www.gonano-project.eu

DELIVERABLE

3.3

Results of the Online consultation

GoNano Deliverable 3.3

Briefing report on the outcomes of the online consultation

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

Work Package:	WP3 – Briefing report on the outcomes of the online consultation
Deliverable number:	3.3
Partner responsible:	Technology Centre CAS (TC CAS)
Compiling author(s):	Marek Pour, Lenka Hebáková and Iva Vančurová, Technology Centre CAS
Contributing author(s):	Sikke Jansma and Anne Dijkstra (University of Twente, UT), Craig Richmond (European Office of the Royal Melbourne Institute of Technology, RMIT), Mette Marie Simonsen (Danish Board of Technology Foundation, DBT)
Quality assurance:	Lise Bitsch (Danish Board of Technology Foundation, DBT)
Planned delivery date:	10/19
Actual delivery date:	10/19
Dissemination level:	PU

CONTENT

EXECUTIVE SUMMARY

Respondents in the Czech Republic, Denmark, Ireland, Netherlands and Spain (N = 893) connect Nanotechnology in general mostly to its specific characteristics (especially its advanced size) and to nonspecific ideas connected with advanced technology or future. The overall current sentiment towards Nanotechnology seems rather positive with 55 % respondents stating mostly positive or positive attitudes. Moreover, this seems to be somehow connected to respondents´ perception of themselves being well informed about Nanotechnology.

When free to choose, respondents often wish to "discuss" Health applications. Specific product suggestions in Health are on average also the most popular ones with *"Improvement of diagnoses of cancer through monitoring proteins"* and *"Early diagnostic devices"* being the most desired product suggestions of all the application areas.

Health and Food application areas are somehow more associated with safety concerns than Energy: subjectively perceived unsafety of a product suggestion and the desirability for the same product suggestion correlate only weakly when compared to moderate correlations in Health and Food product suggestions.

The least safe perceived product suggestions are connected with Food: *with "A food with a balanced mix of nutrients"* and – surprisingly – *"Analytical methods for the detection of nanoparticles".* Needs and values connected to safety are at the same time the most prioritized ones by respondents in both Food and Health application areas.

Concerning stakeholders and their "responsibility" for the safe development of Nanotechnology, respondents stress the key role of researchers in the process, followed by stakeholders from business or policy makers. An input for the following phase of the co-creation process is summarized in the paragraph 3.6.

What can be considered rather successful seems to be the incorporation of as many views as possible including people from various socioeconomic backgrounds, city size, but also lower educated participants as the overall percentage of respondents with primary and secondary education accounts for 54 % answers of all the respondents.

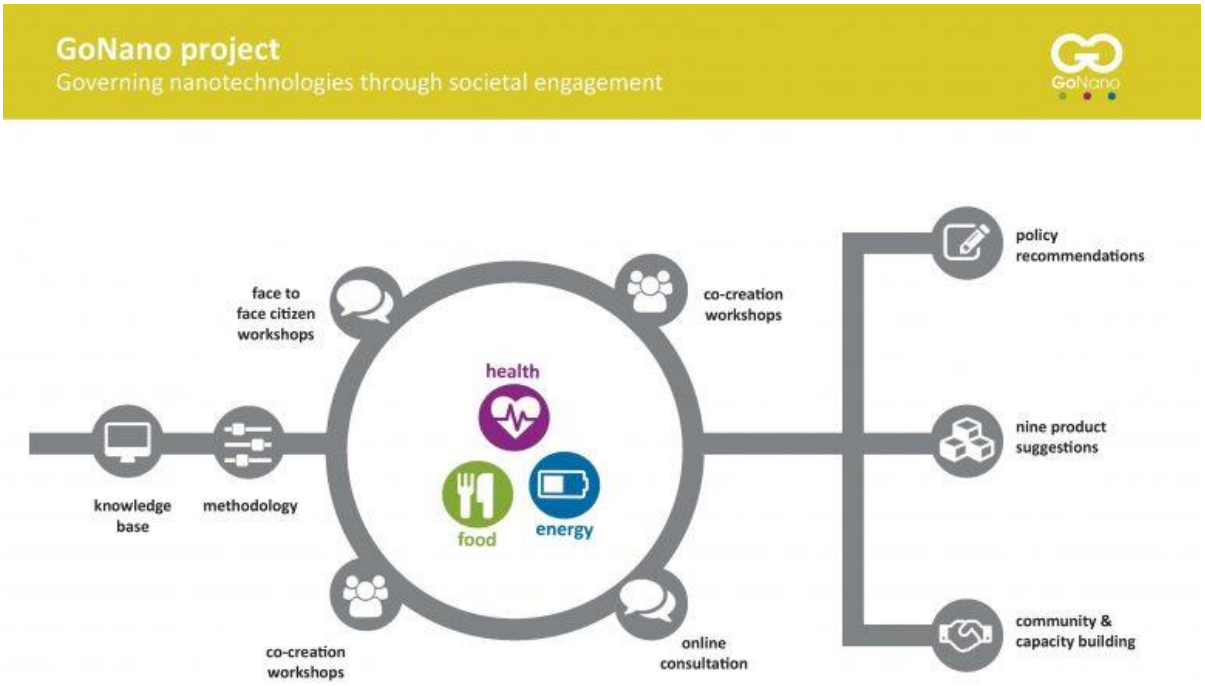
1. INTRODUCTION

GoNano methodology based on the co-creation platform aims to combine several ways of involving various stakeholders and strengthen the cooperation between research, business, policy makers, NGOs, wider public or the media in nano-related fields. The online consultation is an important step in the co-creation process that specifically brings broader perspective to the research aims and product suggestions of the stakeholders from the Stakeholder workshop 1 and at the same time adds additional input for the Stakeholder workshop 2 (see Deliverable 2.1). The online consultation gave citizens (including those of the face-to-face citizen workshops) the chance to see in what way their messages, wishes and concerns were taken up. Overall aim of this step was to ensure a coherent nanotechnology development in three fields with regard to public desirability and preferences.

Target group of this step is a broad public (given IT literacy), including citizens from the first citizen workshop (coherence of ideas). As the online consultation addresses citizens (lay people), it needs to be accessible to this target group. In each country, partners exceeded the aim of 100 different reactions to their consultation efforts (altogether 893 responses for all the five countries have been reached). What can be considered rather successful seems to be the incorporation of as many views as possible including people from various socioeconomic backgrounds, city size, but also lower educated participants as the overall percentage of respondents with primary and secondary education accounts for 54 % answers of all the respondents.

In all the five countries, citizens could choose to contribute to any of the 3 topics, but in pilot countries they could be more attracted to the topic which was debated in the previous two steps of the co-creation process (Citizen consultation and Stakeholder workshop 1). Questionnaire included quantitative and qualitative questions and findings of the online consultation shall be used as an input for debates within the three thematic Stakeholder workshops 2.

Figure 1: Online consultation as an essential part of the co-creation process



The role of the qualitative analysis in the online questionnaire is to bring a more thorough understanding of nanotechnologies in general: (1) Free associations of how people understand Nanotechnology without any *a priori* knowledge are being assessed and analysed, including the sentiment (positivity or negativity) that people "hold" towards nanotechnology. (2) Needs and values – that were formulated by citizens during the Citizen workshops and further elaborated by stakeholders during the Stakeholders workshop 1 – were consequently prioritized for each application area. Thirdly, product suggestions as a result of a cooperation of all the stakeholders involved were assessed concerning their (a) desirability and (b) subjectively perceived unsafety of the product suggestions: The role of quantitative analysis in the process is to provide pilot partners with valid and reliable input from as robust sample as possible to quantify and measure what would be perceived the most desirable and unsafe.

At the same time, questions concerning demographics: age, gender, education, expertise in Nanotechnology-related fields and several others were introduced.

The **data collection** for the online consultation started on July 1st 2019 and ended on September 13th 2019. From the original version, the questionnaire was translated into five languages and translations were tested within respective institutions – three pilot institutions (countries): TC CAS (Czech Rep.), UT (Netherlands), RMIT (Spain) and two partners (countries) involved: HiEW (Ireland), DBT (Denmark). The questionnaire was disseminated using a link through the Qualtrics platform. This link was unable to track identifying information of respondents.

The participants in the pilot countries were recommended – but could choose differently if they wanted – to fill in the respective topic area for its respective country: Energy in Spain, Food in the Czech Republic and Health in the Netherlands. In the Danish and Irish sample, participants could choose their desired topic without any suggestions which therefore served as a brief indicator of which topic is the most interesting for the respondents to answer to. The assumption was that people would be interested more in Health and Food than in Energy as the Energy application could be perceived as somewhat more detached from the everyday concerns of citizens.

Recruitment was initially run through snowball sampling which included efforts to equally cover respondents from all education groups including those who are lower educated. Despite these efforts, lower educated were underrepresented. Therefore, a second recruitment method via third party companies was included to target lower educated respondents (N for the third party recruitment is noted in a separate line in the Table 1).

Table 1: Number of respondents included in the survey

Country	Czech Rep. (Pilot)	Denmark	Spain (Pilot)	Ireland	Netherlands (Pilot)	**Overall**
N	**156**	**195**	**178**	**192**	**172**	**893**
Snowball	109	191	92	97	106	595
Third party	47	4	86	95	66	298
Third party company	STEM, z.s.	Pollfish	Pollfish	Pollfish	Pollfish	

Note: Country estimations were based on the language selection and therefore can differ from the countries in which the questionnaires were actually filled in.

The median time for filling in the questionnaire was nearly 13 minutes as it is recommended to be considered as the maximum length of surveys by some researchers (Fan & Yan, 2010) and which is also in line with our prior expectations given by our pilot testing that estimated the filling-in time from 10 to 15 minutes.

The overall number of unique accesses to the anonymous link was 1223. However, 330 respondents, who did not answer any of the questions and spent less than 5 minutes filling in the questionnaire, have been removed from the analysis, as this seemed to be the absolute minimum for reading the questionnaire through and filling in at least most of the answers. No upper time limit for data exclusion was introduced since one of the benefits of the online consultation platform is that people can come back to fill the questionnaire in at any point desired. Underage respondents (< 18) were also removed from the analysis. Partial filled in questionnaires were included, the number of respondents can therefore slightly differ throughout different questions of the analysis.

2. METHODS AND GOALS

The methods of the analysis aimed to find out more about the wider perception of Nanotechnology in general, but mainly to compare and prioritize the product suggestions, in other words, to understand the (1) desirability and (2) subjectively perceived unsafety of the product suggestions that were developed throughout the previous co-creation phases.

Firstly, a thematic analysis (Braun & Clarke, 2012) was used for the qualitative part of the study, consisting of the question *"What comes to your mind first when you hear the word "Nanotechnology"?"* with results visualized in word-clouds (Wordclouds.com). Ordinal scales (1= Negative to 5= Positive) of *"a priori positive/negative perceptions of Nanotechnology"* were than analysed through correlation analysis with education levels (1= Primary education level, 2= Secondary education level; 3= Tertiary education level)[1] and subjectively perceived awareness about Nanotechnology. The education groups were inspired by the ISCED 2011 levels. The aim was to shorten all the education levels to categories which are easily applied for all the countries involved.

Secondly, needs and values that were expressed by citizens during the citizen consultation and that were later "fact-checked" by stakeholders were prioritized during the online consultation: scores were attributed to each selected need and value (1-4 in Energy, 1-4 in Food, 1-6 in Health due to a different composition of the Stakeholder workshop I in the Netherlands which resulted in a different number of selected needs and values).

Thirdly, standardized "vignettes" were used for five concrete product suggestions or research aims that came out from a collaboration between citizen (Citizen workshop), and stakeholders including citizen (Stakeholder workshop I) from each of the pilot countries – Energy in Spain, Food in Czech Republic and health in Netherlands.

In the Energy area (Spain), five product suggestions were introduced:[2]

1) Autonomous sensor technologies for smart homes and smart cities
2) Exhibition of piezoelectric materials to raise people's awareness of renewable energy solutions
3) Strategies to utilise schools for educating the entire public body about green energy
4) Smart materials and energy devices that save energy and reduce workload at home
5) Ways to translate power grid from fossil fuels to renewable energy

In the Food area (Czech Republic), the suggestions were the following:

1) A food that contains a balanced mix of nutrients
2) Analytical methods for the detection of nanoparticles

[1] Result is a shortened list of categories inspired by the ISCED 2011.
[2] For full descriptions of the product suggestions, please see the Annex I.

3) An antimicrobial meat packaging solution
4) A packaging solution for fruits and vegetables
5) Specific applications for nanofilters

In the Health area (Netherlands), another five product suggestions were introduced:

1) Early diagnostic devices
2) Improvement of diagnoses of cancer through monitoring proteins
3) Field lab for health technologies
4) Data management of artificial pancreas
5) Better link between medical research and business

To understand (1) desirability and (2) subjectively perceived unsafety of the product suggestions, two scales containing three questions were used. Respondents answered on a 5-point Likert scales ranging from 'certainly not to surely would'. For all these product suggestions, two question scales were used: (1) **desirability** scale consisting of three questions:

1) Would this product (idea) be desirable to you?
2) Would you consider using this product (idea) yourself?
3) Would you recommend this product (idea) to your friends and family?

With 5-point answers: 1= Certainly not; 2= Rather not; 3= Neutral; 4= Rather would; 5= Surely would.

And (b) **subjectively perceived unsafety** scale consisting of another three questions:

1) Would you have concerns about the safety of this product (idea)?
2) Would you be worried about unknown consequences of using this product (idea)?
3) Would you feel safe using this product (idea)? R[3]

With 5-point answers: 1= Certainly not; 2= Rather not; 3= Neutral; 4= Rather would; 5= Surely would.

An additional question was used regarding the perception of **whom should reflect** these concerns:

1) Who should most importantly make sure this product (idea) is safe to use?

[3] R= Rotated item.

Participants therefore chose between different groups of stakeholders which were present in the previous phases of the project:

> Researchers: 1= Certainly not, 2= Rather not, 3= Neutral, 4= Rather should, 5= Surely should.
>
> Policy makers / politicians: 1= Certainly not, 2= Rather not, 3= Neutral, 4= Rather should, 5= Surely should.
>
> Industry / companies: 1= Certainly not, 2= Rather not, 3= Neutral, 4= Rather should, 5= Surely should.
>
> Civil society organizations: 1= Certainly not, 2= Rather not, 3= Neutral, 4= Rather should, 5= Surely should.

Scales were developed in close collaboration with the pilot partners, as they were also tested before the final dissemination. Cronbach´s α to measure internal consistency of the scales were assessed for both – desirability and subjectively perceived unsafety scales separately in the three application areas. Results showed that Cronbach´s α were well within the desired and expected values. With desirability scale ranging from **0.89** to **0.91** (0.89 for Energy, 0.91 for Food, 0.91 for Health), and subjectively perceived unsafety scale ranging from **0.85** to **0.90** (0.85 for Energy, 0.90 for Food, 0.88 for Health).[4]

[4] Cronbach´s α were assessed separately for each application area to demonstrate a slight lack of "power" of the instrument in Energy when compared with Food and Health applications.

3. RESULTS

3.1 OVERALL RESULTS

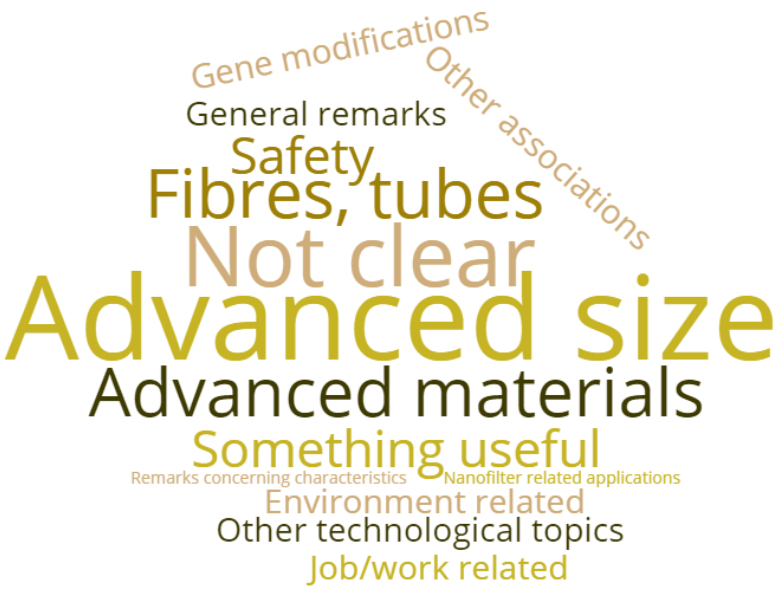
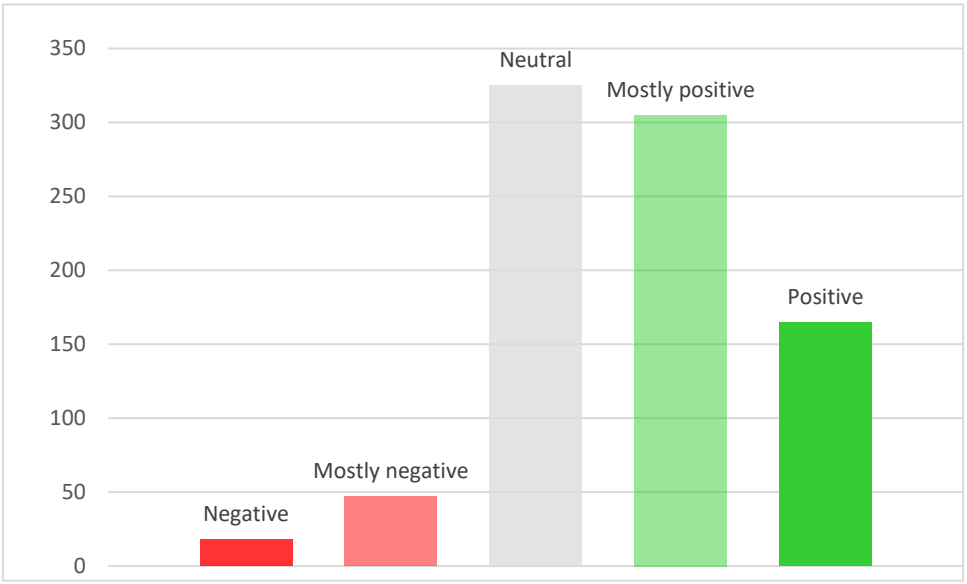


Figure 2: What comes to your mind first when you hear the word "Nanotechnology"? Answers from all the respondents from all five countries (N = 845).

From the results of the thematic analysis of the answers from all the respondents it seems that for most people Nanotechnology is being connected with its **specific characteristics** (40 %): as this would be especially connected to its advanced size (32 %), specific materials (over 3 %) or specific shapes of Nanotechnology – e.g. fibres or tubes (below 3 %). The other significant part the of respondents described Nanotechnology in **general terms** (35 %) as something advanced (15 %) or something connected with future (9 %) describing this idea using popular movies and characters. Or further as something that is closely related to research (5 %). Respondents at the same time often link Nanotechnology to other technologies such as Information technology, Artificial intelligence or Robots (11 %): e.g. prototypes of machines that work on a molecular scale. Over 7 % of all the respondents stated that they do not know anything about Nanotechnology or that they do not have any clear idea of what Nanotechnology is.

The overall "sentiment" that respondents connect with Nanotechnology (N = 860) is rather positive: about 55 % of all respondents chose "mostly positive" or "positive" associations (see Fig. 3).

Figure 3: The a priori perceived sentiment of Nanotechnology in general



The perceived sentiment of Nanotechnology showed a moderate association with respondents´ perception of themselves being well informed about Nanotechnology ($r_s = 0.31$, $p < .001$)[5] and a weak significant correlation with education ($r_s = 0.14$, $p < .001$).

3.1.1 INTEREST IN APPLICATION AREAS

When it comes to respondents´ interest in the application areas: Energy, Food and Health, and since Irish and Danish respondents (N = 394) could choose their application area of nanotechnology with no *a priori recommendation*, it seemed worth to follow on the question what these respondents would be primarily interested in – the expectation was that people would be interested more in Food and Health applications rather than in Energy, as Energy applications can be somehow seen less understandable in everyday context. This notion was to a certain extent supported by the data:

Figure 4: The self-selection of the application area

HEALTH

43 % (171 respondents)

FOOD

34 % (132 respondents)

[5] However, higher education level itself did not correlate with one´s subjective perception of being well informed about Nanotechnology as much ($r_s = 0.11$, $p = .002$).

ENERGY

23 % (91 respondents)

3.1.2 RE-INVOLVEMENT OF RESPONDENTS

Although an effort has been made as pilot partners explicitly asked the previously engaged stakeholders to fill in the questionnaire throughout the snowball sample (N = 292), quite a low percentage of the questionnaires received were filled in by people previously involved in the GoNano activities (Stakeholder workshop, Citizen workshop or people following web/social media):

Figure 5: The re-involvement in the co-creation process

Czech Republic … 37 % (38 respondents)

Netherlands … 24 % (25 respondents)

Spain … 22 % (18 respondents)

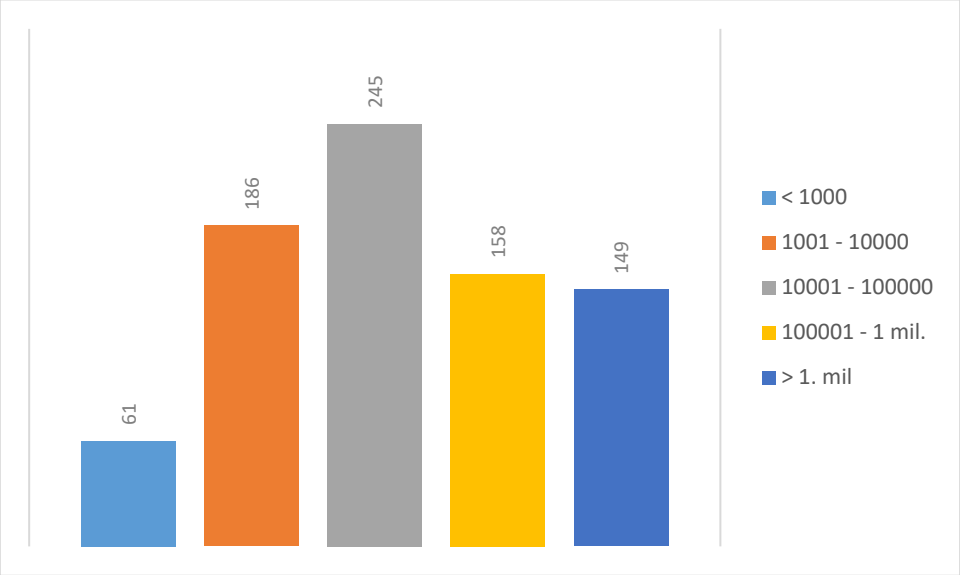
Of all snowball respondents, 9 % were working or studying in nano-related fields *(67 respondents)*, with the highest proportion of experts *(students or people already working in the field)* being represented in the Spanish sample *(20 % of respondents)*.

3.1.3 DESCRIPTION OF RESPONDENTS

The gender of the respondents was almost perfectly balanced *(female= 52 %)*, with the highest difference in the Czech sample *(female= 57 %)*. Participants´ age was on average slightly over 44 years *(M = 44,7; SD = 16,6).*

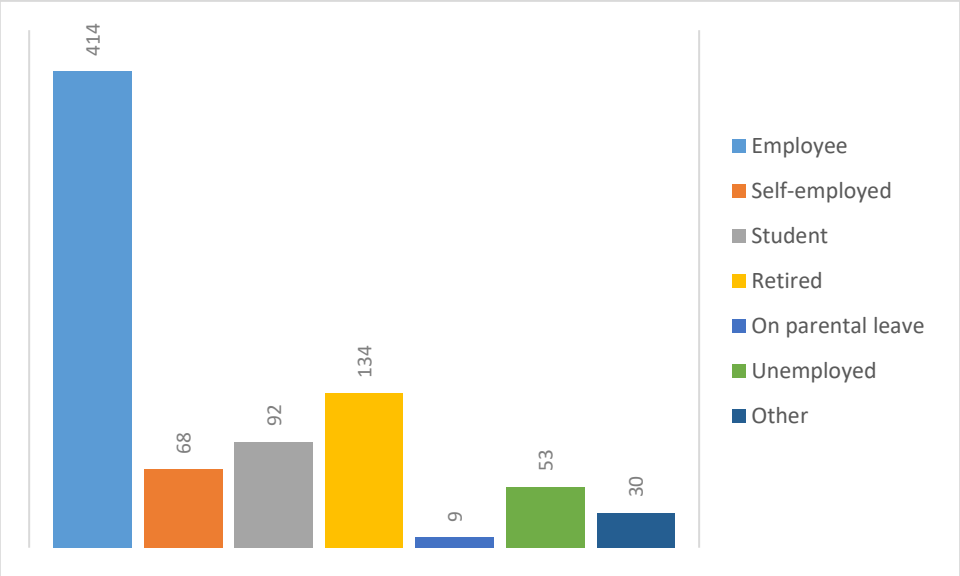
The sample was diverse with respondents from smaller villages and cities (less than 10 000 inhabitants) accounting for 32 %, respondents from mid-range cities accounting for 30 % (more than 10 001 and less than 100 000 inhabitants), and with respondents from bigger cities (more than 100 001) accounting for 38 % of all the responses.

Figure 6: Respondents´ size of the city



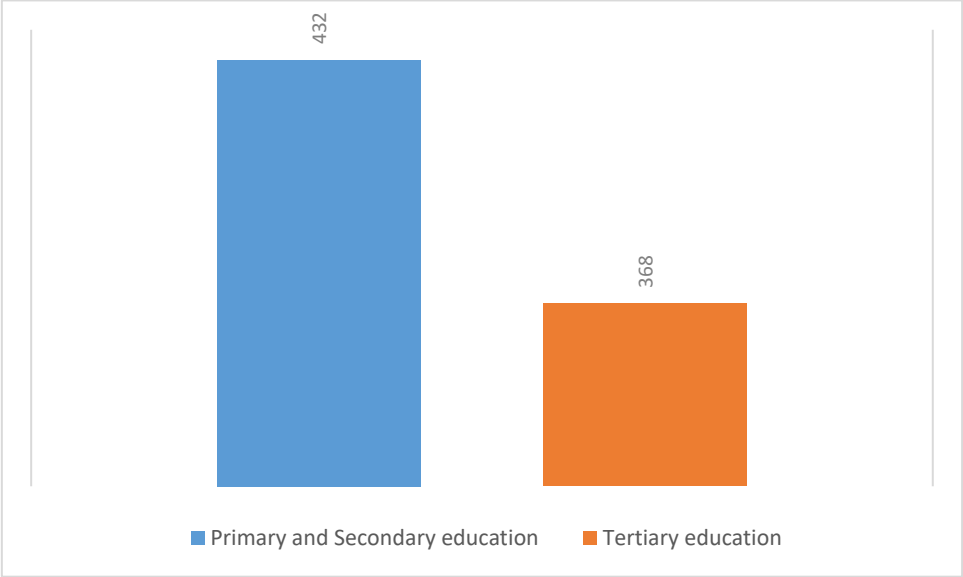
When it comes to economic activity, employees were represented in a slightly more than 50 % of the cases (51 % of all respondents), self-employed and employers in 8 % cases, students in 13 % of all cases, and other economically non-active respondents in 25 % of all cases.

Figure 7: Respondents´ economic activity



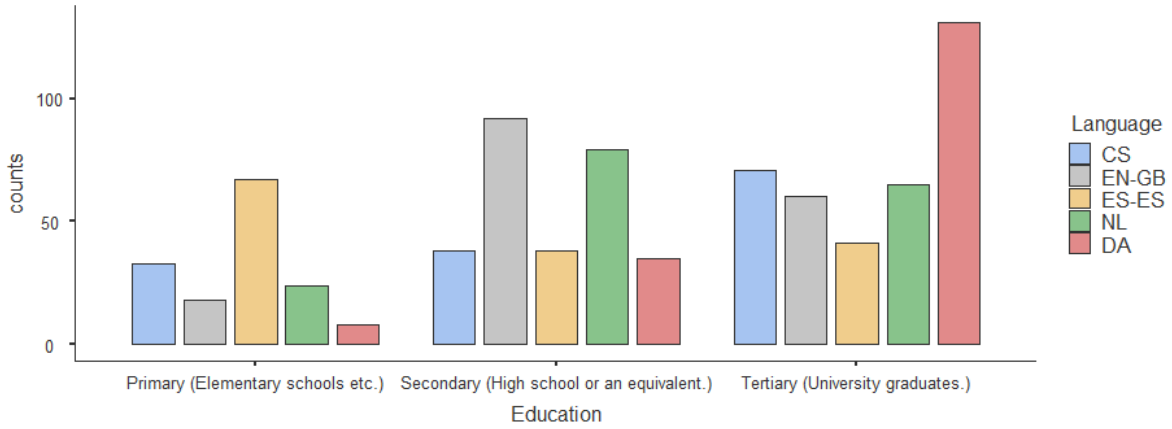
Regarding education in general, the sample consists of 54 % respondents with primary and secondary education, followed by 46 % of respondents with tertiary education.

Figure 8: Education of the respondents



Although a strong effort has been made to reach as varied and representative sample as possible, there is a slight overrepresentation of the tertiary educated in some of the samples when all results are taken together. This is even though additional measures – third party involvement which specifically recruited lower educated respondents – was introduced to specifically tackle this issue.

Figure 9: The distribution of educational levels within language groups



Note: The education groups were inspired by the ISCED 2011 levels. The aim was to shorten all the education levels to categories which are easily applied for all the countries involved.

3.1.4 Desirability and subjectively perceived unsafety of the potential products

When it comes to desirability of all product suggestions compared, the three most desired were:[6] **Improvement of diagnoses of cancer through monitoring proteins** *(M = 4.35, SD = 0.776)*, **Early diagnostic devices** *(M = 4.17, SD = 0.824)* and **Strategies to utilise schools for educating the entire public body about green energy** *(M = 3.98, SD = 1.01).* This aligns with findings from the field of biotechnology where people showed more interest in medical

[6] The full description of the product suggestions is available in the Annex I.

applications than in food applications as well. The interest for Energy applications can be explained from the current attention for climate change and energy transition.

The least three desired/least enthusiastically perceived product suggestions were: **A food that contains a balanced mix of nutrients** *(M = 2.99, SD = 1.07),* **Analytical methods for the detection of nanoparticles** *(M = 3.36, SD = 1.01)* and **Exhibition of piezoelectric materials to raise people's awareness of renewable energy solutions** *(M = 3.42, SD = 1.03).*[7]

Safety concerns were most intensively perceived in the three following cases: **A food that contains a balanced mix of nutrients** *(M = 3.51, SD = 0.849),* **Analytical methods for the detection of nanoparticles** *(M = 3.28, SD = 0.902)* and **Autonomous sensor technologies for smart homes and smart cities** *(M = 3.21, SD = 0.786)*. It seems that to a certain extent, the lower desirability of the product suggestion can be connected to higher safety concerns perceived by respondents – as analytical methods for the detection of nanoparticles negatively correlate the most strongly (*r = -0.55, p < .001)* of all the given correlations.[8]

Concerning the actors making sure that the final products are safe – in all the three topic areas researchers were the ones, who should make sure that the products are safe to use, followed by businessmen, politicians and civil society organizations, as these findings rather confirm what has been yet found out during the evaluation part of the project.

3.2 NANOTECHNOLOGY IN ENERGY

Figure 10: Energy sample – What comes to your mind first when you hear the word "Nanotechnology"?

[7] For more information about the desirability, please see the results for the respective topic areas.

[8] r = -0.46, p < .001 for the "Analytical methods for the detection of nanoparticles" and r = -0.34, p < .001 for the "Autonomous sensor technologies for smart homes and smart cities".

Respondents from the Energy sample mostly associate Nanotechnology with its advanced size characteristics (30 %), perceive it as something innovative, modern and new (22 %), connect Nanotechnology to other already existing or emerging technologies as IT, AI or Robots (11 %), or not associating Nanotechnology with anything clear (9 %).

After choosing the area of interest (Energy), respondents prioritized needs and values. The final prioritization is a sum of a score that was assigned to each ranking (1. – 4 points; 2. – 3 points; 3. – 2 points; 4. – 1 point).

Table 2: Energy sample – Prioritization of the needs and values

Ranking	Need and value	Number of points
1	More energy from renewable resources	527
2	Promoting sustainable development	430
3	Better quality of life	409
4	Educate the public on green energies	364

Of the four needs and values the most important are the "More energy from renewable resources" (527 p.), followed by the need for "Promoting sustainable development" (430 p.), "Better quality of life" (409 p.), and: "Educate the public on green energies" (364 p.)

This prioritization is somehow not reflected in the ranking of product suggestions as the "**Strategies to utilise schools for educating the entire public body about green energy**" seem to be the most popular idea amongst the respondents, followed by **"Ways to translate power grid from fossil fuels to renewable energy"** and on the contrary, with **"Exhibition of piezoelectric materials to raise people's awareness of renewable energy solutions"** being the least "favoured" suggestion.

Table 3: Desirability of the product suggestions in Energy

	Sensor technol.	Piezo. exhibition	Educating public	Energy devices	Renewable energy
N	170	168	164	162	157
Mean	3.71	3.42	3.98	3.88	3.91
Standard deviation	0.96	1.03	1.01	1.00	0.91

Safety concerns are being raised mostly (and in fact only) for the **"Autonomous sensor technologies for smart homes and smart cities"**. Subjectively perceived unsafety and desirability of these ideas and suggestions correlate most strongly – however still weakly – in case of "Sensor technologies" *(r_s= -0.28, $p < .001$)* and in case of "Educating public through schools about the green energy" *(r_s= -0.28, $p < .001$).*

Table 4: Safety concerns of the product suggestions in Energy

	Sensor technol.	Piezo. exhibition	Educating public	Energy devices	Renewable energy
N	171	168	164	161	156
Mean	3.21	2.79	2.49	2.91	2.59
Standard deviation	0.786	0.900	0.922	0.879	0.885

And who should make that "Autonomous sensor technologies" are safe to use? Respondents would claim that this is mainly up to researchers and businessmen.

Table 5: Stakeholders perceived as important to tackle the safety issues (Energy)

	Research	Policy	Business	Civil society
N	156	154	155	154
Mean	4.18	3.67	3.89	3.62
Standard deviation	0.806	1.03	0.975	0.940

3.3 NANOTECHNOLOGY IN FOOD

Figure 11: Food sample – What comes to your mind first when you hear the word "Nanotechnology"?

The Food respondents incline to associate Nanotechnology with its advanced size characteristics (33 %), to perceive Nanotechnology as being connected to something innovative, modern and new (24 %). In comparison with the other pilot countries, Food respondents seem to hold more specific associations with Nano-fibres and nanotubes (13 %). These are followed by associations with future (5 %).

After choosing the area of interest (Food), respondents prioritize the needs and values that come as a mutual result of a cooperation of citizens and stakeholders from the previous parts of the project: The final prioritization is a sum of a score that was assigned to each ranking (1.: points; 2.: 3 points; 3.: 2 points; 4.: 1 point).

Table 6: Food sample – Prioritization of the needs and values

Ranking	Need and value	Number of points
1	Safety of the Nanotechnologies in food with special focus on nanoparticles	930
2	Standardization and a control system	753
3	Prolonged shelf-life of the food	690
4	Customization of food	590

Of all the four needs and values the key one seemed to be the "Safety of the nanotechnologies in Food" (930 p.), followed by the need for "Standardization and a control system" (753 p.), "Prolonged shelf-life of the food" (690 p.), and at last the "Customization of food" (590 p.)

Table 7: Desirability of the product suggestions in Food

	Balanced food	Nanopart. Analysis	Antimicrob. packaging	Fruit/veg. packaging	Nanofilters Application
N	310	304	302	298	293
Mean	2.99	3.36	3.76	3.43	3.87
Standard deviation	1.07	1.01	1.08	1.19	1.01

The most „desired" product suggestion in Food are the „**Specific applications for nanofilters"**, followed by „**An antimicrobial meat packaging solution**", the least „desired" product suggestion is quite surprisingly **"A food that contains a balanced mix of nutrients**" – a novel food suggestion that was voted as the most popular idea of all during the first citizen consultation on Nanotechnology and Food (see Deliverable 3.2). It seems that citizens choose the less invasive option, which is similar to some surveys provided in the biotechnology field.

Ranking of the subjectively perceived unsafety of the product suggestions supports this notion with **"A food that contains a balanced mix of nutrients"** becoming the more important of the two safety concerns from of all the suggestions, followed by the **"Analytical methods for the detection of nanoparticles"**. Interestingly, a subjectively perceived unsafety of the product suggestions moderately negatively correlate with their desirability: r_s= -0.5, $p < .001$ for "A food that contains a balanced mix of nutrients", "Antimicrobial meat packaging system": r_s= -

0.44, $p < .001$ or "Analytical methods for the detection of nanoparticles": $r_s = -0.41$, $p < .001$.

Table 8: Safety concerns of the product suggestions in Food

	Balanced food	Nanopart. Analysis	Antimicrob. packaging	Fruit/veg. packaging	Nanofilter Applications
N	312	301	302	297	294
Mean	3.51	3.28	3.09	3.12	2.98
Standard deviation	0.85	0.90	0.94	0.95	0.94

When it comes to the question of who should make sure these product suggestions are safe to use, the expectation from the respondents would be that this is up to the researchers primarily, followed by businessmen, civil society organizations and politicians / policy makers as the least important stakeholders when it comes to dealing with the safety issue.

Table 9: Stakeholders perceived as important to tackle the safety issues (Food)

	Research	Policy	Business	Civil society
N	292	290	289	290
Mean	4.42	3.55	3.86	3.61
Standard deviation	0.74	1.24	1.17	1.04

3.4 NANOTECHNOLOGY IN HEALTH

Figure 12: Health sample – What comes to your mind first when you hear the word "Nanotechnology"?

The Health respondents most frequently associated nanotechnology with its advanced size characteristics (40 %), followed by IT related technologies, AI related technologies and Robots (11 %), Respondents to a certain extent also associated Nanotechnology with something new, modern and innovative (10 %), and with research and science (10 %).

After choosing the area of interest (Health), respondents prioritized needs and values. The final prioritization is a sum of a score that was assigned to each ranking (1. – 6 points; 2. – 5 points; 3. – 4 points; 4. – 3 points; 5. – 2 points, 6. – 1 point).

Table 10: Health sample – Prioritization of the needs and values

Ranking	Need and value	Number of points
1	Safety of the Nanotechnologies in health	1622
2	Well-being of the customers	1401
3	Accessibility of products and treatment	1372
4	Costs of medical treatment	1141
5	Autonomy of the users in using medical products and treatments	1079
6	Privacy and security of health data	1071

Of the six needs and values, for the Health respondents, the most important are the "Safety of the nanotechnologies in Health" (1622 p.), followed by the "Well-being of the customers" (1401 p.), "Accessibility of products and treatments" (1372 p.), "Costs of medical treatment"

(1141 p.), "Autonomy of the users.." (1079 p.) and "Privacy and security of health data" (1071 p.).

Of all the Health application ideas, the **"Improvement of diagnoses of cancer through monitoring proteins"** was on average the most desirable product suggestion both in Health and amongst the other application areas, this was followed by the **"Early diagnostics"** and creating a **"Better link between medical research and business"** being the least favoured in the Health application area. Remarkably, all scores where above the mid-point 3 of the Likert-scale.

Table 11: Desirability of the product suggestions in Health

	Early diagn.	Diagn. of cancer	Health field lab.	Data Man.	Linking R&B
N	359	352	348	342	338
Mean	4.17	4.35	3.68	3.97	3.65
Standard deviation	0.82	0.78	0.92	0.87	0.91

The safety concerns were associated with the **„Data management of artificial pancreas"**. Moreover, subjectively perceived unsafety was moderately negatively correlated with desirability of the ideas in all cases, most strongly in case of "Early diagnostics": r_s= -.43, p < .001, and "Data management of artificial pancreas" r_s= -.42, p < .001.

Table 12: *Safety concerns of the product suggestions in Health*

	Early diagn.	Diagn. of cancer	Health field lab.	Data Man.	Linking R&B
N	359	351	346	343	336
Mean	2.53	2.73	2.90	3.03	2.89
Standard deviation	0.884	0.868	0.916	0.876	0.907

These safety concerns should be tackled mainly by the researchers, followed by policy makers and business.

Table 13: Stakeholders perceived as important to tackle the safety issues (Health)

	Research	Policy	Business	Civil society
N	335	333	332	331
Mean	4.47	3.96	3.93	3.74
Standard deviation	0.664	0.979	1.06	0.901

3.5 CO-CREATION – FEEDBACK

In the final part, Block 5, of the online questionnaire, respondents were asked not only for providing a basic **demographic information** (such as nationality, gender, education level, age or employment activity), but also feedback on the questionnaire itself and on the co-creation process as such.

In reaction to the first feedback question on whether they think it makes sense to consider the values and concerns of citizens in the early stages of nanotechnology research, in average 78 % of all the 794 responses strongly or partly agreed (CZ: 81 %; IRL 78 %; ES 69 %; NL 83 % and DA 77 %).

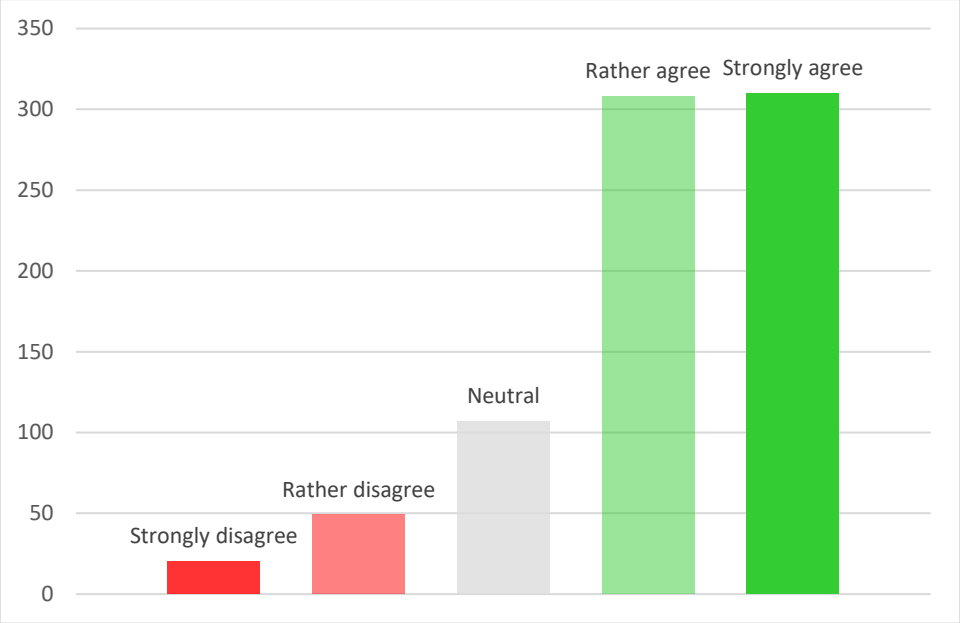
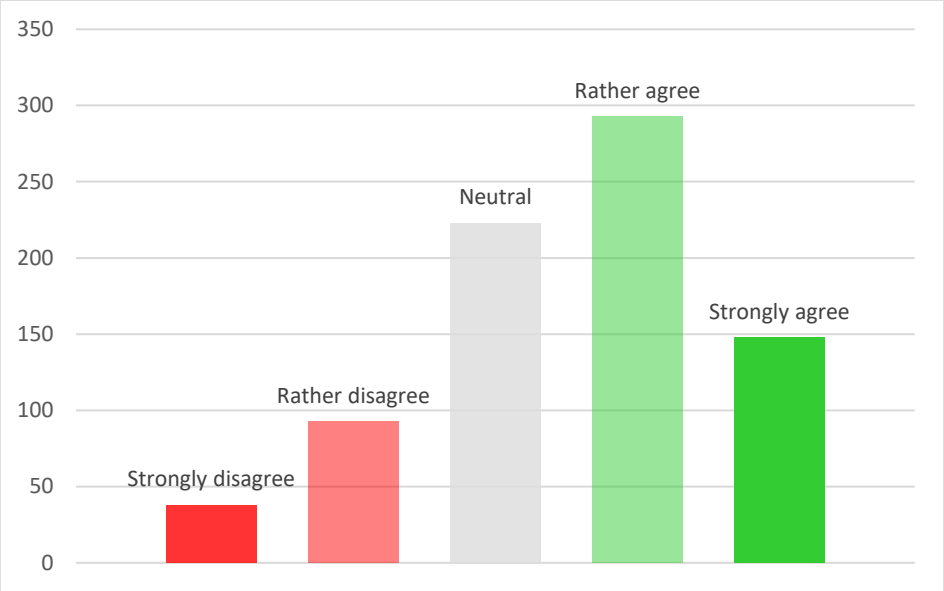


Figure 13: Do you think that it makes sense to consider values and concerns of citizens in the early stages of nanotechnology research? (number of responses from all the five countries)

Secondly, respondents largely strongly or partly agreed as well that they feel confident answering the questions about the product suggestions. Respondents from the pilot countries (CZ, ES and NL) were much more positive here (62 % in average) than the ones from the other two countries (IRL, DA: 46 % in average) where neither the citizen consultation nor the first stakeholder workshop took place on the nano and food / energy / health. That could illustrate that the self-assessment on confidence are related to the previous awareness of the product suggestions in the earlier stages of the co-creation process.

Figure 14: Did you feel confident answering the questions about the product suggestions? (number of responses from all the five countries)



Lastly, respondents remained neutral or slightly positive on whether their opinions would be considered during the further stages of development of the product suggestions. In this context, the fact whether it was the pilot country or not did not play a big difference in reactions.

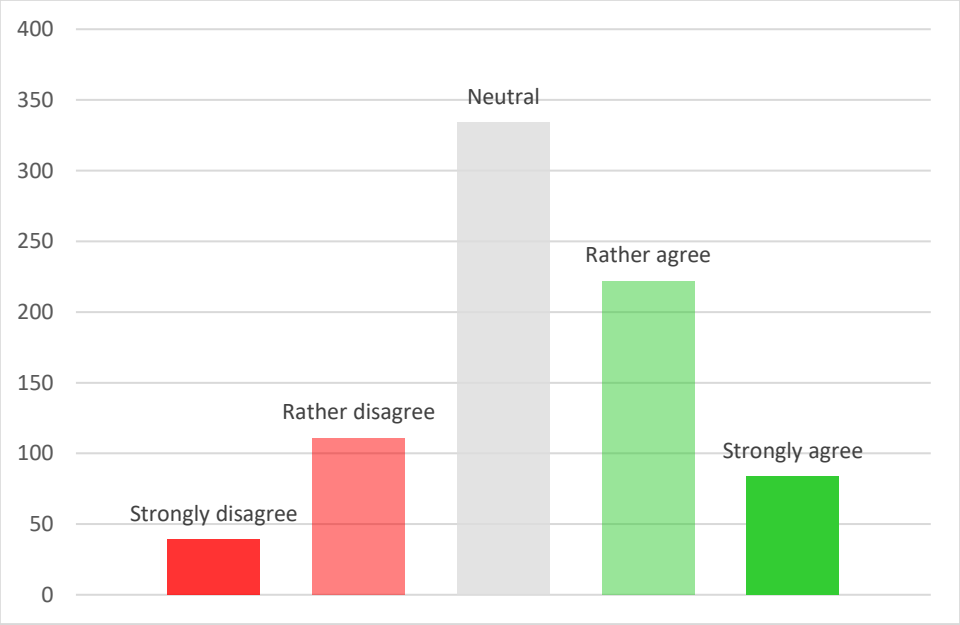


Figure 15: Do you believe your opinions will be considered during the further stages of development of the product suggestions?

3.6 INPUT FOR THE SECOND ROUND OF CO-CREATION

The online consultation brings broader perspective to the research aims and product suggestions of the stakeholders defined at the first stakeholder workshop and adds additional input for the second stakeholder workshop. Co-creation has been further developed by introducing quantitative and qualitative methods on a sample of respondents from five countries (3 pilot countries: Spain, the Czech Republic and the Netherlands and 2 other

partner countries: Denmark and Ireland). The demographic criteria have been carefully taken into account and covered aiming at a representative date collection.

Needs and values formulated by citizens on the Citizen consultation and revised by stakeholders at the first stakeholder workshop were prioritised for the energy, food and health application area. Product suggestions designing by all actors involved during the previous phase of the co-creation process were further assessed concerning their desirability, unsafety and preferences.

Generally, the respondents highlighted safety issues concerning the future applications of Nanotechnology. Health and Food application areas are somehow more associated with safety concerns than Energy. Concerning the actors making sure that the final products are safe in all the three topic areas researchers were the ones, who should make sure that the products are safe to use.

4. DISCUSSION

One of important questions concerning GoNano methodology is the re-involvement of the stakeholders through all the steps, as it indeed seems that the majority of participants in the questionnaire were new and not involved in any of the preceding GoNano activities (84 % in the Snowball sample; 87 % in the overall sample), even though an effort has been made and reminders with the questionnaire links were sent out by all the pilot partners involved with various success (ranging from 37 % of them in the Czech snowball sample to 22 % in Spanish snowball sample).

On the other hand, what can be considered rather successful seems to be the incorporation of as many views as possible including people from various socioeconomic backgrounds, city size, but also lower educated participants as the overall percentage of respondents with primary and secondary education accounts for 54 % answers of all the respondents.

When it comes to education, a very brief version of ISCED categories was used, therefore it is possible that some information might have been lost due to "sharp" distinctions of these three categories of education (Tertiary= 3; Secondary= 2; Primary=1). Moreover, during the discussions after the dissemination of the questionnaire it seemed possible that people would somehow hesitate more to answer/ consider themselves a part of the primary category in such strict categories and especially in countries with relatively higher percentage of higher educated population (e.g. Denmark). An interesting point for further research could be to compare the two different groups selected by whether they were recruited via snowballing (middle and higher educated) or via the third party companies (lower educated). If these groups do not differ significantly, it would mean that actually education is not relevant for having opinions on this topic.

Results of the prioritization of the needs and values raised a question if there is not a slight overestimation present of the need for the people to have more autonomy / to be more involved in the more advanced aspects of usage of the products – the evidence from the current study does not seem to show that it is crucial for people to customize food or for the potential users to be autonomous when it comes to their decisions concerning their health. It could be that these needs and values, including privacy and security issues, should be somehow more connected to the internal deliberations of the experts developing products rather than having potential customers involved in the processes.

When it comes to desirability of the products suggestions, it seems that ideas which can be perceived somehow beneficial for the whole society gain the most popularity. On the other hand, the perceived risks are somehow most strongly manifested in the Food application rather than in other areas.

Concerning the internal consistency of the desirability and subjectively perceived unsafety scales, it was expected that the values would be somehow lower for the Energy applications: One of the main struggles concerning the design of the questionnaire was how to apply the same question scales on such a variety of product suggestions – ranging from concrete products to research aims, to e.g. an arrangement of a festival in the Energy application area.

Therefore an important question is to what extent is the "final ranking" of the product suggestions a result of their differences in specificity, as one would expect that the questions would be somehow less corresponding with more vague or differently structured ideas in general.

5. CONCLUSION

Nanotechnologies in all countries seem to be predominantly connected with characteristics and general remarks that are rather unspecific. Positive attitudes towards Nanotechnology in general seem to be somehow given by subjectively perceived awareness about the topic.

When it comes to the online involvement of the previously participating stakeholders, the co-creation of product suggestions and ideas seems to be somehow limited with low response rate of the previously involved. Nevertheless, all the respondents that are taken into account provide us with important information concerning prioritization, desirability and subjectively perceived unsafety of the ideas and product suggestions developed in the previous phases of the project build an impulse for the Stakeholder workshop 2, which aims to reflect these findings.

Specific product suggestions in Health are on average the most popular ones with *"Improvement of diagnoses of cancer through monitoring proteins"* and *"Early diagnostic devices"* being the most desired product suggestions of all the application areas.

Health and Food application areas are somehow more associated with safety concerns than Energy: subjectively perceived unsafety of a product suggestion and the desirability for the same product suggestion correlate only weakly when compared to moderate correlations in Health and Food product suggestions.

The least safe perceived product suggestions are connected with Food: *with "A food with a balanced mix of nutrients"* and – surprisingly – *"Analytical methods for the detection of nanoparticles".* Needs and values connected to safety are at the same time the most prioritized ones by respondents in both Food and Health application areas.

REFERENCES

Braun, V., & Clarke, V. (2012). Thematic analysis.

Fan, W., & Yan, Z. (2010). Factors affecting response rates of the web survey: A systematic review. *Computers in human behaviour*, *26*(2), 132-139.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. Sage.

The jamovi project (2019). *jamovi*. (Version 1.0) [Computer Software]. Retrieved from https://www.jamovi.org.

R Core Team (2018). *R: A Language and environment for statistical computing*. [Computer software]. Retrieved from https://cran.r-project.org/.

ANNEX I: PRODUCT SUGGESTIONS

Product suggestions in the Energy application area:

1) **Autonomous sensor technologies for smart homes and smart cities**
   A group of senior researchers from design and materials science are considering plans to develop new autonomous sensor technologies for smart homes, to benefit consumers; for smart cities, to benefit drivers, cyclists, and other travellers; for drug tests, to benefit the police, schools, and sporting authorities; and for supply chains, to benefit industries in the logistics sector. A key design criteria is that the materials used in the sensors, including any nanomaterials, should be sustainable or recycled/recyclable.

2) **Exhibition of piezoelectric materials to raise people's awareness of renewable energy solutions**
   A group of junior researchers are considering plans to organise a "Piezo Festival", an arts and music festival for showcasing piezoelectric* materials and devices in order to raise the public's awareness of renewable energy technologies. The group plans to obtain financial backing from the government, private and non-profit organisations, and a piezo-dancefloor company, and they will engage with the arts community to advertise the event on social media platforms such as Instagram and Twitter. The main attraction will be the energy-producing dancefloor, but there will also be other fun activities for kids and stalls for organisations to show off the latest advances in renewable energy technologies.

   * Piezoelectric materials and devices can generate electricity in response to contact or changes in pressure.

3) **Strategies to utilise schools for educating the entire public body about green energy**
   A group of researchers, teachers, and science communicators want to develop a strategy to promote schools as the central hub for educating the entire public body (students, teachers, families, local businesses and civil society organizations) on the importance of green energy and to address local environmental challenges. Repair work-shops at the school will teach the students (and adult learners) how to fix old or broken devices collected from the local community (citizens and businesses) or how the parts and materials can be reused or recycled. An accompanying app will be set up to support communication amongst the community and organisation of events and activities.

4) **Smart materials and energy devices that save energy and reduce workload at home**
   A group of students, researchers, and designers plan to exploit technology advances in nanoscience and sensors to develop smart materials and intelligent devices that can save energy and reduce the workload in the kitchen and around the home. Some of the design features and ideas include a smart shower that heats the water using waste heat from other household devices and processes (refrigerator, oven, solar panels, etc.) and a refrigerator-microwave oven combination that suggests meals based on the available ingredients and then cooks them – all controlled via a mobile app.

5) **Ways to translate power grid from fossil fuels to renewable energy**
A group of researchers and science communicators want to contribute to activities surrounding the transition of the power grid from fossil fuels to renewable energy. They plan to get involved in both top-down legislation and bottom-up community actions by speaking at public information events, writing informative guides and policy recommendations, and developing a "re-grid" community where information on renewable energy activities can be exchanged.

Product suggestions in the Food application area:

1) **A food that contains a balanced mix of nutrients**
A group of chemistry and materials science researchers are developing a prototype food that would contain a balanced mix of nutrients. The target group would be all customers, since the product would be personalized to the customers´ needs. However, potential groups would also include people with allergies and specific dietary needs. Research efforts would concentrate on making useful nutrients in form of particles at the nanoscale. The nutrients would also be encapsulated for targeted delivery to the desired spots within the body.

2) **Analytical methods for the detection of nanoparticles**
A group of researchers from various fields connected to nanotechnologies aim to develop a system for detection and analysis of artificial nanoparticles in food. This method would be standardized and accredited at the international level. Potential customers would benefit from reliable identification and reporting of safe numbers of artificial nanoparticles contained in food. This would help to ensure food safety and allay fears surrounding the potential exposure of the food supply and ourselves to unsafe levels of artificial nanoparticles.

3) **An antimicrobial meat packaging solution**
A group of researchers in nanotechnologies and advanced materials aim to develop a smart food packaging to eliminate the effect of external factors and increase food quality. A key component of the packaging would be its active properties, e.g. using an antimicrobial layer to prevent against bacterial contamination. The target group would be all customers, big food chains and other meat suppliers and distributors. In addition, this packaging should also contribute to overall food waste reduction.

4) **A packaging solution for fruits and vegetables**
A group of researchers have developed a smart food packaging solution that could be used for each piece of fruit or vegetable, with the aim to prolong its shelf-life and to increase the freshness and quality of the food products. The target group would be customers with increased need for safety and freshness of the food. The package would have controlled atmosphere, temperature and a control of the ripening of the food. The packaging solution would also use specific antibacterial coating to protect the food from listeria contamination.

5) **Specific applications for nanofilters**

A group of researchers are developing specific nanofilter applications. These include filtering waste products of drinks (e.g.: wine by-products), filtration of undesired substances, depletion of specific harmful contaminants (e.g. acids, pesticides and heavy metals) from food and drinks. All customers would benefit from the application of these ideas through improved food and water that would lead to a better quality of life.

Product suggestions in the Health application area:

1) **Early diagnostic devices**
   A group of product developers plans to develop a lab-on-a-chip device that can detect the potential for diabetes type 2* in a person ten years before the actual symptoms occur, based on a small droplet of blood taken from the finger. The device is accessible at the general practitioner's office or pharmacy, and on a yearly cycle in community centres and other public places in the neighbourhood. Everyone has access to use the diabetes type 2 test, but high-risk groups will specifically be targeted and motivated to use it. By detecting the potential for diabetes type 2 at a very early stage, people can change their behaviour to reduce the negative effects of the disease.

   * A progressive disease in which the body becomes resistant to insulin or the pancreas makes less insulin.

2) **Improvement of diagnoses of cancer through monitoring proteins**
   Researchers are working on a device that can identify characteristics of tumour cells in a detailed way, which gives information for personalized medicine. A surgeon takes a biopsy of the tumour cells during an operation, and characteristics of these cells are analysed. Based on the personal characteristics, doctors can offer more-effective personalized medications and treatment plan.

3) **Field lab for health technologies**
   A group of researchers, policy makers and other stakeholders plan to develop a hospital-based field lab where scientists working on health technologies can test these with (potential) users (e.g., patients and health professionals). Researchers will test non-invasive technologies, such as diagnostic and monitoring devices, directed to specific patient groups. Apart from collecting input from the (potential) users for the development of the technology, the field lab functions as a way of disseminating scientific developments in the area of health.

4) **Data management of artificial pancreas**
   A group of product developers working on the development of an artificial pancreas, plan to extend the device with a data management plan. The artificial pancreas is a device that can be used by diabetes type 1* patients, which constantly monitors glucose levels and injects insulin when needed. Many health indicators of the patient are collected through this monitoring, and the new data management plan offers the possibility for patients to share the data with a health professional and the manufacturer of the device. Health professionals can then offer personalized feedback to the patient. The manufacturer can also improve the device by analysing the combined data of all patients who use the device.

* An auto-immune disease of the pancreas requiring insulin treatment.

5) **Better link between medical research and business**

Researchers and policy makers of a nanotechnology research institute are working on a programme that focuses on research, which is linked to problems defined by companies working on health technologies and pharmaceuticals. Through such a programme, policy makers will try to make a better link between theory and practice, and to increase the societal impact of their research. Less focus will be on fundamental research in this programme.

ANNEX II: ONLINE QUESTIONNAIRE

Online consultation questionnaire

Title of the questionnaire: Nanotechnologies in Energy, Food and Health
English version 13/05/19
Test

BLOCK 1

Introduction and language selection

Welcome to the GoNano online consultation. What do you think about nanotechnologies and their applications in food, energy or health? Please share your thoughts in the following 10-15 minutes.

The current study aims to assess possible products using nanotechnologies* that could emerge in the near future, as well as dealing with demographic and other variables connected to public opinion on nanotechnologies.

The questionnaire is anonymous and will be treated as such in any further analyses. If you would like to know more about the study, please visit the project website (www.gonano-project.eu).

* Nanotechnologies – the purposeful engineering of matter on the atomic or molecular scale.

1_LANG Choose your language:

- Česky
- Dansk
- English
- Español
- Nederlands

BLOCK 2

Screening questions

FA What first comes to your mind when you hear the word “nanotechnologies”?
Max 30 characters.

- (Please answer with a single word or short phrase).

PCV Are your perceptions of the word “nanotechnologies” mostly negative or mostly positive?
Likert scale.

- 1 mostly negative … 5 mostly positive

INF To what extent do you consider yourself well-informed in nanotechnologies and associated fields (e.g. nanoscience, chemistry, biophysics, etc.)?
Likert scale.

- 1= Not at all informed; 5= Very well informed

EXP Do you study or work in nanotechnologies and associated fields (e.g. nanoscience, chemistry, biophysics, etc.)?
Dichotomic.

- Yes
- No

PRV Have you already participated in any previous GoNano activities?
Single choice.

- No
- Yes, in:
  Citizens’ workshop
  Stakeholders’ workshop
  Other (e.g. Web or Social media)

CHOOSING AN APPLICATION

In the following section, questions will focus on a particular area of nanotechnology research and development. You can choose between Energy, Food and Health.

ENERGY **FOOD** **HEALTH**

(randomized order or three versions of the questionnaire)

BLOCK 3: ENERGY Prioritizing needs and values

During autumn 2018, groups of citizens identified specific needs and values they thought were important to consider when developing future applications of nanotechnologies. In spring this year, stakeholders then selected some of these needs and values and related them to specific ideas and products.

Please prioritize the following needs and values according to your opinion of how important they are for developing nanotechnologies in energy applications:

Putting a number: 1-4
_Better quality of life
_Educate the public on green energies
_ More energy from renewable resources
_Promoting sustainable development

BLOCK 3: FOOD Prioritizing needs and values

During autumn 2018, groups of citizens identified specific needs and values they thought were important to consider when developing future applications of nanotechnologies. In spring this year, stakeholders then selected some of these needs and values and related them to specific ideas and products.

Please prioritize the following needs and values according to your opinion of how important they are for developing nanotechnologies in food applications:

Putting a number: 1-4
_Safety of the nanotechnologies in food with a special focus on nanoparticles
_Standardization and a control system
_Customization of food
_Prolonged shelf-life of the food

BLOCK 3: HEALTH Prioritizing needs and values

During autumn 2018, groups of citizens identified specific needs and values they thought were important to consider when developing future applications of nanotechnologies. In spring this year, stakeholders then selected some of these needs and values and related them to specific ideas and products.

Please prioritize the following needs and values according to your opinion of how important they are for developing nanotechnologies in health applications:

Putting a number: 1-6
_Safety of the nanotechnologies in health
_Well-being of the customers

_Autonomy of the users in using medical products and treatments
_Accessibility of products and treatments
_Privacy and security of health data
_Costs of medical treatment

BLOCK 4: ENERGY **Prioritizing and elaborating product suggestions**

Now, please read and reflect on the following suggestions and tell us your views by answering the corresponding questions:

6) **Autonomous sensor technologies for smart homes and smart cities**
A group of senior researchers from design and materials science are considering plans to develop new autonomous sensor technologies for smart homes, to benefit consumers; for smart cities, to benefit drivers, cyclists, and other travellers; for drug tests, to benefit the police, schools, and sporting authorities; and for supply chains, to benefit industries in the logistics sector. A key design criteria is that the materials used in the sensors, including any nanomaterials, should be sustainable or recycled/recyclable.

7) **Exhibition of piezoelectric materials to raise people's awareness of renewable energy solutions**
A group of junior researchers are considering plans to organise a "Piezo Festival", an arts and music festival for showcasing piezoelectric* materials and devices in order to raise the public's awareness of renewable energy technologies. The group plans to obtain financial backing from the government, private and non-profit organisations, and a piezo-dancefloor company, and they will engage with the arts community to advertise the event on social media platforms such as Instagram and Twitter. The main attraction will be the energy-producing dancefloor, but there will also be other fun activities for kids and stalls for organisations to show off the latest advances in renewable energy technologies.

* Piezoelectric materials and devices can generate electricity in response to contact or changes in pressure.

8) **Strategies to utilise schools for educating the entire public body about green energy**
A group of researchers, teachers, and science communicators want to develop a strategy to promote schools as the central hub for educating the entire public body (students, teachers, families, local businesses and civil society organizations) on the importance of green energy and to address local environmental challenges. Repair work-shops at the school will teach the students (and adult learners) how to fix old or broken devices collected from the local community (citizens and businesses) or how the parts and materials can be reused or recycled. An accompanying app will be set up to support communication amongst the community and organisation of events and activities.

9) **Ways to translate power grid from fossil fuels to renewable energy**

A group of researchers and science communicators want to contribute to activities surrounding the transition of the power grid from fossil fuels to renewable energy. They plan to get involved in both top-down legislation and bottom-up community actions by speaking at public information events, writing informative guides and policy recommendations, and developing a "re-grid" community where information on renewable energy activities can be exchanged.

10) **Smart materials and energy devices that save energy and reduce workload at home**
A group of students, researchers, and designers plan to exploit technology advances in nanoscience and sensors to develop smart materials and intelligent devices that can save energy and reduce the workload in the kitchen and around the home. Some of the design features and ideas include a smart shower that heats the water using waste heat from other household devices and processes (refrigerator, oven, solar panels, etc.) and a refrigerator-microwave oven combination that suggests meals based on the available ingredients and then cooks them – all controlled via a mobile app.

These questions will be repeated for each product (or idea):

Would this product (idea) be desirable to you?
1… Certainly not; Surely would …5
Would you consider using this product (idea) yourself?
1… Certainly not; Surely would …5
Would you recommend this product (idea) to your friends and family?
1… Certainly not; Surely would …5

Would you have concerns about the safety of this product (idea)?
1… Certainly not; Surely would …5
Would you be worried about unknown consequences of using this product (idea)?
1… Certainly not; Surely would …5
Would you feel safe using this product (idea)?
1… Certainly not; Surely would …5

Who should most importantly make sure this product (idea) is safe to use?
Researchers
1… Certainly not; Surely should …5
Policy makers / Politicians
1… Certainly not; Surely should …5
Industry / Companies
1… Certainly not; Surely should …5
Civil society organizations
1… Certainly not; Surely should …5

Do you have suggestions on how this product (idea) could be improved?
Open question

BLOCK 4: FOOD Prioritizing and elaborating product suggestions

Now, please read and reflect on the following suggestions and tell us your views by answering the corresponding questions:

6) **A food that contains a balanced mix of nutrients**

A group of chemistry and materials science researchers are developing a prototype food that would contain a balanced mix of nutrients. The target group would be all customers, since the product would be personalized to the customers´ needs. However, potential groups would also include people with allergies and specific dietary needs. Research efforts would concentrate on making useful nutrients in form of particles at the nanoscale. The nutrients would also be encapsulated for targeted delivery to the desired spots within the body.

7) **Analytical methods for the detection of nanoparticles**

A group of researchers from various fields connected to nanotechnologies aim to develop a system for detection and analysis of artificial nanoparticles in food. This method would be standardized and accredited at the international level. Potential customers would benefit from reliable identification and reporting of safe numbers of artificial nanoparticles contained in food. This would help to ensure food safety and allay fears surrounding the potential exposure of the food supply and ourselves to unsafe levels of artificial nanoparticles.

8) **An antimicrobial meat packaging solution**

A group of researchers in nanotechnologies and advanced materials aim to develop a smart food packaging to eliminate the effect of external factors and increase food quality. A key component of the packaging would be its active properties, e.g. using an antimicrobial layer to prevent against bacterial contamination. The target group would be all customers, big food chains and other meat suppliers and distributors. In addition, this packaging should also contribute to overall food waste reduction.

9) **A packaging solution for fruits and vegetables**

A group of researchers have developed a smart food packaging solution that could be used for each piece of fruit or vegetable, with the aim to prolong its shelf-life and to increase the freshness and quality of the food products. The target group would be customers with increased need for safety and freshness of the food. The package would have controlled atmosphere, temperature and a control of the ripening of the food. The packaging solution would also use specific antibacterial coating to protect the food from listeria contamination.

10) **Specific applications for nanofilters**

A group of researchers are developing specific nanofilter applications. These include filtering waste products of drinks (e.g.: wine by-products), filtration of undesired substances, depletion of specific harmful contaminants (e.g. acids, pesticides and heavy metals) from food and drinks. All customers would benefit from the application of these ideas through improved food and water that would lead to a better quality of life.

These questions will be repeated for each product:

Would this product (idea) be desirable to you?
1… Certainly not; Surely would …5
Would you consider using this product (idea) yourself?
1… Certainly not; Surely would …5
Would you recommend this product (idea) to your friends and family?
1… Certainly not; Surely would …5

Would you have concerns about the safety of this product (idea)?
1… Certainly not; Surely would …5
Would you be worried about unknown consequences of using this product (idea)?
1… Certainly not; Surely would …5
Would you feel safe using this product (idea)?
1… Certainly not; Surely would …5

Who should most importantly make sure this product (idea) is safe to use?
Researchers
1… Certainly not; Surely should …5
Policy makers / Politicians
1… Certainly not; Surely should …5
Industry / Companies
1… Certainly not; Surely should …5
Civil society organizations
1… Certainly not; Surely should …5

Do you have suggestions on how this product (idea) could be improved?
Open question

BLOCK 4: HEALTH **Prioritizing and elaborating product suggestions**

Now, please read and reflect on the following suggestions and tell us your views by answering the corresponding questions:

6) **Early diagnostic devices**
A group of product developers plans to develop a lab-on-a-chip device that can detect the potential for diabetes type 2* in a person ten years before the actual symptoms occur, based on a small droplet of blood taken from the finger. The device is accessible at the general practitioner's office or pharmacy, and on a yearly cycle in community centres and other public places in the neighbourhood. Everyone has access to use the diabetes type 2 test, but high-risk groups will specifically be targeted and motivated to use it. By detecting the potential for diabetes type 2 at a very early stage, people can change their behaviour to reduce the negative effects of the disease.

* A progressive disease in which the body becomes resistant to insulin or the pancreas makes less insulin.

7) Data management of artificial pancreas

A group of product developers working on the development of an artificial pancreas, plan to extend the device with a data management plan. The artificial pancreas is a device that can be used by diabetes type 1* patients, which constantly monitors glucose levels and injects insulin when needed. Many health indicators of the patient are collected through this monitoring, and the new data management plan offers the possibility for patients to share the data with a health professional and the manufacturer of the device. Health professionals can then offer personalized feedback to the patient. The manufacturer can also improve the device by analysing the combined data of all patients who use the device.

* An auto-immune disease of the pancreas requiring insulin treatment.

8) Improvement of diagnoses of cancer through monitoring proteins

Researchers are working on a device that can identify characteristics of tumour cells in a detailed way, which gives information for personalized medicine. A surgeon takes a biopsy of the tumour cells during an operation, and characteristics of these cells are analysed. Based on the personal characteristics, doctors can offer more-effective personalized medications and treatment plan.

9) Better link between medical research and business

Researchers and policy makers of a nanotechnology research institute are working on a programme that focuses on research, which is linked to problems defined by companies working on health technologies and pharmaceuticals. Through such a programme, policy makers will try to make a better link between theory and practice, and to increase the societal impact of their research. Less focus will be on fundamental research in this programme.

10) Field lab for health technologies

A group of researchers, policy makers and other stakeholders plan to develop a hospital-based field lab where scientists working on health technologies can test these with (potential) users (e.g., patients and health professionals). Researchers will test non-invasive technologies, such as diagnostic and monitoring devices, directed to specific patient groups. Apart from collecting input from the (potential) users for the development of the technology, the field lab functions as a way of disseminating scientific developments in the area of health.

These questions will be repeated for each product:

Would this product (idea) be desirable to you?

1… Certainly not; Surely would …5

Would you consider using this product (idea) yourself?

1… Certainly not; Surely would …5

Would you recommend this product (idea) to your friends and family?
1… Certainly not; Surely would …5

Would you have concerns about the safety of this product (idea)?
1… Certainly not; Surely would …5
Would you be worried about unknown consequences of using this product (idea)?
1… Certainly not; Surely would …5
Would you feel safe using this product (idea)?
1… Certainly not; Surely would …5

Who should most importantly make sure this product (idea) is safe to use?
Researchers
1… Certainly not; Surely should …5
Policy makers / Politicians
1… Certainly not; Surely should …5
Industry / Companies
1… Certainly not; Surely should …5
Civil society organizations
1… Certainly not; Surely should …5

Do you have suggestions on how this product (idea) could be improved?
Open question

BLOCK 5 Demographic questions and feedback

And finally, please answer a few questions about yourself and this questionnaire:

NAT What is your nationality?
- open question

AGE How old are you?
2 characters max; numbers only.
- open question

GEN What is your gender?
Single choice.
- Female
- Male
- Other

EDU What is your highest educational level?
Single choice between 3 categories. (Source: Eurostat)
- Third level (ISCED 5-8. CZ: University graduates; NL: HBO, universiteit; ES: University graduates)
- Secondary (ISCED 3-4. CZ: High school; NL: MBO, havo, vwo; ES: Bachillerato or vocational qualification)

- Primary (ISCED 0-2. CZ: Elementary school + Apprenticeship; NL: basisonderwijs / lagere school, lob/vo/vmbo; ES: Primary + ESO 1-4 of Secondary)

LOC What is the size of your city? (Approximately)
Single choice. (Source: CIMULACT Questionnaire)

- Over 1 million inhabitants
- 100 001 – 1 million inhabitants
- 10 001 – 100 000 inhabitants
- 1 000 – 10 000 inhabitants
- Below 1 000 inhabitants

ECA What is your current economic activity?
Single choice.

- Employee
- Self-employed / Employer
- Student
- Retired
- On parental leave
- Unemployed
- Other

MNG Do you think it makes sense to consider the values and concerns of citizens in the early stages of nanotechnology research?

1… Strongly disagree; Strongly agree …5

CNF Did you feel confident answering the questions about the product suggestions?

1… Strongly agree; Strongly disagree …5 (rotated)

FTR Do you believe your opinions will be taken into account during the further stages of development of the product suggestions?

1… Strongly disagree; Strongly agree …5

FDB Do you have something else in mind to tell us?
Open question.

Farewell text

Thank you for participating in the online consultation of the GoNano project. For more information and results, please follow us on the www.gonano-project.eu website or social media (Facebook, Twitter).

If you would like to receive further information about the results and the project, please give us your e-mail address:
Open question.

GoNano is a project funded by the European Commission, in the area of Nanotechnologies, Advanced Materials, Advanced Manufacturing and Processing, and Biotechnology (NMBP) of H2020.