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meeting the needs of nanotechnology

Deliverable Report

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1.	Gov4Nano Advisory Board	Yes
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3.	NMBP-13 RiskGONE	Yes

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1 Summary

This report provides an overview of the activities conducted to (i) assess public risk perception related to nanotechnologies, (ii) identify how to build trust in tech governance, and (iii) investigate the role of training and education through different examples.

From 2019 to 2023, several activities were carried out, most of them jointly with the NMBP-13 sister projects NANORIGO and RiskGONE. These activities were based on literature reviews, as well as previous experience and expertise of the project partners.

At the initiative of RiskGONE, a joint online public survey on risk perception was launched and analysed, and compared to State-of-the-Art literature. Also, a joint stakeholder survey was conducted to determine how to increase the trust of various stakeholders in risk governance.

In addition, education and training activities were conducted to, on the one hand, transfer expert knowledge to the next generation of nano-scientists and raise awareness of risk governance issues among young researchers, and, on the other hand, to assess whether individual risk perception has changed after specific knowledge about the risks and benefits of nanotechnology and its applications has been provided.

The results provide numerous insights for establishing an organisational form for Nano Risk Governance and what should be considered with respect to public's perception of risk and how to strengthen the trustworthiness of civil society.

Next to that, this report includes several best practice examples for (i) training, (ii) providing online information to the general public, and (iii) engaging civil society at public events such as the European Researchers' Night.

2 Description of task

In Annex 1 (part A) of the Grant Agreement No. 814410, on page 33, Task 3.4 is described the following:

> *"Based on the identified indicators, Task 3.4 focusses on the integration and conceptualization of the two pillars "civil society" as well as "insurance" into conditions for an organisational form for Nano Risk Governance. Task 3.4 will thereof elaborate and integrate into conditions for an organisational form for Nano Risk Governance, the structure on (i) how to involve civil society and (re-)insurance industry needs, and (ii) how to monitor the successful interaction with these stakeholders. Building the two pillars will be achieved by screening relevant literature, implementation and evaluation of questionnaires, and specific user committee-workshops. Furthermore, public risk perception on nanotechnology and its application in different products will be monitored through the project runtime, especially before and after dedicated engagement activities, enabling a quantitative evaluation of the relation between risk perception and increased knowledge about nanotechnologies. This task will build on Task 3.1, Task 3.2 and Task 3.3, working in close collaboration and feeding information to WP5. This will guarantee that the information collected in this WP is fed into the conditions for an organisational form for Nano Risk Governance. A main action will be including the civil society/(re-)insurance industry's views into the mission of the organisational form for Nano Risk Governance. In particular, needs and views of these stakeholders will be used to develop the operational structure of the organisational form for Nano Risk Governance (link to Task 5.1). Moreover, cooperating and feeding into WP6 ensures that "civil society" as well as "insurance" are represented and included into the overall organisational form for Nano Risk Governance stakeholder framework. Key Actions: (i) Literature recherché and discussion meetings to conceptualize the structure of the two pillars. (ii) Developing questionnaires, establishing user committees, and organizing/performing workshops."*

3 Description of work & main achievements

3.1 Background of the task

Civil society has to deal with uncertainties about risks of nanotechnology. It is important to identify, analyse and understand their needs. In the context of Gov4Nano, WP3 focused on characterizing how risk perception emerges in civil society; particular attention was paid to identifying specific information needs of this stakeholder group.

Based on previous work in Gov4Nano (i.e., D3.1. "Report on parameters, elements and information forming and influencing the risk-perception of different civil society groups"[1]), factors that determine the risk perception of nanotechnologies in the civil society were described, bringing together insights from sociological risk research and public perception studies on nanotechnologies focused on four interconnected questions:

- The "Why" – Why do the risk perceptions of different civil society groups matter?
- The "How" – How do risk perceptions in civil society emerge?
- The "What" – What do we know about the risk perception of different civil society groups?

[1] https://www.gov4nano.eu/wp-content/uploads/2022/12/G4N-Factsheet-D3.1_Parameters-elements-and-information-forming-and-influencing-the-risk-perception-of-different-civil.pdf

- The "What next" – What to do about the risk perception in civil society?

In comparison to many other emerging technologies, nanotechnologies are perceived positively by the European public. At the same time, most Europeans however know little about nanotechnologies and have difficulties in assessing their risks and benefits. In addition, the maturing of nanotechnologies into an "enabling technology" has in the last years led to changes in the visibility of nanotechnologies. Whereas the potentials of nanotechnologies were communicated and the public perceptions measured extensively in the early 2000s, the public discussion on nanotechnologies has waned. The reduction in nano-specific Science, Technology and Innovation (STI) policies has gone hand in hand with less nano-specific communication and less attention to public perceptions. Although the current public opinion can still be described positive, the emergence of new civil society actors and communication channels bears risks for nanotechnologies as well. This diversity makes civil society more unpredictable: In addition to professional civil society organisations, the internet has given laypeople tools for raising issues to the public agenda. In the absence of nano-specific communication structures it may be difficult for regulators and technology developers to react if the public opinion towards nanotechnologies or single applications changes suddenly.

Risk perceptions in the civil society have implications for all emerging technologies. For technology developers, the way the public perceives possible risks of technologies is important as it ultimately impacts their social license to operate. Following the concept of Responsible Research and Innovation, attention to public risk perceptions may help to improve the acceptability, sustainability and societal desirability of the technology and its products. Against this background it is important to examine how risk perceptions emerge in the civil society, how a balanced assessment of risks and opportunities in the civil society could be fostered and what kind of a role different kinds of institutions might have to play in risk communication.

In WP3, Task 3.1, the outcomes of different national and European studies and reports on public perceptions of nanotechnologies (e.g., the Eurobarometer, synthesis report of the project Nanoview of the German Federal Institute for Risk Assessment) were evaluated and combined with the findings of sociological risk research. In this way, the dynamics of risk perception in the civil society could be analysed and conclusions for further work in the project Gov4Nano and for the organisational form for Nano Risk Governance were derived.

When considering the risk perceptions in the civil society, it is first necessary to differentiate between professional representatives of civil society (CSOs), who essentially share the principles of technical risk assessment, and laypeople, who assess the risks and benefits of technologies in a different way. Although some general observations can be made on the risk perception by laypeople – for instance, laypeople tend to emphasise the severity of possible damages more than the probability of their occurrence – individual risk perceptions are affected by our personal experiences, preferences, feelings and values. These can be grouped in four categories:

1. Psycho-social factors: Religion, general attitudes towards technology or nature, political stance, trust in institutions, feeling of security and welfare
2. Sociodemographic factors: Gender, age, education, income, ethnicity
3. Object-related factors: Familiarity with the technology in question, general science knowledge, interest towards new technologies, potential risks and benefits
4. Other factors: Use of media, the role one plays in the society

It is important to also note that risk perception does not take place in a vacuum but in an interplay with the surrounding society. Especially the media has a substantial role in "framing", channelling and providing interpretations how different technologies and the institutions involved in their development could be viewed.

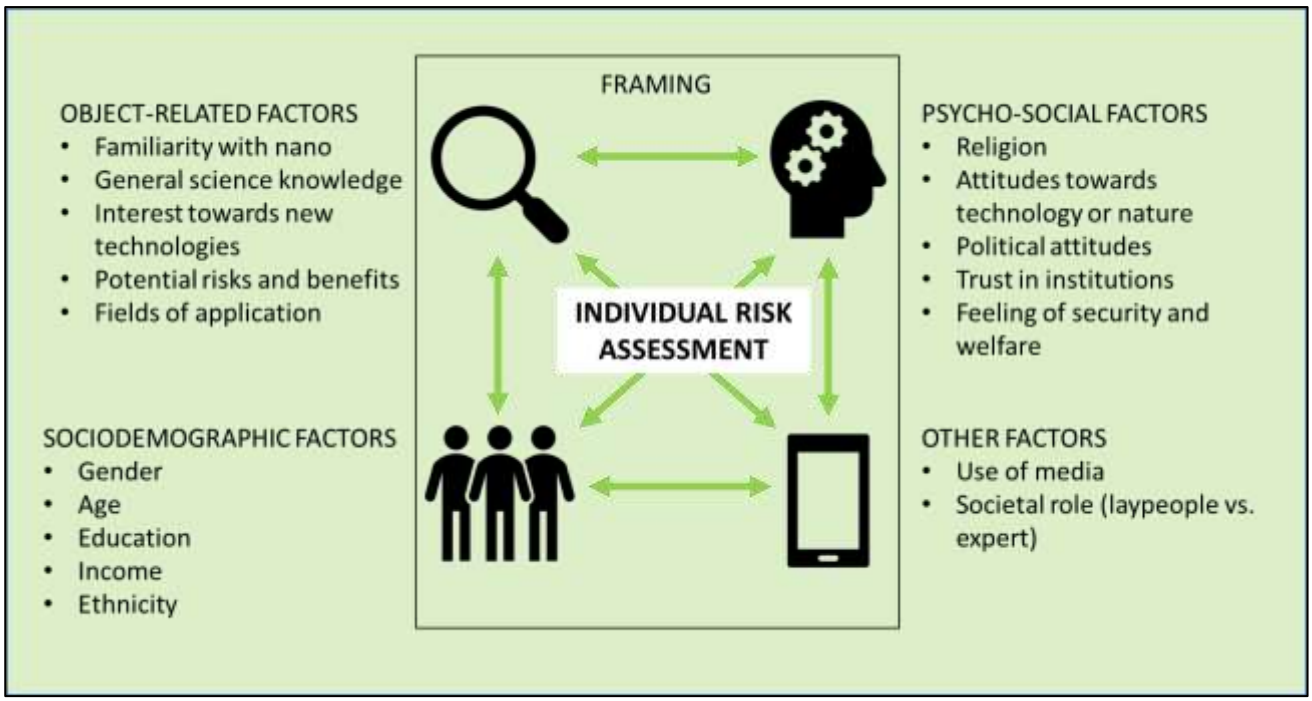

Figure 1: Determinants of individual risk perception in the context of nanotechnologies.

Following the increased attention to nanotechnologies as a key enabling technology, public opinions of nanotechnologies have been frequently assessed by means of qualitative and quantitative studies. Whereas the awareness of nanotechnologies varies significantly across European countries, the public perception of nanotechnologies is generally more positive than that of many other technologies. For instance, in the latest Eurobarometer, 41% of Europeans consider nanotechnologies to have a positive and only 10% a negative effect on our future way of life. However, 40% of Europeans replied that they didn't know – a figure very high.

Furthermore, in the last years, the public attention of nanotechnologies has declined. Nanotechnologies are no longer a central campaigning issue for CSOs and media articles on "nano" have become scarcer. Google search queries confirm the trend: Since 2004, queries with the keyword nanotechnologies have dropped steadily.

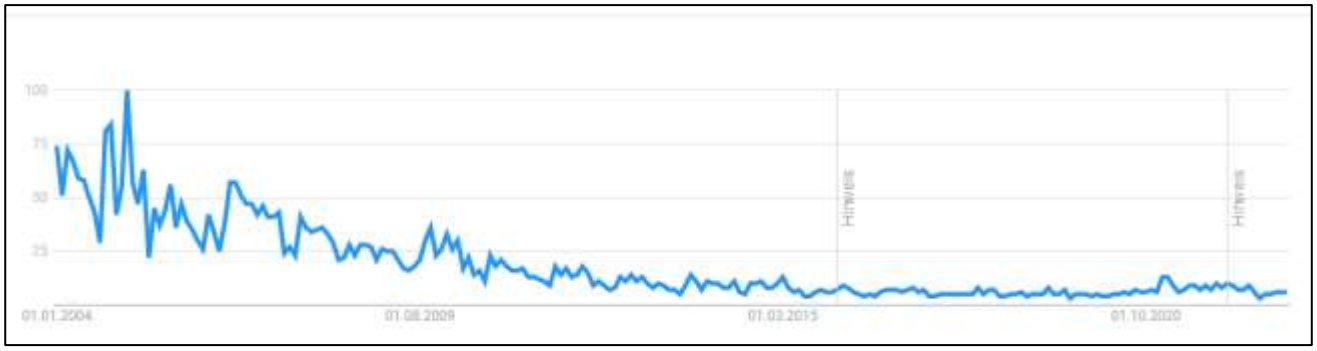

Figure 2: Changes in Google queries for "nanotechnologies" in 2004-2022 (percentages from the peak (100%) in 2005, Source: Google Trends).

Based on these findings, some important points of discussion were raised:

- There is a strong argument to be made for professional CSOs to be further involved directly in risk governance (and in the organisational form for Nano Risk Governance). They represent legitimate interests of the European public and their involvement contributes to the acceptance of the risk governance regimes.
- Developments in the public opinion need to be monitored also beyond the professional CSOs. The emergence of social media and online campaigning platforms such as Avaaz, Campact or Change.org have led to a diversification – and unpredictability – of the civil society.
- In times of sensational media, provision of reliable and transparent information on risks and benefits of emerging technologies is increasingly important. Existing information platforms on nanotechnologies should not be duplicated, but however critically examined and possible gaps filled in.

3.2 Description of the work carried out

3.2.1 Risk perception survey

At the initiative of RiskGONE and with the collaboration of Gov4Nano and NANORIGO, a survey was developed to investigate risk perceptions of ENMs and nanotechnology, in order to better understand societal acceptance of ENMs and provide input for communication about ENMs. Main variables considered for the survey development were:

- Perceived benefits and costs of ENMs
- Risk perception of ENMs and nanotechnology considering environmental risks, societal risks and human health risks
- Perceived knowledge on ENMs by respondents and their main information sources to obtain knowledge on ENMs
- Attitudes towards research and use of ENMs
- Willingness to use products containing ENMs
- Perception of control
- Trust in politicians, governmental agencies, journalists, scientists, non-governmental organisations (NGOs)
- Trust in regulations and methodologies for evaluating risks related to ENMs
- The allocation of economic responsibility (i.e., "who will pay") for ENMs, development, risk reduction and risks that may happen regarding its use

Previous research on risk perception of ENMs has shown a difference across application (Palma-Oliveira, 2009). Thus, given that result and the surge and diversity on application since the last decade the survey questions consider specific types of applications. For this survey, primarily applications on cosmetics, medical and food sectors were considered. In addition, TiO2 and carbon nanofibers were identified as potential cross-project ENMs to be studied by a group of experts from the three NMBP-13 projects. The table below presents some examples of applications that were considered to develop the survey. The applications in bold are the ones selected to be used on the survey.

Table 1. Examples of ENM applications that were considered to develop the survey.

	Stays inside			Superficial contact			Inside the body		
	Food	**Cosmetic**	**Medicine**	**Food**	**Cosmetic**	**Medicine**	**Food**	**Cosmetic**	**Medicine**
Rare use			*Pharma machines to produce medicines (e.g., synthesizers)* // ***High resolution MRI*** // *medical diagnosis machines*		***Nail polisher*** *(Ag)*				*Medical diagnosis tests // Needles for injecting medicines n disease tissues (CNF)* // ***Nanorobots during surgery*** // *Water treatment, water sterilization* (TiO_2)
Sometimes		*Clothes* (TiO_2)	***Food packaging*** (TiO_2)		***Antiaging face cream*** (TiO_2), *toothpaste*		Beverages // **agriculture use** (TiO_2)		
Permanent		***Walls paint***			***Dental implant***				***Pacemaker, implantable cardioverter-defibrillator (ICD)***

The survey was pre-tested in Portugal in February 2020 by RiskGONE partner FactorSocial both with laypeople and also with experts during the Materials Science & Nanotechnology Conference which took place in Lisbon 26-28 February 2020. All inputs were carefully considered, together with feedback from a pre-test of the survey. A final version of the survey was prepared in English (see Annex 1) and translated into 11 languages (Bulgarian, Croatian, Dutch, French, German, Greek, Italian, Norwegian, Polish, Portuguese and Spanish[2]). Links to the survey forms were disseminated through the networks of the three NMBP-13 projects and their partner organisations. Based on the excel database extracted from the survey platform, statistical analysis was performed using Statistical Package for Social Sciences (SPSS), and results were analysed in comparison with existing literature. The conclusions of the survey are presented in 3.3.1 "Survey results on public risk perception".

3.2.2 Trust survey

From its project start, Gov4Nano heavily collaborated with the two NMBP-13 sister projects NANORIGO and RiskGONE. This inter-project collaboration was facilitated through so-called NMBP-13 Core Groups addressing the key topics within the projects. Engaging stakeholders was one crucial topic where collaboration and good coordination was needed – the aim was to join forces and engage with external stakeholders in a structured way, to not ask the same questions to the same people multiple times. BNN as WP3 leader and NIA as WP6 leader were nominated to represent Gov4Nano in the NMBP-13 Core Group on Stakeholder Involvement. Monthly meetings were organised to discuss and align all stakeholder activities. A common NMBP-13 stakeholder database was also established (following and respecting GDPR rules), including CSOs and NGOs.

The NMBP-13 projects decided to make one joint online survey for external stakeholder focusing on their views and needs related to risk governance. Among others, the following questions were asked:

- Are you personally satisfied with how risks from engineered nanomaterials (ENMs) currently are assessed, managed and regulated in Europe?
- Are you confident that the current regulatory system in place in Europe will enable satisfactory and sustainable risk assessment and management of ENMs in the future? (e.g., 3rd generation, smart/active ENMs)
- What, if anything, do you think should be done to enhance trust between industry, regulators and societal stakeholders?

Between June and October 2022, this online survey was promoted and shared by all three projects, via email, social media (i.e., LinkedIn and twitter), and personal contacts from project partners. There were 28 responses in total from 15 different countries, with representatives from the following stakeholder groups:

- SMEs (2)
- Research and Technology Organisations (2)
- Large Enterprises (4)
- Government Agencies (6)
- Consultancy or Service Providers (3)
- Academic Institutes (11)

[2] Further detailed information and the translated surveys are presented in RiskGONE's Deliverable Report D3.5 "Draft guidelines on the societal acceptance of nanomaterials considering risk and benefit perception": https://riskgone.wp.nilu.no/home-riskgone-project/resources/project-resources/

The results and responses especially to these three questions are presented in 3.2.2.2 "Survey results on how to enhance trust between different stakeholders".

Next to that, BNN and RIVM interacted with the TIGtech[3] project, which focused on trust in tech governance. Both BNN and RIVM participated in 2019 in a workshop where the main trust drivers were discussed and further elaborated. The main outcomes of this workshop are summarized in 3.2.2.1 "Trust in tech governance".

3.2.3 Engagement and training activities

Several engagement and training activities with different stakeholder groups were performed during the whole Gov4Nano project runtime.

Key activities addressing civil society and laypeople were contributions to the annual "European Researchers Night" (ERN). Led by BNN, a group of key partners from all three NMBP-13 projects jointly prepared materials related to nanotechnology and risk governance, and presented them at various local events during the ERN in different European countries.

Next to that, the NMBP-13 projects contributed to the annual "Nanosafety Training School" and prepared and conducted sessions on risk governance, to train early career researchers on the issues around the risk governance process and present the risk governance framework and its steps. Other training workshops and webinars were held by TEMASOL, including a mini-survey that assessed the change in personal risk perception after attending a dedicated training.

Further communication activities targeted to the general public, focused on risks and benefits about ENMs and nanotechnology, were performed by using social media channels (i.e., LinkedIn and twitter). In 2022, BNN was also involved in the revision of the Austrian "Nano Information Platform" that is hosted by the Austrian Federal Ministry for Social Affairs, Health, Care and Consumer Protection. The revised website was launched in January 2023.

Highlights of the performed activities are presented in 3.3.3 "The role of training and education" as well as 3.3.4 "Lessons learned from engaging with civil society from 2019 until 2023", and serve as best practice examples on how to engage with and communicate to civil society.

[3] https://www.tigtech.org/

3.3 Results

3.3.1 Survey results on public risk perception

The risk perception survey (answered by 142 individuals from different origins and with different knowledge about ENMs) was able to provide a set of indications about risk perception and communication. First of all, the attitude about ENM has become consistent and with less difference amongst applications when compared with previous research (Palma-Oliveira et al., 2009; Larsson et al., 2019). However, the image that emerged from the risk perception shows a much more complex picture; if the average answers are neutral there is a sharp difference between the group of people that express a high public health risk in the use of ENMs (around 27%) and the ones that reveal a very low risk perception level. Consistent with this pattern is the list of the risks pointed by the subjects where the increased presence in the environment and the toxicity to humans are some of the worries.

Consistently with the results of Palma-Oliveira et al. (2009), the medical applications are the ones that raise a more positive evaluation. The above results are consistent with a clear willingness to use the ENMs across all domains with a lower percentage in what concerns food packaging and higher regarding medical use. Important to understand the dynamic of risk perception is the low perception of control and the limited type of information gathering and use available and reported.

Trust is an important factor in understanding the dynamic of risk. The results of the survey not only show a distrust in the social media and an average trust in the governmental bodies but a high evaluation of scientific information. The existence of a risk governance framework for ENMs is considered highly positive. These results are very consistent with a tendence of not giving credit to the so called social but, nevertheless, being influenced by it.

All these results are consistent with, probably, the most revelling of results from the survey; the percentage of subjects that recognize their current use of ENMs are a minority compared with the majority of the subjects that do not know if they use ENMs or assume they are not. The very existence and spread of their use are underestimated. One can hypothesize that's a reason for the lower risk perception and the difference across uses. Basically, and in accordance with previous research the higher risk perception was correlated with ENMs that could have a higher contact with one's body.

These results are important as they can shed some light not only on the understanding of risk perception of ENMs but also in the risk communications strategy. One can assume that the attitude towards ENMs is not very precise and correlated with other values that are important to the subjects. Thus, ENMs are different from GMOs, for instance, since they did not achieve the degree of valuative independence that were characteristic of the latter. Some groups that stress the importance of the "connection" with a more "natural" way of life will, when confronted with the idea of ENMs, tend to evaluated as "anti-natural".

Given this pattern of results one can assume that if the ENM would be hardly noticed (for instance the use of ENM in medicine is a practice with dozens of years), the existence of any kind of risk problem and crisis related with their use would launch a probably very deep and widespread risk communication problem.

The existence of an integrated risk governance framework and structure would be interesting from that perspective since, given its independence and continuous involvement, will predict and respond to minimal signal of such a crisis.

3.3.2 Trust in tech governance

Why trust matters to tech governance

> *"We make many trust-based decisions each day. Every time we pay for something, choose what to eat, what to buy, or who's advice to act upon, dismiss or endorse – we consciously and unconsciously place trust in institutions, information, people, processes. Without these generalised and specific acts of trust our societies simply wouldn't work. A great many of these decisions also show an implicit trust in governance – in the effectiveness of the rules, regulations, standards, procedures and institutions which help ensure products are safe, elections are fair, values are upheld and institutions of all types do what they are supposed to. A trustworthy governance system for technology which we can (and do) trust will allow us to get on with our lives, confident in the belief that risk of harm to people and the environment is managed and complex values and ethical trade-offs resolved in the wider public interest."* (Hilary Sutcliffe, Director TIGTech & SocietyInside)

Five things to know about trust[4]

- Trust is an outcome, best achieved by focusing on others
- It is a hope about expectations fulfilled
- Trusting people first makes them more likely to be trustworthy and to trust you back
- Trust is a spectrum, not an either-or judgement
- Trust is dynamic, messy, personal and two-way

The OECD takes into account three main channels that may influence trust: i) an individual's characteristics, including personal preferences, expectations and socioeconomic background; ii) the institutional environment the individual acts in; iii) and the societal and community context (Murtin, Fleischer et al. 2018). Both short and long-term factors, as well as micro and macro-level aspects are thus addressed. Obviously, the causal chains from each determinant will differ depending on the type of trust considered. Nevertheless, previous studies document that their trust in others and trust in institutions share a number of common drivers.

3.3.2.1 Trust drivers

The seven trust drivers[5] as developed by the TIGtech project show providing evidence of trustworthiness is important for trust.

1. **Intent.** It shows your commitment to public interest in action.
2. **Competence.** It allows you to more clearly demonstrate delivery against expectation & competence.
3. **Respect.** By 'showing your workings' in plain language and in a more open way you demonstrate your respect for all stakeholders.
4. **Integrity.** Greater visibility of process and impact demonstrates integrity in action.
5. **Inclusion.** It allows demonstration of how different perspectives have contributed to decision-making.
6. **Fairness.** It demonstrates fairness and 'procedural justice' in action.
7. **Openness.** This more radical openness is an important way to uphold this trust driver.

[4] https://www.tigtech.org/insights/key-findings
[5] https://www.tigtech.org/insights/7-drivers-of-trust

Figure 3. Seven Trust Drivers for Emerging Tech Governance (Soeteman-Hernández, Sutcliffe et al. 2021).

3.3.2.2 Survey results on how to enhance trust between different stakeholders

Within a joint NMBP-13 stakeholder survey, the topic of trust and how to potentially increase it among various stakeholders was assessed.

Survey respondents were asked, if they are personally satisfied with how risks from ENMs currently are assessed, managed and regulated in Europe.

The majority of respondents are not satisfied currently (see Figure 4).

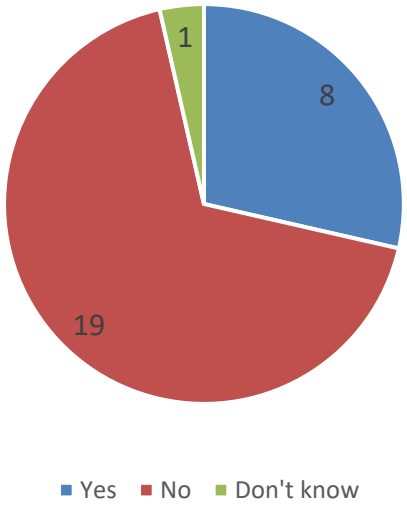

Figure 4: Are you personally satisfied with how risks from engineered nanomaterials (ENMs) currently are assessed, managed and regulated in Europe?

Of the eight respondents that are satisfied with the current system, three are from industry, two from government agencies, two from academia and one from a consultancy.

More respondents are confident in future risk assessments, than in the current approach. However, one person who believes that the current system is satisfactory, does not believe the same for future developments.

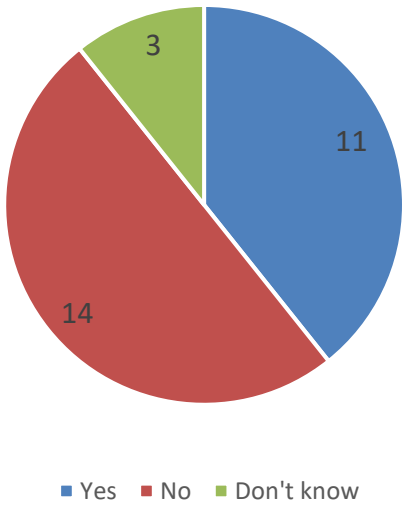

Figure 5: Are you confident that the current regulatory system in place in Europe will enable satisfactory and sustainable risk assessment and management of ENMs in the future? (e.g., 3rd generation, smart/ active ENMs)

In response to the question *'What, if anything, do you think should be done to enhance trust between industry, regulators and societal stakeholders?',* the following main issues were identified by survey respondents:

- More transparency between industry, regulators, and other stakeholders
- More transparency and involvement of society as a stakeholder, highlighting the importance of keeping people informed of decisions and how they may impact their life
- Co-constructing what 'trust' looks like and why it's needed
- Regular, iterative dialogue between stakeholders
- Establishing multi-stakeholder working groups
- Building-up permanent tripartite structures for communication, discussion and development of guidance, which do not only focus on ENMs but can be open to all advanced materials
- Better communication and creating more awareness regarding ENMs
- Clear communication about what is known and what is not known currently regarding potential risks and benefits of ENMs, made available through easily accessible forums
- Better involve actual toxicologists into the discussions
- Wider networking activities between regulators and stakeholders, further communication activities to present nanomaterials benefits and limited risks
- Championing of good science
- Data sharing and cooperation among all stakeholders

- Creating incentives for sharing data and having open conversations between stakeholders
- Data organisation was a necessary prerequisite; now that this is improving, more expertise on how to evaluate that data is needed
- Making more data about hazards publicly available
- The future effects of ENMs in the environment following the disposal of any product containing ENMs needs to be considered as well as identifying risk to manufacturers and consumers
- Clear rules on how to deal with safety issues related to ENMs
- The community needs a list of validated tools for occupational and regulatory risk assessment, which are sufficiently mature
- Harmonize definitions in sector-specific regulations, in REACH, and in national inventories
- More responsibility of industries to communicate about nanomaterials that are actually used
- Speeding-up dossier review (regulator task) & improvement (industry task), including more reliable & simplified grouping (regulator task), leading to more data-supported assessments (industry task)
- Building long-term trusted environments for stable evaluation processes, enable especially groups from the civil society to take part in risk assessment and foresight processes, as early and as concise as possible
- More communication, workshops and knowledge transfer between different entities
- Increasing the involvement of industrial companies in the dialogue on risk governance through attractive events; vice versa, researchers, regulators and other stakeholders should be part of popular industry-led events where the companies are active anyway
- Regulators should try to better understand the needs of industry

The overriding message is that there should be more transparency, dialogue, open conversations, and cooperation between industry, regulators, and stakeholders; and that society should be involved. It was also felt that industry had a responsibility to communicate about which nanomaterials are being used. If multi-stakeholder working groups were established, regular iterative dialogues could take place. One suggestion was that '*permanent tripartite structures for communication, discussion and development of guidance*' should be created and extended to all materials. This would meet the need for stable evaluation processes, risk vs. benefit assessments, foresight processes, and awareness of measures being taken.

Another commented on the '*urgent need to get back to a rational discussion also to keep industrial production in Europe*'.

It was strongly felt that manufacturers and consumers should be informed of the environmental and human health risks involved in the disposal of any products containing ENMs, now and in the future; and data about hazards should be more publicly available. In this regard, it was stated that we should develop expertise in how to evaluate the data produced so far, and there should be incentives to encourage data sharing. Modelling was another consideration, with one respondent commenting that we are: '*Missing preferred exposure models: QSARs for screening. The various QSAR projects are beginning to help. This all takes time though*'.

There were a number of statements concerning the need for guidance in critical areas from organisations such as ECHA and the OECD, while others were concerned about the lack of harmonised and aligned regulatory guidance that does not '*account for nanoform nuances, even by derogation*'. At the same time, it was noted that definitions in sector-specific regulations should be harmonised in tandem with REACH, and in national inventories. It was acknowledged that work is still being developed in many areas; nevertheless, occupational, and regulatory risk assessment require validated tools that are sufficiently mature, and there should be '*Clear rules on the safety issues related to nanomaterials*'.

A focus of the NMBP-13 projects has been inclusivity in the decision-making processes, and so respondents were asked; '*What, if anything, do you think should happen to ensure the participation of civil society?*' This was recognized as important by all respondents, that civil society should be encouraged to participate through incentives and benefits recognition and there should be ongoing campaigns to encourage involvement from different demographic groups as well as academia, society, policymakers, and producers from a wide range of sectors and disciplines. Furthermore, that it is important to ensure that individuals who may be vulnerable to impact and risk are involved. This requires the '*use all possibilities and channels to inform about scientific evidence on risks and non-risks*'.

Several respondents were of the opinion that communication could be enhanced through education within schools, and through a regular release of information aimed at non-experts and conveyed using non-specialist terminology. Messages should aim to raise awareness of key findings and avoid misinformation or scaremongering.

3.3.3 The role of training and education

An online workshop entitled "Nanotechnology and its implications to society: Training session on risks, benefits and governance" was prepared by TEMASOL for scientists at early career stages (PhD students and post-docs). Invitations to the workshop were sent to members of the group Early Career Researchers in nanotechnology, of NMBP-13 projects (Gov4Nano, NANORIGO, RiskGONE), NMBP-15 projects (ASINA, SABYDOMA, SAbyNA, SbD4Nano) and to all working groups of the EU NanoSafety Cluster[6]. Five topics were covered during the workshop: i) Perception of risks and benefits; ii) Safe-and-Sustainable-by-Design; iii) Risk Assessment; iv) Risk Governance; and v) Regulation for ENMs. Literature reviews and the authors' own knowledge were used to create the content of the workshop.

After the performed workshop, a survey on the perception of nanotechnology was sent out to the participants who worked on various research topics in the fields of human and eco-toxicology, nanosafety, exposure assessment, law, modelling and environmental assessment. Respondents also had varying experience on nanotechnology, working for less than one year to 10 years in the field.

Among the topics addressed during the workshop, respondents were most familiar with human and environmental risk assessment, while Safe-by-Design was the least understood concept (see Figure 6). All students agreed with the need of training on risk assessment for their work and seemed quite interested by sustainability and Safe-by-Design topics (40% and 30% of respondents answered "very useful", respectively). It is worth noting that the answers to this part of the questionnaire might be biased by the fact that these respondents already expressed their interest in such topics by registering to the workshop and might therefore not represent fully the community of Early Career Researchers in the nanoscience field.

[6] https://www.nanosafetycluster.eu/

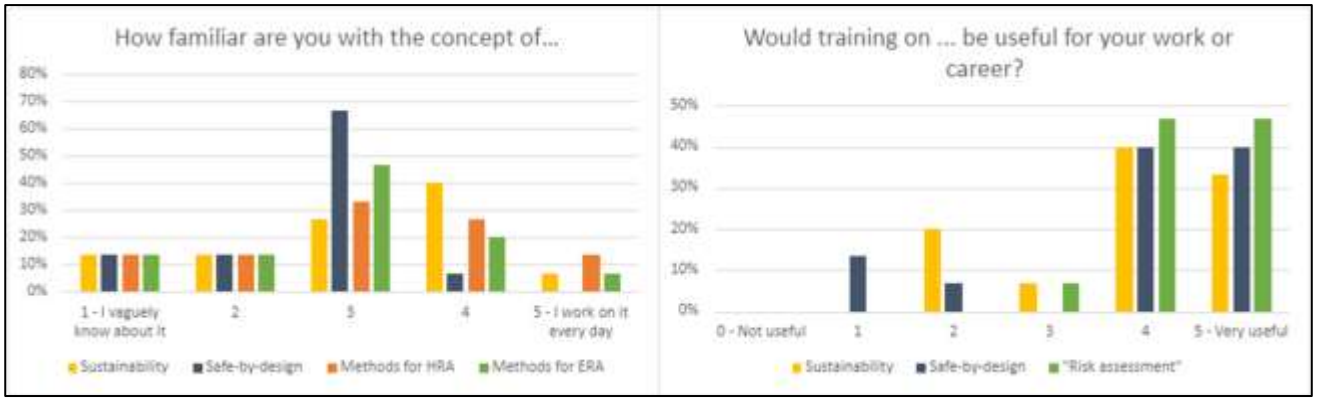

Figure 6. Familiarity and need for training on workshop topics.

Regarding the participants' perception of nano-applications benefits and risks, most of them recognised moderate to high risks towards human and environmental health (see Figure 7). The highest risks were perceived for human health, for pesticides, cosmetics & sunscreens, medicine, and food. Higher benefits were perceived for human health than for the environment, especially regarding medicine and electronics. The lowest benefits were found for pesticides and food.

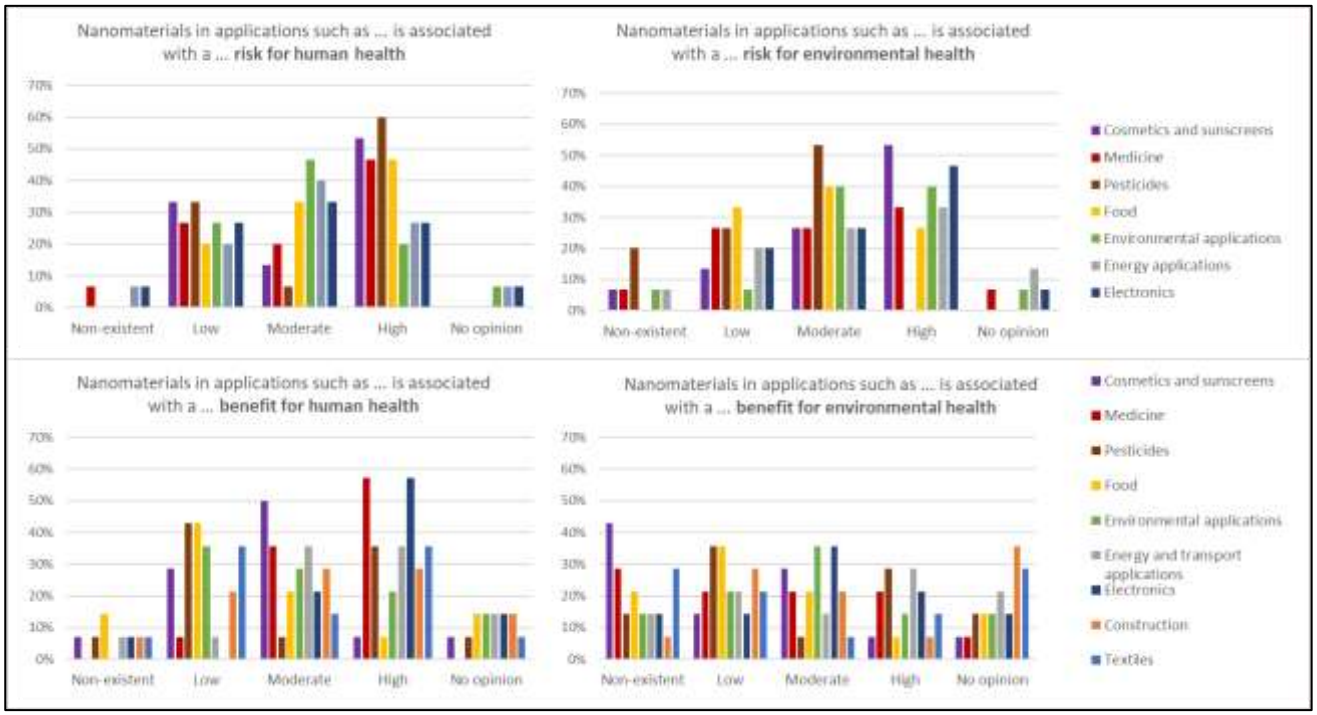

Figure 7. Benefits and risks perceptions of students for various nano-applications.

Higher trust was felt towards public institutions than to industry (see Figure 8). Sunscreen, cosmetics & hygiene products as well as food were the applications most avoided for purchase (40% and 33% of respondents, respectively, deliberately chose to avoid it), probably because these are the product categories for which risks were most often related in the media.

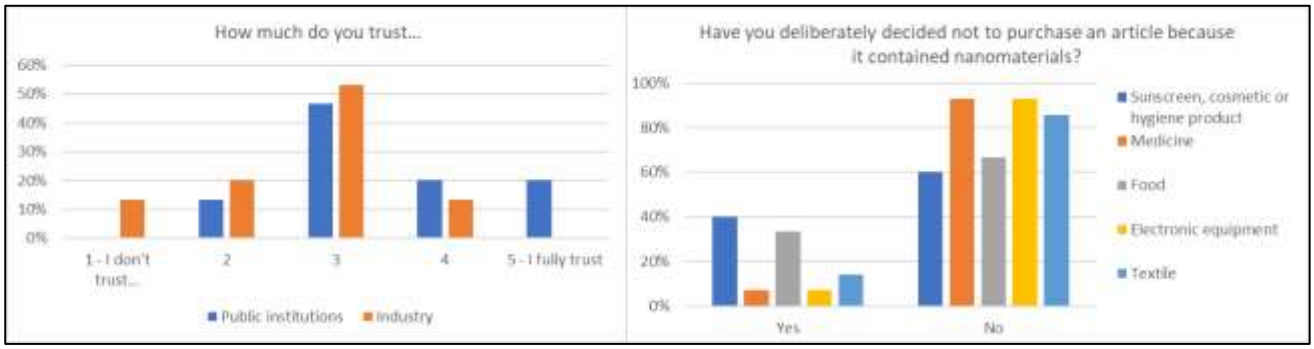

Figure 8. Trust in nanotechnology and associated stakeholders.

The workshop itself did not actively change participants' perceptions of risk, but provided them with background information on the broad and complex topic of risk governance. Overall, the students' expectations from the workshop were generally met, although they expressed their regrets regarding the lack of time for discussion and reflection on each other's thoughts and for interaction with experts. 60% of attendees would clearly recommend the workshop to their colleagues.[7]

3.3.3.1 Best practice example: European Researchers Night

The "European Researchers' Night" (ERN) is a public full-day event in various locations across Europe where different research topics are presented at booths and open workshops are held.

From 2020 until 2022, the three NMBP-13 projects used the ERN to communicate and engage with civil society in different countries regarding nanotechnologies and risk governance. The aim of this activity was to facilitate an interactive dialogue between project partners and laypeople regarding risk governance issues related to nanotechnology, and to gather different views and opinions from the general public. The content for the joint NMBP-13 contribution developed (i.e., a set of information material (English language) and a general video on "Making nano work for us" [8,9]) was translated into the local language by the respective presenting partner. All materials were also made publicly available in the "Collection for NMBP-13 education and ERN resources" on nanoHUB[10].

Gov4Nano beneficiary BNN participated in the ERN in Austria to the annual-held event "Life is Science"[11], representing Gov4Nano alongside other EU-funded projects, with workshops and a booth focused on "Nanomaterials and Nanotechnologies". BNN staff endeavoured to bring the topic of nanomaterials closer to the general public through informative presentations, posters and a "nano-memo" matching game developed within a previous H2020 project. More than 100 people, ranging from children to students to adults, stopped to chat with us and play the games. The level of awareness the visitors had about nanomaterials was surprisingly high and many interesting conversations took place. The materials appeared to be suitable to a range of audiences. The interactions took place in German.

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[7] Further detailed information and the full survey are presented in Gov4Nano's Deliverable Report D3.6 "Recommendations on how the organisational form for Nano Risk Governance should train and educate civil society and insurers - Showcases and best practice examples": https://www.gov4nano.eu/abouttheproject/project-results/

[8] https://www.youtube.com/watch?v=sVHViFX4meg (English version)

[9] https://www.youtube.com/watch?v=5CI39ypbyyg (German version)

[10] https://nanohub.org/groups/nanosafetycluster/collections/nmbp-13-education-resources--ern

[11] https://www.lifeisscience.at/

- Poster – „Nano" so weit das Auge sehen kann – und darüber hinaus! ("Nano" as far as the eye can see – and beyond!) (see Annex 2)
- "Seeing Nano" Memory game developed within the EU H2020 project Seeing Nano https://www.ecsite.eu/sites/default/files/information_sheet_uk_390x130mm02.pdf
    - There are 2 levels to this game, a simple version appropriate for children, non-readers and those with limited scientific knowledge, and a more difficult version.
- "Fact or Fiction" game (see Annex 3), for this occasion translated into German
    - This game was both used as printed version as part of a booth, as well as online version during an online workshop[12] due to the COVID-19 pandemic.

Figure 9. Beatriz Alfaro Serrano (BNN) playing Seeing Nano matching game at ERN 2022 in St. Pölten, Austria.

Lessons learned from the ERN experiences:

- Presented content should be reduced, product-oriented (consumer-related), understandable and "catchy" for civil society.
- Keep in mind that there are limited interaction possibilities, as visitors spend approx. 10 minutes per booth on average.
- The material presented should be in the local language and easily accessible (i.e., difficult expert terms should be avoided).
- A variety/mix of information and presentation material should be used, for example:
    - Posters
    - Fact sheets and info cards with key messages

[12] Recording of the online workshop: https://www.youtube.com/watch?v=0FqbPGQuuFM

- Media articles and scientific publications
- Videos
- Mini-survey with max. five questions
- Interactive quiz and/or game

- Special emphasize should be put on supporting critical thinking of civil society as it was facilitated via the "Facts or Fiction" game.

3.3.3.2 *Best practice example: Nanosafety Training Schools*

A key activity of the EU NanoSafety Cluster and its running projects is the annual Nanosafety Training School, traditionally held in Venice, Italy. Since more than 10 years, young nano-scientists gather in Venice for a one-week training school. Usually, the school attracts between 100 and 200 participants. Together with NANORIGO and RiskGONE, Gov4Nano contributed to the training schools and provided training sessions focused on risk governance, with the aim to train next generation scientists on the different steps of the risk governance framework.

In 2022, the risk governance session was built as role play where all students were asked to discuss the TiO_2 case from different stakeholder groups' perspectives. This role play was a great success and helped the students to understand different stakeholder needs and discuss them.

Figure 10. Group picture of the participants and trainers of the Nanosafety Training School in 2022.

The recordings of the school and its sessions are publicly available to be re-watched on the EU NanoSafety Cluster YouTube channel[13].

[13] Recordings from the Nanosafety Training School 2021 provided on the EU NanoSafety Cluster YouTube channel: https://www.youtube.com/playlist?list=PLDBSs2loZJ3_71mwTb_U_uRLrpzwDviEW

3.3.4 Lessons learned from engaging with civil society from 2019 until 2023

Engaging stakeholders, and especially laypeople, purely online is difficult. Compared to experts that can be personally identified and then actively invited to a meeting/training/event etc., laypeople must be attracted differently. During the COVID-19 pandemic, several activities targeted to civil society took place fully virtual. This worked well for some specific webinars or workshops, but the personal exchange that you have when random people just stop by a booth at a conference was totally missing. Thus, more extensive use of social media and online presence in form of website-content on the topic of potential risks and benefits related to ENMs was emphasized during the four years runtime of Gov4Nano.

3.3.4.1 Best practice example: The use of social media

Social media play an important role nowadays for communication to laypeople. When communicating on social media about nanotechnologies, focus should be put to transparently communicate both potential risks and benefits, using State-of-the-Art research knowledge. The organisational form for Nano Risk Governance could serve as a trusted source for latest information that could be utilized for scientifically-sound social media campaigns, and identify serious sources of information to support avoiding the spreading of fake news.

In December 2022, Gov4Nano beneficiary BNN launched a social media campaign "12 Days of Nanomaterials" to bring the topic closer to the general public. The campaign identified 12 different nanomaterials linked to one example application in everyday life (e.g., toothpaste, medicines), written in a simple way for a broad audience without a scientific background. A graphic was made for each nanomaterial showing the application and the posts were published on Twitter and LinkedIn. Where possible, links were made to relevant EU-funded projects employing the relevant nanomaterial in research. All posts were compiled on the website with additional background information and links.

- Twitter thread: https://twitter.com/bionanonet/status/1599702754917634048?s=20&t=ZA12w4uYUJF1rYSui132rA
- Example LinkedIn post with longer text and linking to projects: https://www.linkedin.com/feed/update/urn:li:activity:7009432866824581120
- Website compilation: https://www.bnn.at/12-days-of-nanomaterials/
- Retweet from Gov4Nano account: https://twitter.com/bionanonet/status/1599702754917634048?s=20&t=EU6o7KhQcpzAmJEMY6YGyA

Next to that, in September 2022, Gov4Nano beneficiary BNN held a public webinar on how to use social media to promote scientific results. The webinar was aimed at H2020 and Horizon Europe researchers but all were welcome. In total, 46 participants attended to learn some Do's and Don'ts for setting up their Twitter and LinkedIn accounts and sharing their research and project outcomes.

Three takeaways from the webinar that increase the efficiency of the use of social media:

1. **Start with the most important info.** Many people will see a social media post as a notification on their phone with just the first several words visible – or in the case of LinkedIn as just the first 3 lines. It should be ensured that these first words say something meaningful.

2. **Video > Image > Text only.** Postings should include an image to accompany the text wherever possible. Even better are videos, as they can earn a lot of impressions and visibility for the topic.
3. **Celebrate others.** Congratulate others (well-known trusted colleagues, institutions, etc.) on their work and promote the activities – this support will help to get research and topics seen by a wider audience.

3.3.4.2 Best practice example: The Austrian "Nano Information Platform"

The Austrian "Nano Information Platform"[14] is a public website focused on nanomaterials and nanotechnologies targeted to the general public. It provides State-of-the-Art content of nanotechnology in the following topics: (i) Basic Knowledge; (ii) Health; (iii) Applications; (iv) Environment; (v) Workplace; (vi) Science; (vii) Regulation; (viii) Advanced Materials; and (ix) News. It also provides the option to directly get in touch via email with the Austrian Ministry of Health, who hosts the website. "Nanoinformation.at" is a joint effort of different organisations and experts. In total, 14 institutions contributed to the creation of this information site for the public, which are also listed on the website.

Figure 11. Landing page of the Austrian "Nano Information Platform".

The platform serves as best practice example on how to provide a trusted source of information on potential risks and benefits of ENMs to the general public. The organisational form for Nano Risk Governance should encourage National authorities to develop such a platform, supporting them in providing latest information and knowledge and also monitor them.

[14] https://www.nanoinformation.at/

3.4 Evaluation and conclusions

Based on the results presented in this report, it can be concluded that the public risk perception towards nanotechnologies has not changed significantly in recent years. Public attention and discussion on the general topic have decreased. When a public discussion did arise, it was not about nanotechnologies, but about a very specific material and application (more or less independently of whether it was "nano" or not).

Nevertheless, it is important to be aware of how public risk perception is built, and how trust in tech governance can be addressed and strengthened by incorporating trust drivers.

Regular dialogues with all stakeholders and scientific-based communication using different communication and information channels are key to a future organizational form for Nano Risk Governance.

Education and training are also important factors that do not directly influence risk perception, but should help laypeople to better understand the complexity of an issue, and that as safety research evolves and new knowledge becomes available, new approaches should also be applied to risk governance. The organisational form for Nano Risk Governance should monitor and, where appropriate, support training and education activities by providing scientifically sound State-of-the-Art information.

4 Deviations from the work plan

Minor deviations from the original work plan occurred primarily due to extensive collaboration with the NMBP-13 sister projects NANORIGO and RiskGONE. BNN, as WP3 lead, was appointed to the NMBP-13 Joint Core Group on Stakeholder Engagement, which enabled close collaboration on all stakeholder engagement topics (including engaging laypeople, early career researchers, and civil society organizations). The COVID-19 pandemic and associated lockdowns were perceived as minor shortcomings, particularly with regard to civil society engagement and training/awareness activities. Nevertheless, most of the planned activities were converted to online events (such as the European Researchers' Night and the annual Nanosafety Training School), allowing for sufficient integration of stakeholder engagement activities as planned.

5 Performance of the partners

All WP3 partners contributed to the planning, organisation and implementation of engagement activities (e.g., survey on public risk perception, participation in the European Researchers' Night, preparation and organisation of training schools and workshops, etc.) as expected. BNN, as WP3 leader, coordinated the activities and ensured the collaboration with the two NMBP-13 sister projects NANORIGO and RiskGONE. Regular WP3 meetings were organised by BNN on monthly basis to discuss the progress and next steps with Gov4nano partners.

6 References / Selected sources of information

Gov4Nano D3.1 "Report on parameters, elements and information forming and influencing the risk perception of different civil society groups"

Gov4Nano D3.6 "Recommendations on how the organisational form for Nano Risk Governance should train and educate civil society and insurers - Showcases and best practice examples"

Larsson, S., Jansson, M., & Boholm, Å. (2019). Expert stakeholders' perception of nanotechnology: risk, benefit, knowledge, and regulation. Journal of Nanoparticle Research, 21, 1-17.

Murtin, F., Fleischer, L., Siegerink, V., Aassve, A., Algan, Y., Boarini, R., ... & Smith, C. (2018). Trust and its determinants: Evidence from the Trustlab experiment.

NANORIGO D4.7 "Report on multidisciplinary and multistakeholder dialogue"

Palma-Oliveira, J.M., de Carvalho, R.G., Luis, S. & Vieira, M. (2009). Knowing Much While Knowing Nothing: Perceptions and Misperceptions about Nanomaterials. In Igor Linkov and Jeffery Steevens (Eds.) Nanomaterials: Risks and Benefits (437-462). Netherlands: Springer.

RiskGONE D3.5 "Draft guidelines on the societal acceptance of nanomaterials considering risk and benefit perception"

Soeteman-Hernández, L. G., Sutcliffe, H. R., Sluijters, T., van Geuns, J., Noorlander, C. W., & Sips, A. J. (2021). Modernizing innovation governance to meet policy ambitions through trusted environments. NanoImpact, 21, 100301.

7 List of abbreviations

CSOs	Civil Society Organisations
ENMs	Engineered nanomaterials
ERN	European Researchers Night
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
QSAR	Quantitative structure–activity relationship
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals

Annexes

Annex 1. Public risk perception survey

Questionnaire - English

RiskGONE, Gov4Nano and NANORIGO are European projects focused on the development of a Risk Governance Council designed to govern and manage possible risks associated with nanotechnologies. With this goal, it is fundamental to understand what people know and how they perceive nanotechnologies. The present survey, coordinated by the RiskGONE team, aims to understand your attitudes towards nanotechnology and nanoproducts and their risks. There are no right or wrong answers as they express your feelings or opinion.

The answers provided in this survey are completely anonymous and will only be used for the purpose described above. Any and all data gathered as a result of these participatory exercises will be coded and retained in full accordance with the relevant national regulations and legislation regarding data protection. Data may be used in the preparation of scientific publications and reports, but such that the identity of individual respondents cannot be revealed.

This survey is designed to be anonymous. The project has no possibility to identify respondents through direct or indirect means. This also means that individual responses, once submitted, cannot be deleted upon request. The data will be stored on servers located in the European Union or Norway. The raw dataset with all survey responses will be deleted one year after the termination of the RiskGONE project, which is currently planned to finish 31 December 2022.

Please keep in mind you are free choose to participate or not in this survey. You may ask questions at any time before, during, or after your participation in this survey; and you are completely free to stop answering whenever you want.

Where can I find out more?

Responsible for the design and analysis of the survey is Factor Social (Portugal). The RiskGONE project is coordinated by the Norwegian Institute for Air Research – NILU (Norway). The electronic survey is implemented by NILU.

If you have questions about the survey, please contact:

FactorSocial – dalilaantunes@factorsocial.pt

NILU – riskgone@nilu.no; eab@nilu.no

Thank you for agreeing to take part in this survey! We ask you to read the instructions

carefully and respond as accurately as possible.

I hereby agree:

- to take part in this survey;
- that my response will be saved and treated for analysis until 1 year after the RiskGONE project end date.

1. Have you ever heard about…	1= No and I don't know what it means	2= Yes, but I don't know what it means	3= Yes and I know a bit about it	4= Yes and I'm an expert on it
… Nanomaterials?				
… Nanotechnology?				

Nanomaterials are materials that consist on particles that are so small that you cannot see them. They are components of some products and technology.

Nanotechnology refers to technology manipulating materials that are so small that you cannot see them. It can be used for producing nanomaterials and tailoring of new materials, devices and systems.

2. In general, are you in favor or against research on nanomaterials?	1= Complete-ly against	2= Against	3= Neutral	4= In favor	5= Complete-ly in favor

3. Are you in favor or against the use of nanomaterials…	1= Comp-letely against	2= Against	3= Neutral	4= In favor	5= Comp-letely in favor
3.0 In general?					
3.1.1 If applied on high resolution MRI?					
3.1.2 If applied on food packaging?					
3.1.3 If applied on walls paint?					
3.2.1 If applied on nail polisher?					
3.2.2 If applied on anti-aging face cream?					
3.2.3 If applied on dental implants?					
3.3.1 If applied on chirurgical nanorobots?					
3.3.2 If applied on agriculture?					
3.3.3 If applied on pacemaker (implantable cardioverter-defibrillator - ICD)?					

4. How concerned are you about the risks associated with nanotechnologies	1= Not concerned at all	2= Slightly concerned	3= Moderate-ly con-cerned	4= Very concerned	5= Extreme-ly concerned
4.0 In general?					
4.0.1 For society?					
4.0.2 For the environment?					

4.0.3 For public health?					
4.1.1 If applied on high resolution MRI?					
4.1.2 If applied on food packaging?					
4.1.3 If applied on walls paint?					
4.2.1 If applied on nail polisher?					
4.2.2 If applied on anti-aging face cream?					
4.2.3 If applied on dental implants?					
4.3.1 If applied on chirurgical nanorobots?					
4.3.2 If applied on agriculture?					
4.3.3 If applied on pacemaker (implantable cardioverter-defibrillator - ICD)?					

5. The use of nanomaterials brings more positive or negative effects…	1= Only positive	2= More positive than negative	3= Equally positive and negative	4= More negative than positive	5= Only negative
5.0 In general?					
5.0.1 For society					
5.0.2 For the environment?					
5.0.3 For public health?					
5.1.1 If applied on high resolution MRI?					
5.1.2 If applied on food packaging?					
5.1.3 If applied on walls paint?					
5.2.1 If applied on nail polisher?					
5.2.2 If applied on anti-aging face cream?					
5.2.3 If applied on dental implants?					
5.3.1 If applied on chirurgical nanorobots?					
5.3.2 If applied on agriculture?					
5.3.3 If applied on pacemaker (implantable cardioverter-defibrillator - ICD)?					

6. What do you consider to be the main benefits of using products containing nanomaterials?

_____
_____
_____
_____

7. What do you consider to be the risks of using products containing nanomaterials?

_____
_____
_____
_____

8. How strong do you think the positive effects of nanotechnology can be…	1= No effects at all	2= Weak effects	3= Moderate effects	4= Severe effects	5= Extreme effects
In general?					
8.0.1 For society					
8.0.2 For the environment?					
8.0.3 For public health?					
8.1.1 If applied on high resolution MRI?					
8.1.2 If applied on food packaging?					
8.1.3 If applied on walls paint?					
8.2.1 If applied on nail polisher?					
8.2.2 If applied on anti-aging face cream?					
8.2.3 If applied on dental implants?					
8.3.1 If applied on chirurgical nanorobots?					
8.3.2 If applied on agriculture?					
8.3.3 If applied on pacemaker (implantable cardioverter-defibrillator - ICD)?					

9. How many people do you think will benefit directly or from positive side effects of nanotechnology…	1= None	2= A few	3= Some	4= Many	5= All
9.0 In general?					
9.1.1 If applied on high resolution MRI?					
9.1.2 If applied on food packaging?					

9.1.3 If applied on walls paint?					
9.2.1 If applied on nail polisher?					
9.2.2 If applied on anti-aging face cream?					
9.2.3 If applied on dental implants?					
9.3.1 If applied on chirurgical nanorobots?					
9.3.2 If applied on agriculture?					
9.3.3 If applied on pacemaker (implantable cardioverter-defibrillator - ICD)?					

10. How strong do you think the negative effects of nanotechnology can be	1= No effects at all	2= Weak effects	3= Moderate effects	4= Severe effects	5= Extreme effects
10.0 In general?					
10.0.1 For society?					
10.0.2 For the environment?					
10.0.3 For public health?					
10.1.1 If applied on high resolution MRI?					
10.1.2 If applied on food packaging?					
10.1.3 If applied on walls paint?					
10.2.1 If applied on nail polisher?					
10.2.2 If applied on anti-aging face cream?					
10.2.3 If applied on dental implants?					
10.3.1 If applied on chirurgical nanorobots?					
10.3.2 If applied on agriculture?					
10.3.3 If applied on pacemaker (implantable cardioverter-defibrillator - ICD)?					

11. How likely are nanotechnologies applications to harm health…	1= Extreme-ly unlikely	2= Unlikely	3= 50% chance	4= Likely	5= Extreme-ly likely
11.0 In general?					
11.1.1 If applied on high resolution MRI?					
11.1.2 If applied on food packaging?					
11.1.3 If applied on walls paint?					

11.2.1 If applied on nail polisher?					
11.2.2 If applied on anti-aging face cream?					
11.2.3 If applied on dental implants?					
11.3.1 If applied on chirurgical nanorobots?					
11.3.2 If applied on agriculture?					
11.3.3 If applied on pacemaker (implantable cardioverter-defibrillator - ICD)?					

12. How many people do you think will suffer negative direct or side effects of nanotechnology…	1= None	2= A few	3= Some	4= Many	5= All
12.0 In general?					
12.1.1 If applied on high resolution MRI?					
12.1.2 If applied on food packaging?					
12.1.3 If applied on walls paint?					
12.2.1 If applied on nail polisher?					
12.2.2 If applied on anti-aging face cream?					
12.2.3 If applied on dental implants?					
12.3.1 If applied on chirurgical nanorobots?					
12.3.2 If applied on agriculture?					
12.3.3 If applied on pacemaker (implantable cardioverter-defibrillator - ICD)?					

13. How willing would you be to…	1= Would not, for sure	2= Would probably not	3= Might or Might not	4= Would probably	5= Would, for sure
13.0 Use something containing nanomaterials, in general?					
13.1.1 Submit yourself to high resolution MRI developed with nanomaterials?					
13.1.2 buy food in food packaging containing nanomaterials?					
13.1.3 Paint your house with walls paint containing nanomaterials?					

13.2.1 Use nail polisher containing nanomaterials?					
13.2.2 Use anti-aging face cream containing nanomaterials?					
13.2.3 Use dental implant containing nanomaterials?					
13.3.1 submit yourself to a chirurgic procedure including chirurgical nanorobots?					
13.3.2 Consume food produced by agriculture using nanomaterials?					
13.3.3 Use a pacemaker (implantable cardioverter-defibrillator - ICD) containing nanomaterials?					
13.4.1 use a product containing metal oxides					
3.4.2 use a product containing titanium alloys					
13.4.3 use a product containing nano carbon fibers					

13.5 – If you answered *'would not, for sure'* or *'would not'*, can you specify in which circumstances would you use something produced with nanotechnology and/or nanomaterials?

I would if

_____
_____
_____
_____
_____

14. How much control do you have on your exposure to nanotechnologies	1= Completely uncontrollable	2= Uncontrollable	3= Neutral	4= Controllable	5= Completely controllable
14.0 In general?					
14.1.1 If applied on high resolution MRI?					
14.1.2 If applied on food packaging?					
14.1.3 If applied on walls paint?					
14.2.1 If applied on nail polisher?					

14.2.2 If applied on anti-aging face cream?					
14.2.3 If applied on dental implants?					
14.3.1 If applied on chirurgical nanorobots?					
14.3.2 If applied on agriculture?					
14.3.3 If applied on pacemaker (implantable cardioverter-defibrillator - ICD)?					

14.4 – If you answered '*controllable'* or '*completely controllable'*, explain how do you control your exposure?

_____
_____
_____
_____

15. How much control do you have on your exposure to the risks of nanotechnologies…	1= Completely uncontrollable	2= Uncontrollable	3= Neutral	4= Controllable	5= Completely controllable
15.0 In general?					
15.1.1 If applied on high resolution MRI?					
15.1.2 If applied on food packaging?					
15.1.3 If applied on walls paint?					
15.2.1 If applied on nail polisher?					
15.2.2 If applied on anti-aging face cream?					
15.2.3 If applied on dental implants?					
15.3.1 If applied on chirurgical nanorobots?					
15.3.2 If applied on agriculture?					
15.3.3 If applied on pacemaker (implantable cardioverter-defibrillator - ICD)?					

15.4 - If you answered *'controllable'* or *'completely controllable',* explain how do you control your exposure?

_____
_____
_____
_____

16. Do you believe yourself to be more or less affected by risks of nanotechnology than other people?	1= Much less	2= Less	3= Same way	4= More	5= Much more

16.1 If you answered differently from *'same way'*, can you please state why?

_____
_____
_____

17. How informed are you about the risks of exposure to nanomaterials and nanotechnologies…	1= Not informed at all	2= Slightly informed	3= Moderate-ly informed	4= Very informed	5= Extreme-ly informed
17.0 In general?					
17.1.1 If applied on high resolution MRI?					
17.1.2 If applied on food packaging?					
17.1.3 If applied on walls paint?					
17.2.1 If applied on nail polisher?					
17.2.2 If applied on anti-aging face cream?					
17.2.3 If applied on dental implants?					
17.3.1 If applied on chirurgical nanorobots?					
17.3.2 If applied on agriculture?					
17.3.3 If applied on pacemaker (implantable cardioverter-defibrillator - ICD)?					

18. Where do you search for information about nanotechnology?		I don't search for information on nanotechnology
18.0 In general?		
18.1.1 If applied on high resolution MRI?		
18.1.2 If applied on food packaging?		

18.1.3 If applied on walls paint?		
18.2.1 If applied on nail polisher?		
18.2.2 If applied on anti-aging face cream?		
18.2.3 If applied on dental implants?		
18.3.1 If applied on chirurgical nanorobots?		
18.3.2 If applied on agriculture?		

19. Considering the responsible development of nanotechnologies, how much do you trust	1= Completely dis-trust	2= Distrust	3= Neutral	4= Trust	5= Completely trust
19.1 Methodologies for evaluating nanotechnology risks					
19.2 Public regulations					
19.3 Testing by producer industry and companies					
19.4 That public health concerns are protected prior to take nanotechnologies into the market					

20. Considering information about nanomaterials and nanotechnology, how much do you trust the following *actors*?	1= Comple-tely distrust	2= Distrust	3= Neutral	4= Trust	5= Comple-tely trust
20.1 National ministries					
20.2 Government agencies					
20.2 European Union					
20.3 Politicians					
20.4 Trade Unions					
20.5 Environmental Organizations					
20.6 Consumer Organizations					
20.7 Industry and companies					
20.8 Scientists					
20.9 Journalists					

21. Considering information about nanomaterials and nanotechnology, how much do you trust the following *media*?	1= Comple-tely distrust	2= Distrust	3= Neutral	4= Trust	5= Comple-tely trust

21.1 TV and radio					
21.2 General Newspapers and magazines					
21.3 Professional / Dedicated Newspapers and magazines					
21.4 Company websites					
21.5 Websites of ministries and government agencies					
21.6 Websites of scientific organizations					
21.7 Social media (e.g., Facebook, Twitter, etc.)					
21.8 Blogs or YouTube videos					
21.9 Family and friends; personal contacts					

22. What should be the role of the following organizations on the development and research of nanomaterials and nanotechnologies?	
22.1 EU	
22.2 EU agencies	
22.3 National government	
22.4 National agencies	
22.5 Industry	
22.6 Universities / Academia / Scientists	
22.7 NGO	
22.8 Journalists / Media	

23. Who shall pay for…	Govern ment	Industry	Professio-nals using it	Final Users	Insurance	Other
23.1 nanomaterials development						
23.2 nanomaterials risk evaluation						
23.3 nanomaterials risk reduction						
23.4 societal risks resulting from use of nanotechnologies						

23.5 environmental risks resulting from use of nanotechnologies						
23.6 health risks resulting from use of nanotechnologies						

24. If an independent Governance Risk Council for Nanotechnology is developed…					
24.1 do you consider it valuable or irrelevant?	1= Complete -ly irrelevant	2= Irrelevant	3= Neutral	4= Valuable	5= Complete -ly valuable
24.2 what should be its role?					
24.3 who should be included as a member of the council (what kind of people?)?					

Do you use anything produced with nanotechnology and/or containing nanomaterials?

Yes ☐ Don't know ☐ No ☐

25.1 If yes, what?

_____
_____

26. Demographics						
26.1 Age	18-25	26-30	31-40	41-60	61-80	81 or over
26.2 Sex	Male			Female		
26.3 Education	None or Basic	Professional education	BSc	MSc	PhD	
26.4 Nationality						
26.5 Do you have children?	No	Yes, they are adults	Yes, they are 10-18 years old	Yes, they are 6--10 years old	Yes, they are less than 6 years old	

26.6 Professional experience with nanotechnology and/or nanomaterials				No	Yes	
26.7 Work for	Government	Academy	Industry	Consultancy	NGO	Other

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For more information on governance of nanomaterials see the following websites:

RiskGONE

NANORIGO

Gov4Nano

Annex 2. General poster presented by BNN at ERN in Austria

BNN

„NANO" SOWEIT DAS AUGE SEHEN KANN – UND DARÜBER HINAUS!

10^{-9} Meter = **1 Nanometer**

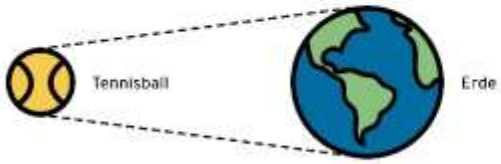
10^{-6} Meter = **1 Mikrometer**

10^{-3} Meter = **1 Millimeter**

1 Meter

WIE GROSS IST EIN NANOMETER?

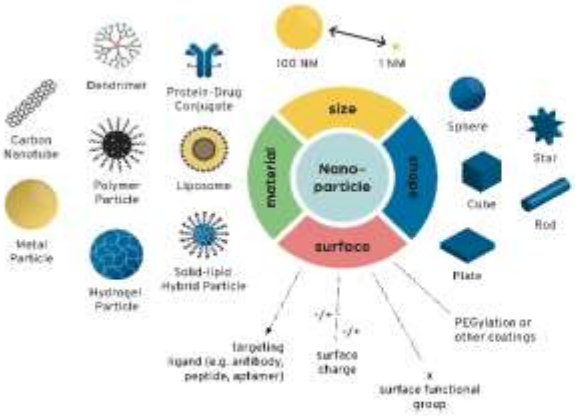
Ein Nanometer ist ein milliardstel Meter = 10^{-9} bzw. 0,000.000.001 m. Das Größenverhältnis von einem Nanometer zu einem Tennisball entspricht dem Größenverhältnis von einem Tennisball zur Erde. Was sich im Bereich von Nanometern befindet, ist für das bloße Auge nicht mehr erkennbar. Selbst optische Mikroskope schaffen es nicht, Teilchen in diesem Bereich sichtbar zu machen!



Aufgrund ihrer winzigen Größe sind Nanomaterialien ziemlich knifflig. Sie können ganz unterschiedlich reagieren! **Ein gutes Beispiel ist Aluminium:**

Alufolie = nicht reaktiv

Aluminium in Nanoform = reaktiv, sogar explosiv (z.B.: im Raketenantrieb)



Nanotechnologien nutzen die besonderen Eigenschaften von Atomen und Molekülen im Nanometerbereich.

NANOPRODUKTE IM ALLTAG

Wo wird Nanotechnologie eingesetzt?

- ✔ Kosmetik
- ✔ Elektronik
- ✔ Medikamente
- ✔ Lebensmittel
- ✔ Kleidung
- ✔ ...und viele mehr!

Wie sicher sind Nanoprodukte für Mensch und Umwelt, und wer entscheidet das?

Risikobewertung

Risiko = Gefahr x Aussetzung

Was?
Identifizierung von Gefahren
Gefahrencharakterisierung

Wie viel?
Aussetzung am Menschen
Aussetzung an die Umwelt

Die BNN Forschungsgesellschaft mbH trägt dazu bei, die Sicherheit und Nachhaltigkeit von Nanomaterialien & Nanotechnologien zu fördern.

WWW.BNN.AT

Annex 3. "Facts or fiction" game

Instructions:
13 topics are presented below with a specific statement linked to it. Participants can then guess, if the statement is a "fact" or a "fiction", which can lead into an interactive discussion. The explanation which reveals if it's a "fact" or "fiction" is then provided afterwards.

*****

The attack of nanomachines

"Nanomachines exist in nature. They can attack your body."

Yes, indeed, we are daily exposed to such nano monsters. Viruses such as influenza virus or HIV are biologic nanoscale machines, which can be a threat to your body.

*****

Nano in food?

"Nanoparticles are contained in food products offered in supermarkets."

Yes, indeed, there are available food products which contain silicon dioxide- or titanium dioxide-nanoparticles for instance. They influence characteristics such as consistency and / or colour of the respective product. Since some years, such products have to be labelled.

*****

Caries, never again!

"Thanks to nanotechnology there exist dental nano-robots, which clean autonomously tooth surfaces."

Sorry, they don't exist for now. However, toothpaste containing hydroxyapatite nanoparticles is available. These particles can rebuild affected dental enamel and restore the tooth surfaces.

*****

Anthropogenic nano invasion?

"Nanoparticles exist in nature for only a few decades, because humans started to produce them."

Wrong: Naturally occurring nanoparticles exist from the beginning of time, e.g., carbon black in volcanic ash or other combustion processes. Artificial nanoparticles, however, have been produced since just a few decades.

*****

Emergency doctor: Dr. Nano

"Nanorobots can be injected in the bloodstream and instantly reach wounds (e.g., caused by accidents) and repair them."

Up to now fiction, but intensive research is performed to target drugs to their site of action, hence, enhancing their effectivity.

*****

Candlelight dinner, a nanoparticle slinger?

"When a candle is lit, billions of nanoparticles are generated and dispersed in the ambient air."

Indeed! The soot of a candle flame includes billions of nanoparticles, which are generated during the combustion process.

*****

Nano-taxi

"Nanoparticles direct drugs through the body and bring them to their final target without intermediate stop."

Yes, tumour therapies exist, where drugs are safely packaged with sugar chains and directed through the bloodstream to the tumour; like a nano-taxi. Arriving at the target, the drug-laden nano-transporters are taken up by tumour cells and release their lethal cargo. Malignant cells die; healthy tissue widely remains untouched.

*****

Tear-proof tissues

"Nanoparticle coated tissues are particularly tearproof and absorptive."

Sorry, such tissues don't exist!

*****

The smallest car in the world!

"The smallest car in the world is just 2 nm in size."

Yes, the smallest car in the world is indeed constituted of just one molecule and is just 2 nm in length. Each tire is composed of one fullerene built of 60 atoms.

*****

Nanoparticles cure cancer

"Iron nanoparticles can be injected in the body to combat cancer cells."

Indeed, iron oxide nanoparticles are injected in tumour tissue and exposed to high frequency alternating magnetic fields. Thus, the tumour is heated to 45°C and cancer cells specifically die off.

*****

Changing socks: never again!

"Due to nanotechnology never-stinking socks are available."

Socks are available, which contain silver nanoparticles to prevent bacterial growth. Anyway, socks should be changed and washed routinely.

*****

Automatic flavouring

"Fry pans are available that are coated with salt and pepper nanoparticles, so that the meal is automatically flavoured when fried."

Sorry, but flavouring has still to be done by oneself. Such intelligent fry pans do not exist.

*****

Smart clothing

"Intelligent textiles are available, which check blood pressure and pulse and – if necessary – administer the appropriate medicine."

To date not realistic. However, research is performed on such textiles.