Safer Nanomaterials and Nanomanufacturing Institute: "Green nanotechnology has been making great forward progress, but the challenges presented above point to an agenda of actions where involvement by the scientific research community, industry and government could bring about changes that would be crucial to supporting a more rapid and effective commercialization of green nanotechnology. Such changes have the potential to re-establish competitive leadership in the field, with positive economic implications for the manufacturing and associated job creation."

The challenge, then, is to create a more 'socially robust' governance framework that includes a capacity to anticipate and respond to broader ethical and societal concerns.

5.5 IN CONCLUSION: IS THERE A BUSINESS CASE FOR CO-CREATION?

In conclusion, there may well be a business case for co-creation. The GoNano project in itself did not uncover the evidence to suggest that co-creation could lead to direct commercial benefit for companies. More straightforward and convincing examples would be needed for this purpose. However, co-creation may offer opportunities to operationalise the commitment of companies to stakeholder engagement, possibly as part of their Corporate Social Responsibility strategies. However, the successful adoption of co-creation does seem to be limited to those cases where 'doing good' and 'doing well' coincide.

The business case for co-creation seems to look stronger if it is interpreted more broadly, as the potential to realise value beyond monetary terms and for all innovation actors. For both companies and researchers, co-creation could help to define new inroads for research, gain access to future technology users and attract new sources of funding. For policy makers, co-creation could offer solutions to wicked problems that carry broader stakeholder support.

The GoNano experiences provide some initial clues to the potential added value of adopting iterative, product-focused, transdisciplinary collaborations as part of innovation processes in research, innovation and policy making. To make a convincing business case for co-creation however, many more examples are needed.

APPENDIX 1 – GoNANO/NANORIGO CO-CREATION WEBINAR – PROGRAMME



GoNano / NANORIGO Webinar - *Applying co-creation in NMBP-13?*



Wednesday 28 October, 13:00 - 15:00 CET, on WebEx

Programme

- 13:00 Welcome and introduction** (Chair: Kees Le Blanch)
Purpose of the meeting and programme: exploring opportunities for co-creation in NMBP-13, building on findings from GoNano and other co-creation experiences
- 13:05 Introductions**
Mentimeter warm up
- 13:15 Opportunities and challenges of co-creation** (Daan Schuurbiens)
Lessons learned from GoNano and other initiatives
- 13:30 Hilary Sutcliffe: Co-creation, Trust and Nano Risk Governance**
Causes of trust and distrust in tech governance
- 13:45 Discussion: co-creation in NMBP-13?**
What role could / should co-creation play, if any?
- 14:00 Break**
- 14:10 Co-creation in NMBP-13: why, with whom, and how?**
Discussing three examples:
1. User-led design of the web-based platform
2. Weighing quantitative and qualitative criteria in the MCDA
3. Building a trusted Risk Governance Framework?
- 14:50 Reflection and conclusions** (Kees)
Reflection from Hilary: final thoughts and watchouts
Conclusion: is there a 'business case' for co-creation in NANORIGO?

APPENDIX 2 – GoNANO/NANORIGO CO-CREATION WEBINAR – PRESENTATIONS SLIDES

1. APPLYING CO-CREATION IN NMBP-13? (DAAN SCHUURBIERS)


GoNano / NANORIGO webinar:


Applying co-creation in NMBP-13?

Sharing experiences from GoNano and other co-creation initiatives

 This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 814530. This document reflects only the author's viewpoints. The Commission is not responsible for any use that may be made of the information it contains.

1



English 

[Register](#) [Login](#)

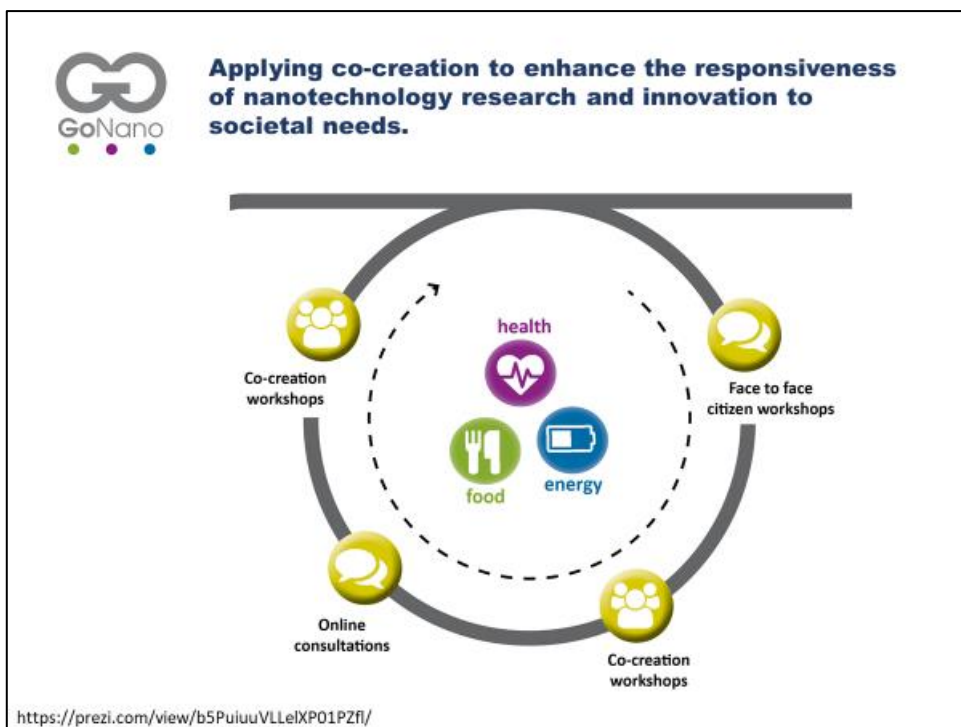
Funding & tender opportunities
Single Electronic Data Interchange Area (SEDIA)

SEARCH FUNDING & TENDERS ▾ HOW TO PARTICIPATE ▾ PROJECTS & RESULTS WORK AS AN EXPERT SUPPORT ▾

Risk Governance of nanotechnology (RIA)
TOPIC ID: NMBP-13-2018

“Significant progress has been achieved in relation to research regarding the safety of engineered nanomaterials and the transfer of this knowledge into regulation. Still, more needs to be done as nanotechnology reaches the market. To fill this gap,

...transdisciplinary risk governance is required based on a clear understanding of risk, its management practices and the societal risk perception by all stakeholders.”





What is co-creation?

“Co-creation is the joint development of new value.

It is a form of collaborative innovation: ideas are shared and improved together.”

See also: [FRONTEER Youtube clip - What is co-creation?](#)



Integrating societal needs and concerns through co-creation
– Image © Tonke Koppelaar

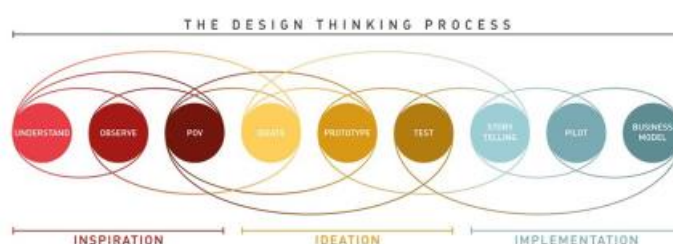


Co-creation in GoNano

1. Transdisciplinary:
involving diverse stakeholders
2. Product-focused:
making something together
3. Design thinking:
 - iterative
 - divergence/convergence
 - creative process: attention to visualization/ prototyping

Four stages

1. Exploration: exploring the needs and values of participants
2. Ideation: brainstorming ideas (divergence)
3. Prototyping: develop concrete outcomes/demonstrators (convergence)
4. Reflection: reflect on feasibility of the prototype, consider improvements



7



Main findings (re co-creation...)

1. Co-creation is a tool that can serve different purposes. In GoNano:

1. Co-creation as *user-led design* (type of product already planned), e.g. user interface for the artificial pancreas
2. Co-creation as the *creation of shared value through product development* (no pre-existing marketable product), e.g. HARVESTORE, BASF Creator Space
3. Co-creation as *envisioning technological futures* (no marketable product, but demonstrators developed as input for policy), e.g. NANOPLAT project, Vision Lines 2020.
4. Etc...

2. Co-creation is not a panacea:

Co-creation presents opportunities *and* drawbacks. Working together with different types of stakeholders increases the 'transaction costs' of the collaboration. Developing a shared language takes time. In fact, many 'ordinary', straightforward, technical problems may best be solved by traditional, monodisciplinary teams.

3. Co-creation can be an effective tool to tackle complex problems that require alignment between working practices, knowledge levels, expectations and concerns across widely divergent fields of expertise

The type of problems that one encounters in developing a nanotechnology risk governance framework!

8



GoNano Task 5.3: The 'business case' for co-creation?

Explore whether and how co-creation might help to strengthen the development of the RGF and NRG in NMBP-13

- Discuss three cases in the second hour: web-based platform, MCDA, RGF + co-creation suggestions
- No obligation: *exploration*
- As concrete as possible: identify next steps?

Different scopes for co-creation:

- 1 or more hours, as individual session;
- 1 or more days, as individual workshop;
- 1 or more months, as iterative process;
- 1 or more year.

(Some) resources available:

- T1.9: Mapping user needs and stakeholder interests in nano risk governance
- T3.4: Assessment of ethical, legal, social, environmental and economic aspects of the RGF
- T4.5: Enabling interdisciplinary collaborations in the NRG
- WP5: Integrating ethical and societal considerations in the case studies

9



**Involving societal stakeholders
as a source of creativity in research**

A co-creation toolkit for researchers and engineers



NANORIGO

**Integrating societal considerations in the
NANORIGO Risk Governance Framework
– an overview of qualitative tools.**

Maud Bomert and Daan Schuurblies (DPF), 14 July 2020

Co-creation in NMBP-13:
why, with whom, and how?

- The web-based platform
- The MCDA
- The Risk Governance Framework

2. TRUST, CO-CREATION & NANO RISK GOVERNANCE (HILARY SUTCLIFFE)



TIGTECH

Trust, Co-creation & Nano Risk Governance

Society Inside
People Shaping Innovation

COMPETENCE
INTENT - PUBLIC INTEREST
OPENNESS
INTEGRITY
INCLUSION
RESPECT

About TIGTech

Starting point:

It is important that the *governance* of tech should, in its own right be trustworthy and earn the trust of citizens and those participating in governance design.

When trust matters, what happens differently?

This presentation - insights as a stimulus for discussion:

- ▶ Why trust matters and drivers of trust
- ▶ What is co-creation and how might it help
- ▶ When to do it and why

Supported by the **World Economic Forum** and funded by **Fraunhofer-Gesellschaft**, Europe's largest group of applied science research institutions.

Fraunhofer Institute for Systems Innovation & Research is our academic partner

Co-directors:
Hilary Sutcliffe
Conrad von Kameke

Trust & Tech Governance

- ▶ We all make trust-based decisions every day – many which show an implicit trust in governance
- ▶ Trust facilitates cooperation, collaboration, compliance. Distrust, the opposite.
- ▶ Trust in institutions helps them get on with their jobs, innovate & respond effectively to changing circumstances
- ▶ Trust is the outcome of others perceiving trustworthiness. It is contextual and about expectation fulfilled.

“The question ‘How can we restore trust?’ is on everyone’s lips.

The answer is pretty obvious:

First be trustworthy.

Second provide good evidence of your trustworthiness.”



Baroness Onora O'Neill,
Winner 2017 Berggruen Prize

Avoiding distrust

"The system is complicated' isn't a good enough excuse for lack of action – find the way to do your job properly."

Citizen Dialogue - UK Food Standards Agency – Trust in a changing world

1. **Citizens trust governance when it is working fairly** - governance institutions visibly standing up for the public interest, laws created & enforced, perpetrators punished, breaches published.
2. When it doesn't seem to prioritise **making money over people and planet**
3. When it effectively navigates **values and ethics of tech in the public interest**
4. Governance institutions are seen as **opaque, aloof, disconnected** from the real world problems of people

TIGTECH 

7 Trust Drivers are core

Remarkable academic consensus – these qualities matter to us psychologically and sociologically

They are familiar to the point of banality – is this why we underestimate their importance?

 TRUSTWATCH

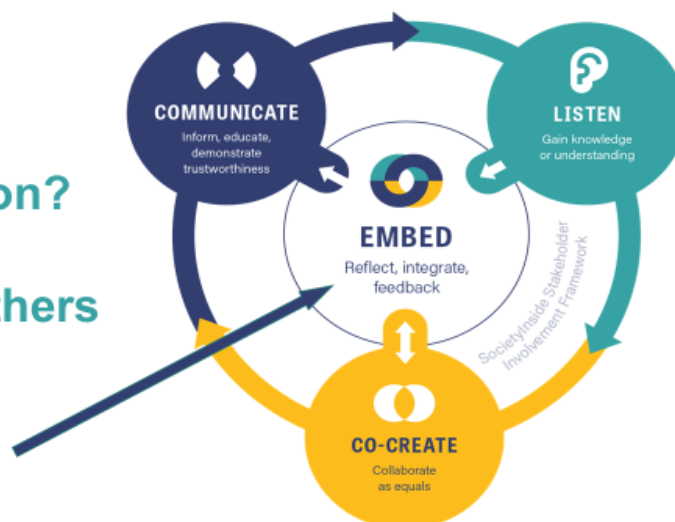
A fun spotting game!





What is co-creation?
...working with others

In the public interest



Listen (options to ignore, but responsiveness important)

- ▶ Research (lit review, qual & quant), own & other's meetings, phone/zoom calls, certain advisory panels (eg H2020 Adv boards) workshops, citizen's assemblies/juries, on-line initiatives (collective intelligence), data mining, web & media scraping

Co-create (collaboration as equals where ignoring/over-rule not an option)

- ▶ Multi-stakeholder collaborative initiatives or partnerships (Eg EDF/Dupont) governance design processes (sandboxes, policy labs.) collaborative R&D (GoNano, Design Thinking/Safe by Design pilots) certain advisory panels (eg User Committee),

Communicate (not just promotion, supports listen/co-create/embed)

- ▶ Direct via personal interaction, calls/meetings, email, meeting minutes, website, publishing, events, explanations, justifications

Embed (the core purpose of the above)

- ▶ Reflect on, incorporate perspectives into analysis, assessments, responses, actions



“Citizens are more likely to trust a decision that has been influenced by ordinary people than one made solely by government or behind closed doors”



Who? Anyone

- ▶ Multi-disciplinary experts and academics (tox, risk, science, social science, humanities) – regulatory guidelines
- ▶ Business – (all sizes) – risk assessment, sandboxes, policy labs
- ▶ Multiple-stakeholders – frameworks, guidelines (EDF/Dupont)
- ▶ Citizens – UK Nanomaterials in the environment moratorium, vTaiwan, Mitochondrial donation

“When a governance process is fair, it leads to greater acceptance of decisions, better compliance, and more cooperative behaviour in dealing with agents of government”

OECD Trust & Public Policy



Why?

- ▶ Diverse & often decentralised perspectives result in better and wiser judgements
- ▶ Others have knowledge & skills you need (& not know you lack)
- ▶ Highlight early warnings of problems, assumptions, biases, echo chambers & break deadlocks
- ▶ Gives greater legitimacy to decision-making - particularly about complex judgements with no right answers
- ▶ People are more likely to trust a decision that has been reached in a fair and inclusive manner even if the judgement doesn't go their way

When?



Our No1 finding?

The importance, and difficulty, of listening & taking seriously people whose opinion we don't really value but who we need to hear.



Keep an open mindset

Challenge your own assumptions (It can't happen, it won't happen, it's not happening)

Design trustworthy processes

Creating trusted environments so all participants & onlookers can see that a fair process has been undertaken even if the outcome doesn't go their way

“Don't ask yourself if someone is right. Ask yourself under what circumstances might this be true”

Daniel Kahneman

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Thank you!

Please go to www.tigtech.org if you would like to see a draft of our report

Society
Inside
People Shaping Innovation

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