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NanoSafety – Risk Governance of Manufactured Nanoparticles

Report on Results of Focus Groups
incl. Draft Conclusions Paper

Deliverables No.3 & 4 of the
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Project Description

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The project is being carried out by
the **Institute for Technology Assessment and Systems Analysis (ITAS), Karlsruhe Institute of Technology (KIT) (Project Co-ordinator);** together with
the **Institute of Technology Assessment (ITA), Austrian Academy of Sciences, Vienna**;
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GENERAL INFORMATION

The Nano*Safety* project deals with the governance of the potential environmental, health and safety (EHS) risks of manufactured nanoparticles. Because of the great uncertainties regarding their actual health and environmental effects and numerous methodological challenges to established risk assessment procedures (definitions, toxicology, exposure and hazard assessments, life cycle assessment, analytics, and others), risk appraisal and risk management of manufactured particulate nanomaterials (MPN) are confronted with serious challenges. At the same time, precautionary regulatory action with regard to MPN is demanded by a number of stakeholders and parts of the general public.

Regulation under uncertainty raises fundamental political questions of how lawmakers should regulate risk in the face of such uncertainty. To explore this issue in greater detail, the project focuses on two important perspectives of regulation: Risk management strategies for MPN as discussed or proposed for the EU or its member states, and risk communication problems and needs for EHS risks of MPN.

This working paper is a document of phase three of the project.

It is intended to present first insights into results of two focus group exercises that were part of the project's work programme. The aim of the focus groups was to investigate perceptions, associations and expectations of laypersons with regard to manufactured particulate nanomaterials and options for its regulation. Its results will become part of the concern assessment which will be discussed in the phase III-report of this project (due in July 2011).

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DRAFT CONCLUSIONS / EXECUTIVE SUMMARY

The focus of the NanoSafety Project is on the appraisal of environmental health and safety (EHS) risks of manufactured particulate nanomaterials (MPN, often briefly denoted "nanoparticles"). Risk appraisal comprises two elements: risk assessment and concern assessment. While risk assessment has been extensively discussed in the Phase II-Report of this Project, phase III will focus on concern assessment. Concern assessment is aiming at providing sound insights and a comprehensive diagnosis of concerns, expectations and perceptions that individuals, groups or different cultures may link to the hazard. Getting a good grasp on these different elements is an important factor in understanding how individuals and groups perceive and assess risks, what actions (or non-actions) are perceived as being risky for what reasons and how the different actors risk management and communication are expected to take action.

A broader summary of the research results on concerns and perceptions of MPN EHS risks by different societal groups will be provided in the forthcoming Phase III—Report of the NanoSafety project, due in July 2011. This working paper is part of the preparatory work for this report, it presents first insights into the results of two focus group discussions with laypeople that were organized within the framework of the NanoSafety project and took place in April 2011. The decision to include an element of original empirical research into this project was initiated by the finding that the current research situation on MPN EHS risk perception in the general public proved somewhat unsatisfactory because of a small body of empirical results and disparate scientific perspectives.

In the following, we present the results of these two events. In order to be able to compare the results of both focus groups in Karlsruhe and in Vienna, they were organized as similar as possible. In both venues, about 15 members of the general public took part in moderated four hour discussions. The first part was used to gain insights into the ideas, concepts and associations the citizens had on manufactured particulate nanomaterials ("nanoparticles"), while the second part was dedicated to discuss the expectations of the citizens regarding regulation and political action. The reader should keep in mind that the design of STOA projects provides only very limited resources for original social sciences fieldwork. Therefore, the scope of this research is partly exploratory and can provide only first findings. More in-depth studies are needed but have to be left to future, more traditional projects.

The focus group discussions were started by asking the participants which products containing nanoparticles they knew, became aware of in shops or supermarkets or have already used. Most of the participants mentioned products which claimed to contain nanoparticles. Several had already bought products which are advertised as "nano". The known 'nanoproducts' predominantly account for cleansing, impregnating and polishing products for cars and households. Products from other application fields like electronics, textiles, medicine, cosmetics and food were also specified. Many of the listed products can be related to the everyday life of the participants acting as consumers, in some cases they can be also linked to their professional experiences.

In the course of the discussion, more and more products and applications where mentioned. In sum, a considerable amount of products and applications which seemed to

be already in use and on the market was listed up. As a result, the participants were astonished about the broad scope, spectrum and extent of ‘nanoproducts’ already available. They appeared unsettled and expressed their uncertainty asking whether nanoparticles are also in other everyday life products like hairspray and deodorants, which are not nano-labelled. They were confused about the sense and relations of the different applications reaching from car finish to ketchup, some even felt blindsided or steamrollered.

Some participants described the characteristic effects and properties with key words and metaphors like “Trojan horse”, “lotus effect” and “non-adhesive agent”. With these jointly self-derived solutions and explanations for the characteristics of ‘nanoproducts’, the participants developed a heuristic to relate the different ‘nanoproducts’ with their benefits and reasons for application. It was evident that the citizens conceptualize unknown effects with analogies, pictures and metaphors.

During the course of the discussions, questions occurred about what nanoparticles actually are and how ‘nanoproducts’ could be distinguished from ‘non-nanoproducts’. For a number of discussants in Karlsruhe, the starting point for describing the term nanoparticle was the size, they assumed that nanoparticles are small-sized particles. For others, the nanoscale was not clearly differentiated from the micro-size/scale since they used the general term "microscopic size". While the participants from Karlsruhe tried to find a kind of definition for nanoparticles, the Vienna discussion on the conceptualisation initially started and mainly evolved around the subjects natural versus artificial and biology versus physics etc. Many discussants in both groups arbitrarily mixed their terminology using nanoparticles, nanotechnology and sometimes also ‘nanoproducts’ quasi synonymously. Other participants used the term (nano)technology in a broader sense, mainly for technical processes to manufacture nanoparticles.

In general, we got the impression that the participants knew rather little about the benefits and risks of ‘nanoproducts’ from different materials. They demanded more information about the specific benefits and potential risks of ‘nanoproducts’. While for the participants from the Karlsruhe group nanoparticles are relatively well known for example in the form of surface coatings with so-called ‘lotus effect’ as well as in cleaning or care products for home or cars, the participants in Vienna hardly could make sense of the difference between nanotechnology and nanomaterials.

Most participants in both groups expressed their overall expectation that nanotechnology will contribute to wealth and better living conditions. Especially, an important contribution to progress for medical applications was expected. While the Viennese group explicitly welcomed developments in the realm of “technology”, the Karlsruhe group rated applications as useful if practical aspects improving their everyday life.

Rather early in the course of the conversation, in both groups general and concrete health risks were mentioned. A dominant argumentation was the potential inhalation of nanoparticles and the related adverse health effects. The statements of the Karlsruhe group were mostly combining the perceived risks with proposals for regulatory measures in order to improve the responsible handling and application of ‘nanoproducts’ from a viewpoint of consumers, while the Viennese group predominantly expressed their concerns without combining them to a concrete call for measures. The fact that there exist uncertainties in the risk assessment of nanoparticles and different opinions among

scientists regarding possible risks of caused irritation and concerns among the participants, some even expressed a kind of helplessness.

It seemed to be consensus within the two groups that new technologies bear chances as well as risks. The citizens were quite aware that both chances and risks have to be taken into account in order to make a choice for or against the application of a new technology. They appreciated consumer products and household products becoming better due to new technologies. But some of them were also sceptical about whether the promised benefits were always really necessary and a benefit for the consumer - and not only for the producer.

Some people mentioned that the higher price didn't reflect the benefit of the product. Others often did not see convincing benefits but knew that there might be drawbacks related to the use of the products. Especially related to household products, some Viennese participants claimed that they are satisfied with the existing products and do not need further features. Interestingly, in Karlsruhe several participants rather weighted the benefits against the lack of knowledge than against concrete perceived risks. The lack of knowledge about concrete risks might be one reason why the participants often gave conditional answers. A number of participants even stated clearly that due to the lack of knowledge, a reasonable balancing of chances versus risks is not possible. In general, the rationality of their action could be considered as being based on precaution. In case of doubt they would prefer the conventional product.

Another aim of the focus group events was to elicit the expectations of the citizens regarding regulation and political action. Different measures were suggested by the participants, most of them were not conceived separately but rather a combination of different measures that complement one another. For example, labelling was mostly proposed in combination with additional preliminary information or a product list could only be advantageous together with easily comprehensible information.

Both groups showed a strong, almost unanimous request for more and better information. While the Karlsruhe participants wanted to be informed about the things they consume, their benefits and risks, in local newspapers, reports in other media or the public discourse, the Viennese were calling for more information about the general definition and the nature of nanoparticles – especially since they realized that they already might be confronted with 'nano' without their knowledge.

Although some Karlsruhe attendees rather preferred sources independent from industry or the state, several participants of both groups requested the state to work out regulations in order to initiate the information flow. The Viennese attendees urged either for a neutral institution or a governmental body to provide understandable, clear information as soon as research discovers new findings. They called in for research by independent authorities, by universities, or state-run institutions. There was almost no trust in research results by industry. Notably, the attendees of both groups realized the international dimension of the problem to regulate e.g. information responsibilities and thus even think about the EU as a responsible actor. Also public media was expected to be a source of information; one even mentioned that this would be their duty.

Remarkably, the aspect of information in Karlsruhe and Vienna was closely linked to the issue of labelling and vice versa. For example, it was agreed that labelling is expected if any risks are connected with the use of a certain ingredient (in this case nanoparticles)

similar to hazardous substances. But they also agreed that the consumer needs information ahead of a purchase decision, because the information by labelling alone is limited. Information about the hazardous nature of a nano-ingredient needs to be communicated enabling the consumer to interpret the label, to allow for a risk-benefit-consideration by the consumer and thus for an informed purchase decision.

It is important to note that missing knowledge in connection with rumours and guesses about possible risks of 'nanoproducts' (e.g. by news coverage, superficial knowledge or labelling without additional information) creates uncertainties and distrust among the consumers. Labelling was the most important measure suggested by the participants of both groups and came up already in an early stage of the discussion. Some of the Karlsruhe participants even believe that labelling of 'nanoproducts' should be a matter of course. Labelling was seen as a pre-condition to become more sensitive to particulate nanomaterials and to obtain additional information on their use, risk and appropriate disposal. Several argued that they wish to decide by themselves whether they want to come into contact with nanoparticles or not and to make their own decision based on information and labelling. Thus, labelling serves as a basis for deliberation and choice.

Although a majority of the attendees would like to recognize 'nanoproducts' by a label, the question of the design of such a label lead to a controversial debate. One important part of the discussion was concerning voluntariness or obligation – in other words: the credibility of the label. A superior authority which would assure a mandatory and monitored label would increase the trustworthiness of a 'nanolabel'. The Karlsruhe attendees assumed that a reliable 'nanolabel' should be assigned by an independent regulatory body, a state or federal agency. Voluntary labelling by the manufacturers was perceived as insufficient by both the citizens in Karlsruhe and Vienna. Therefore they demanded a mandatory labelling for 'nanoproducts'. Moreover, the participants of both groups agreed that a 'nanolabel' should be consistent and precise. Several of the Karlsruhe attendees would support the idea that all manufactures use the same kind of label which again implicates a mandatory labelling. A few Viennese participants suggested that a norm has to be developed. Some were afraid of confusing or even missing labels, especially in the food sector, where 'nano' is seen as most critical.

Another interesting aspect that was discussed in Karlsruhe revolved around the question which effect a 'nanolabel' would have on the consumers. They agreed that a 'nanolabel' always would have a signal effect. In contrast to the "organic logo" which elicits positive associations, a 'nanolabel' would rather act like a neutral or even a warning signal (similar to the hazard symbols) for some participants. In contrast to organic food, which is connected with beneficial property, several of them stated that they don't see 'nano' in the same way. While the label per se is value free, the effect of the label is strongly dependent on the information that is delivered together with it.

One of the hottest topics of the political debate around risk government of nanoparticles is the establishment of 'nano' registries for products or materials. Notwithstanding, in none of both groups a registry was a central theme in the discussions. Moreover, the participants didn't even use the word "registry". This might have occurred due to the fact that citizens can only suggest regulatory instruments that are familiar to them. Thus, the topic was touched only indirectly.

The Viennese participants pointed out two main aspects of information: information for citizens on one hand and information status quo in research on the other hand.

Therefore, in Vienna a lively discussion about the role of research evolved that dominated the second part of the event. The focus was more on who should perform research than on the area of research. As mentioned before, proper and neutral information about risks was rated very high by most of the participants. Potential risks were traced back to the current lack of knowledge and uncertainties. The participants of the Viennese group extensively agreed that research needs to be done by independent, state-run or university institutions to guarantee unbiased findings. State-run research via universities was considered as a chance for the state to align different interests. In contrast to Karlsruhe, they didn't discuss measures not as detailed because it seemed irrelevant for them to elaborate measures when the information basis is still missing. Their motto was "it seems to be that even experts don't know the risks yet" and so, the elaboration of measures seemed to be pointless to them.

Throughout the whole discussion in both focus groups in Vienna and Karlsruhe, the safety of consumer product was one of the most important issues to the participants. In the face of uncertainty concerning the effects of nanoparticles on human health and the environment, the participants reacted in very different ways. Several participants, especially in Karlsruhe, demand a general preventive ban of 'nano' in consumer products because the uncertainty makes them feel that uneasy that they reject everything associated with 'nano'. The dilemma of uncertainty and lack of knowledge on the one hand and the great number of 'nanoproducts' already on the market on the other hand was discussed with particular emphasis.

Few citizens in Karlsruhe explicitly demanded a definitive ban (a moratorium) of 'nanoproducts'. Other participants of this group weren't that strict. They thought of the possibility to subject 'nanoproducts' to a (governmental) permission after they were proven to be harmless. This proof of safety should be carried out by the manufacturers before the products enter the market. Subsequently, those tests should be the basis for a governmental approval of the product, an authorization process like it is compulsory for drugs, including long term studies. They concluded that an authorisation process and the obligation of long term studies would make a moratorium unnecessary.

The Viennese participants discussed in a similar way. They were dealing with a seal of quality - similar to the "Fair Trade" seal - that represents a risk assessment procedure which guarantees the safety of the product. They also discussed if there were any institutions that could take over this task, because most of them doubted that there is one existing that is competent as well as incorruptible.

Thus, it seems that most of the Viennese participants have not been aware that products have to be tested regarding safety issues by the producer before they are launched. In this respect it was interesting to see that the participants in Vienna had very little trust in the producers. Instead, most of them expected that possible risks of a product would be concealed as long as possible by the producers.

Both in Vienna and Karlsruhe an increase of funding for research was proposed. The aim of increased research should not only be the improvement of the science base but also detailed consumer information. Funding was considered a generally agreed action against uncertainties, improving knowledge and gaining evidence. Most of the participants in Karlsruhe called for an increase of research funding in the area of toxicology, eco-toxicology or food research.

1. WHY FOCUS GROUPS WITHIN THE NANOSAFETY PROJECT?

1.1. On the Role of Concern Assessments in Risk Governance Processes

Risk management is a complex process. Over the last decades, several models for risk management have been proposed. The most recent one has been introduced by the International Risk Governance Council (IRGC) in 2005 (IRGC 2005) and developed further into a new conceptual framework for the risk governance of nanotechnology in a white paper published in 2006 (IRGC 2006). Risk Governance, according to the IRGC, *"includes the totality of actors, rules, conventions, processes, and mechanisms concerned with how relevant risk information is collected, analysed and communicated and management decisions are taken. Encompassing the combined risk-relevant decisions and actions of both governmental and private actors, risk governance is of particular importance in, but not restricted to, situations where there is no single authority to take a binding risk management decision but where instead the nature of the risk requires the collaboration and co-ordination between a range of different stakeholders. Risk governance, however, not only includes a multifaceted, multi-actor risk process but also calls for the consideration of contextual factors such as institutional arrangements (e.g. the regulatory and legal framework that determines the relationship, roles and responsibilities of the actors and co-ordination mechanisms such as markets, incentives or self-imposed norms) and political culture including different perceptions of risk"* (Renn 2008).

This working paper is certainly not the adequate place for a comprehensive academic discussion about the advantages and shortcomings of the IRGC model in comparison to its predecessors. We have chosen to use it as a conceptual framework for the NanoSafety project for a number of more or less practical reasons:

- The IRGC framework is more sophisticated than other risk management models. It acknowledges that managing the risks of emerging technologies in modern societies involves a multitude of different actors and is a dynamic process with various iterations and feedbacks.
- It acknowledges that risk governance decisions have to be taken in instances of complexity, uncertainty and ambiguity. Therefore, strategies should be based on a corrective and adaptive approach and take into account the level and extent of available knowledge and a societal balancing of the predicted risks and benefits.
- The framework includes two innovative concepts for the governance of (potential) EHS risks arising from the use of manufactured particulate nanomaterials (MPN): It integrates a scientific risk-benefit assessment (including environment, health, and safety (EHS) and ethical, legal and other social issues (ELSI)), with an assessment of risk perception and the societal context of risk (referred to in the white paper as concern assessment).
- Inherent to all elements of this framework is the need for all interested parties to be effectively engaged, for risk to be suitably and efficiently communicated by and to the different actors and for decision-makers to be open to public concerns.

The IRGC Framework consists of four phases (Figure 1): Pre-Assessment (Phase 1), Risk Appraisal (Phase 2), Tolerability and Acceptability Judgement (Phase 3) and Risk Management (Phase 4).

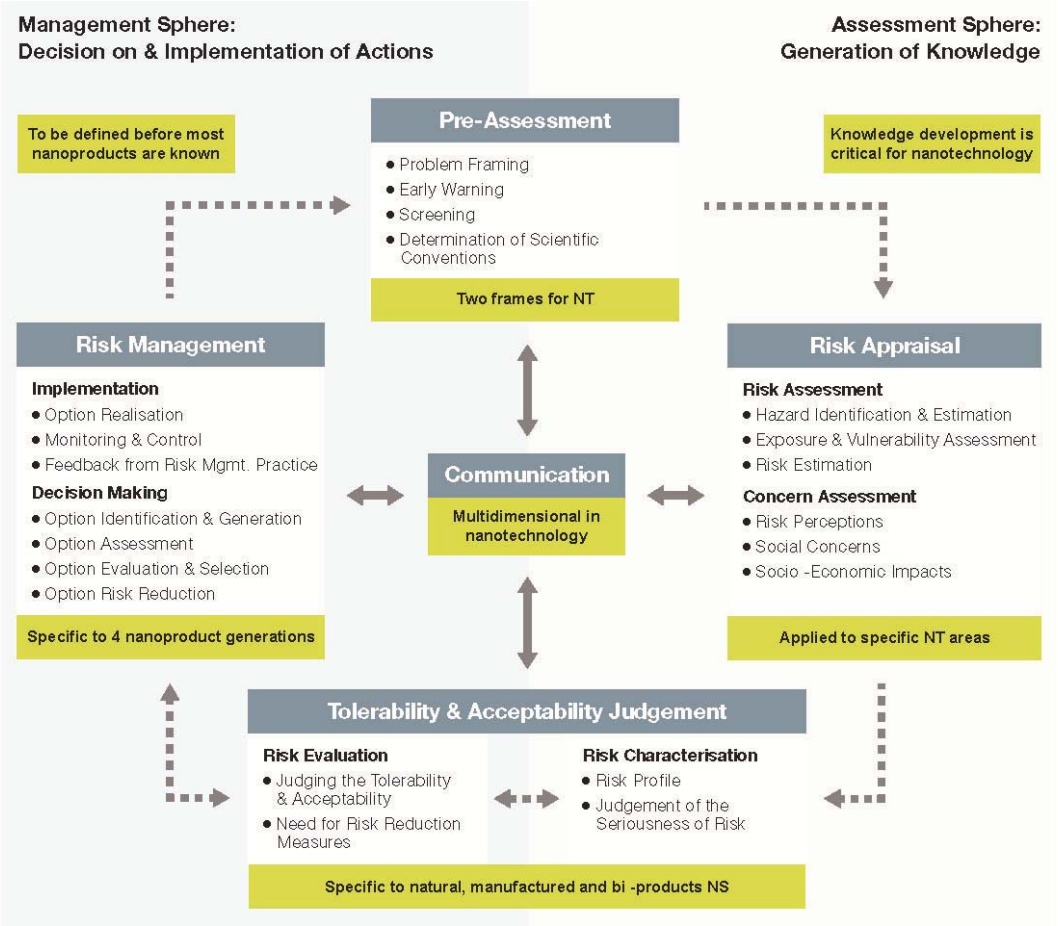

Figure 1: Steps in IRGC Risk Assessment and Management Framework for Nanotechnology (NT); NS denotes Nanostructures (taken from IRGC 2006).

The focus of the NanoSafety Project is on the risk appraisal of MPN. Risk appraisal is the second phase of the IRGC risk governance framework and comprises two elements: risk assessment and concern assessment. For MPN risks, the classic risk assessment component - dealing with hazard, exposure and risk - is particularly important. Its challenges and problems which are exacerbated by the situation that the speed of product development and application exceeds the ability of risk assessors to appraise any new risk(s) have been extensively discussed in the Phase II-Report of this Project (Fleischer et al. 2010).

This perspective has to be complemented by a concern assessment. In a book article that addresses conceptual issues of the IRGC framework raised by external experts in a round of formal comments, the lead authors define concern assessment as "*a social science activity aimed at providing sound insights and a comprehensive diagnosis of concerns, expectations and perceptions that individuals, groups or different cultures may link to the hazard*" (Renn and Walker 2008). Understanding these different concerns, expectations and perceptions is an important factor in understanding how individuals and groups perceive and assess risks, what actions (or non-actions) are perceived as being risky for what reasons and how the different actors risk management and communication are expected to take action.

1.2. Public Perception of MPN EHS Risks

Generally speaking, public perception of technological risks depends on two sets of factors. The first consists of psychological factors such as perceived threat, familiarity, personal control options, and positive risk-benefit ratio. The second set includes political and cultural factors such as perceived equity and justice, visions about future developments, and effects on personal interests and values. While the first set of components can be predicted to some degree on the basis of the properties of the technology itself and the situation of its introduction, the second set is almost impossible to predict (IRGC 2006).

To address this challenge, two options have been pursued. Political bodies both at the European and the Member State levels have organized various multi-stakeholder dialogues where representatives from public authorities, scientists, industry associations, consumers, environment and other civil society organisations as well as the general public exchanged views and discussed issues regarding MPN EHS risks. One example is the series of "Nanotechnology Safety for Success Dialogue" workshops organised and hosted by the Commission in Brussels almost every year since 2007. Some of these dialogues also developed recommendations to policymakers.

The stakeholder dialogues are complemented by sociological research into perception of MPN EHS risks within the general public[1]. Social science uses different kinds of well established methods to analyze developments and problems of the society. These methods fall into two distinct categories, the first one cover rather quantitative methods which are designed to ascertain large and therefore representative datasets. These methods allow revising existing hypothesis and making statements about defined groups of people. Typical examples are large, standardized polls. The second category covers rather qualitative methods designed to gain insights into individual arguments, ideas or values and to explore new aspects of an issue. Thus, they are designed rather open (not standardized) to capture even unexpected facts. Beside depth interviews, focus groups are typical examples of qualitative methods (Fleischer and Quendt 2007).

The scoping phase of the NanoSafety Project has shown that the results of large representative opinion surveys are only of limited value for gaining deeper insights into perceptions of EHS risks of manufactured particulate nanomaterials for various reasons:

- Since the majority of the respondents (numbers range from 60 to 90 percent) have no clear understanding of the terms nanotechnology or nanoparticles, they therefore express only assumptions or guesses.
- Large surveys (like Eurobarometer) usually ask about statements regarding nanotechnology as a whole. It remains unclear to which part of the multifaceted concept of nanotechnology the respondents in these surveys refer and how these answers are (or, from a scientists perspective, can be) related to the perception of EHS risks of manufactured particulate nanomaterials.

One example for the latter challenge can be taken from a 2010 Eurobarometer survey (Gaskell et al. 2010). Here, in order to tap into four clusters of perceptions of

[1] A summary of the research results on public perceptions will be provided in the forthcoming Phase III—Report of the NanoSafety project.

nanotechnology, respondents were presented ten statements about nanotechnology and asked whether they totally agree, tend to agree, tend to disagree or totally disagree. Figure 2 presents the results for EU-27. As a general impression, one third of the respondents believed that nanotechnology may do harm to the environment and is not safe to human health, respectively. One third expressed an opposite view and one third didn't know.

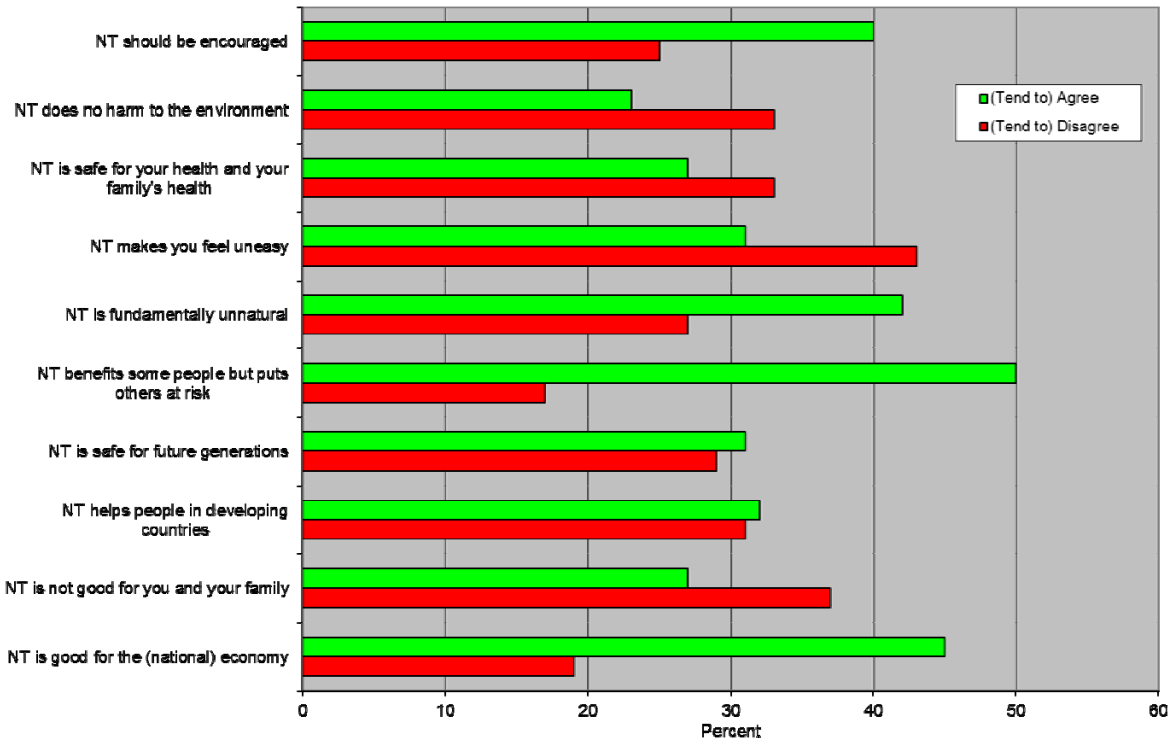

Figure 2: Perceptions of nanotechnology, EU-27, Fieldwork Jan/Feb 2010. Data were taken from Gaskell et al. (2010). For the sake of clarity, we have summarized the answers in two groups (agreement and disagreement). Please also note that – on average – one third of the respondents the numbers answered "don't know", therefore the numbers don't add up to 100 percent.

Qualitative methods have proven to be more successful. With regard to nanotechnology, since around 2000 various exercises in public engagement and participation have been conducted. They have been organised or funded by governmental authorities or industry associations in the forms of one-off events, as part of a research project or as a formal body. Different methods of deliberation and participation have been applied. Transparency of their procedures and access to the results of these exercises differ considerably, especially for researchers not involved in the actual projects. Only few of them were explicitly focussed on MPN EHS risks, most – especially the early ones - dealt with nanotechnology in general. But the published results of almost all of them also comprise recommendations or expectations regarding MPN.

We have attempted to analyse the results of these events. This was somewhat hindered by some methodical difficulties like a varying quality of documentation, occasionally insufficient information about the actual process and participant selection, and language problems (some project reports are only available in the respective national languages). We found, however, some similarities in the outcomes that allow for drafting a number of "general" statements:

- Health effects of engineered nanoparticles, nanotechnology in food, some biomedical applications of nanotechnology and outcomes of the convergence of nanotechnology with IT, biotechnology and cognitive sciences are areas of particular public concern.
- Transparency and open information are considered to be crucial prerequisites for trust in and acceptance of nanotechnology. Consumers demand coherent declaration of nanoparticles (or nanotechnology) in products.
- Participants vote for unlimited research opportunities but simultaneously expect researchers to responsibly handle nanotechnology and its applications. They ask for benefit and risk analyses, their results should be communicated to and discussed with the public.

This situation – small body of empirical results and disparate scientific perspectives on perception of MPN EHS risks – proved somewhat unsatisfactory. To get deeper insights into citizen's perspectives on nanoparticles risks, we proposed to realize own focus group discussions within the NanoSafety project. Since STOA projects usually are aiming at offering advice to policymakers, resources for original research are limited within these projects. We therefore had to confine ourselves to performing two focus groups in Karlsruhe in Vienna.

In the following, we present the results of these two events, including some theoretical remarks. We want to remind the reader that due the limited scope of the research, this report is partly exploratory and can provide only first findings. More in-depth studies are needed but have to be left to future, more traditional projects.

1.3. Focus Groups – Theoretical Background

Focus groups as a method of qualitative social research are remarkably old. This method has been described in the literature already in the 1920ies, e.g. by Bogardus in 1926. However, until the 1990ies little attention was paid to the method and it was rarely used because of a lack of systematic development (Morgan 1997). Nowadays, focus groups experience a revival and numerous handbook were published (Bürki 2000 and literature therein). The focus group method was adapted to several kinds of objects of research, starting from market studies to medical research (e.g. Morgan 1997; Powell and Single 1996). Thus, variants of the method got different names like focus groups, group interview or group discussion.

In general, focus groups are moderated discussions about a defined topic with a group of 7 to 20 participants that are selected according to defined criteria (Morgan 1997). The participants of one focus group usually share one attribute (e.g. all are inhabitants of the same city), but are assembled for maximum diversity in all other attributes (e.g. age, sex, social and professional background). Usually the discussion is triggered by a thematic input that provides information on the topic (e.g. text, brochure, short movie or slid show). In general, the discussion should take place on an equal level of knowledge on the selected topic or at least a common basis (e.g. Morgan 1997; Bürki 2000). The moderation of the focus group takes care that the conversation stays close to the topic by using an interview guide (Merton and Kendall 1946). Nevertheless, the participants are talking mostly amongst themselves rather than with the moderator (e.g. Bürki 2000; Barbour 2007).

One aim of a focus group setting is to enable an everyday-life-like conversation situation among the participants in which they should be able to express their opinions and points of view in their own way to the others group members – the interaction is the crucial feature of the focus group (Kitzinger 1994; Kitzinger 1995). In the analysis, this allows a better understanding of the relations of the statement to the participant's everyday life and insights into the backgrounds and foundations of certain arguments. Further, the focus group discussion intends to feature the positions on which consensus might be reached in a certain group, its contexts and justifications, as well as reasons for disagreements within the group.

Another aim of focus groups is to reveal aspects of an issue that are new to the researcher. Moreover, focus groups allow eliciting the most salient issue as well as the reason why the issue is salient (Morgan, 1997). Thus, it is possible to link people's statements to their real behaviour (Lankshear 1993).

Notably, the analysis of the focus groups is not considered as a collection of single opinions but rather the group's opinion as a product of interaction. Thus, the focus group's outcome does not claim to depict representative statements about a certain group of citizens or the society in general because of the small number of participants (Bohnsack 2003). A further drawback is that the researcher cannot plan interactions, the flow and directions of the conversation. Even the moderator can influence these only a little (Morgan 1997). Moreover, the assembly of the group can be difficult. Since the participation is voluntary, it might be hard to gather a representative/heterogeneous group. And because the participants need a certain motivation to join the group, there will always be a certain bias in the character and opinions of the participants (Barbour 2007).

In addition, focus groups have always a double function: on the one hand they serve to inform about the knowledge, opinions and needs of the interviewees, but on the other hand the focus group as an event serves the interviewees also as an information source, place to talk and learn about a topic and the possibility to become involved in a political process (Race et al. 1994; Dürrenberger and Behringer 1999).

2. EMPIRICAL SETTINGS

In order to be able to compare the results of both focus groups in Karlsruhe and in Vienna, the events were organized as similar as possible. Both events took place in the evening and lasted four hours with a longer break after about 90 minutes. The first part of the event was used to gain insights into the ideas, concepts and associations the citizens had on manufactured particulate nanomaterials ("nanoparticles"). According to the aim of the focus groups in this project and in order to hear the uninfluenced ideas of the participants, they didn't get additional in-depth information from the organizers on nanomaterials prior to the event. In addition, it was also avoided to deliver expert information during the discussion by the organizers or the moderation. This proved to become sometimes challenging for the participants since their motivation for joining the event was often that they would like to get information on nanoparticles. For the most part, they were not familiar with the idea that the organizers ask for information from the citizens. The second part of the events was dedicated to discuss the expectations of the citizens regarding regulation and political action. In order to inform this discussion, a so called "Info-Letter" was presented to the participants immediately after the break. This paper summarized on one page the current knowledge about nanoparticles, their applications including connected uncertainties concerning health and environmental risks of nanoparticles. In the following sections, the empirical settings of both events are described in more detail.

2.1. The Karlsruhe Focus Group

Recruiting

The participants for the Karlsruhe focus group were recruited via a random sample of 1,000 contact information of inhabitants of the city of Karlsruhe. Thereto, the registration office of the city of Karlsruhe was asked to compile this sample by picking 500 men and 500 women in the age of 18 to 82 (equally distributed) from all inhabitants of Karlsruhe. Finally, a list was available containing the contact information of 1,000 inhabitants of Karlsruhe including their age and sex. They were invited to a "Discussion Forum Nanoparticles". The mail sent out with the invitation letter also contained short information about the NanoSafety project background and briefly the aim of the event. The invitation letter was sent about one and a half month before the event. The letter was asking the people to confirm their participation within three weeks by sending back a confirmation sheet including voluntary details about their profession and social commitment (memberships in social or political organizations).

Group setup

In total, 26 inhabitants of Karlsruhe responded to our invitations, 20 of them wanted to participate. Out of those 20 interested people, we invited 17 in respect to equal distribution in sex, age, social and professional background (students, working people different branches, currently unemployed and pensioners). The focus group was finally conducted with 14 persons since three missed the event excused and one unexcused. Finally it turned out that the group covered broad spectrum of different attitudes. And in spite people did not know each other, they found together in a pleasant, very open and respectful discussion atmosphere.

Procedure

The “Discussion Forum Nanoparticles” (focus group) took place at the evening of April the 19th 2011 from 5:30 to 10:00 pm. It started with an informal welcome with refreshments until 6 pm. The first discussion round from 6:00 to 7:45 pm opened with a short introduction by the moderation and was started with the question: “Have you ever heard about nanoparticles?” The participants described that they think nanoparticles are, what and where they had heard about them and whether they knew or bought products containing them. Later on, the group discussed why they did or would buy such products (perception of chances) or why they did or would not do so (perception of risks). The first part ended in a pause with refreshments and buffet. The second discussion round from 8:15 to 10:00 pm started with a 10 min. for reading of the “Info-Letter” mentioned above. Subsequently the group was able to express their feeling about this information and discussed their expectations towards the government/state in respect to nanoparticles. In the residual time the consequences of those expectations were discussed in more detail. In the final quarter of an hour before Farwell, the group was asked to fill in an evaluation questionnaire and there was time to answer factual queries on the topic nanoparticles and the project. The whole focus group discussion was recorded on a voice recorder in accordance to the participants which was transcribed. In addition to the moderator, three members of the project team were present.

2.2. The Vienna Focus Group

Recruiting

The recruitment of the participants for the Vienna focus group was performed by the commercial opinion research institute “INTEGRAL Markt- und Meinungsforschungsges.m.b.H.”. They have a pool of 3000 volunteers. By phone contact they selected 19 persons according to following criteria:

- Equal distribution of men and women
- Covering all stages of life between 18 – 75 with an as much as possible homogenous distribution
- Covering all graduations
- Covering different occupational areas
- Two third should be employed
- Partly from Vienna and partly from the urban hinterland

According to the design of the focus group (see below) the recruiting organization didn’t deliver any information related to nanotechnology during the recruitment.

Group setup

15 citizens half from Vienna and half from urban hinterland were participating in the event. Although an equal distribution of male and female was invited, with 9 women and 6 men there was a slight female domination. The participants cover all kinds of graduations and stem from different occupational areas. From 24 to 68 years, all stages of life where covered. The participants didn’t know each other and the last event they participated was about one year ago. The discussion was characterized by a high disciplinary and respectfully discussion in a concentrated atmosphere.

Procedure

The focus group took place the evening of April the 27th 2011 from 5:45 to 10:00 pm. The event was divided into two parts. The first part was dedicated to sample ideas, concepts, associations and experiences the citizens had regarding to nanoparticles and applications of nanotechnology. The second part was reserved to discuss expectations of the citizens regarding the role of government, politicians, industry, the media and consumers. The participants where welcomed by a contact person of the recruiting organization who handed over an incentive of 40 Euro. The focus group started at 6:00 pm with a presentation of the project, its aim and addressees (European Parliament) and the introduction of the agenda of the evening. According to the design of the focus group, the introduction didn't contain any information on nanoparticles and 'nanoproducts'. The discussion began with a self-introduction of each participant in which he or she should very shortly present why he or she decided to participate in this event. After the discussion, the participants were asked to fill in an evaluation questionnaire, too. The whole focus group discussion was recorded on a voice recorder in accordance to the participants in order to provide a basis for transcription. The team who conduct the workshop consists of one moderator, an assistant moderator and two staff members documenting the event.

3. RESULTS

This chapter describes the results of the two focus group interviews carried out in Vienna and Karlsruhe in April 2011. With the aid of transcripts of the audio recordings the different arguments and discussion lines were analysed. Some instructive examples of citizens' perspectives and arguments are presented as quotes. Both events are discussed jointly according to dominant subjects, which came up in both discussion groups. Thus the variety of opinions towards specific subjects could be well presented and significant differences between the groups of Vienna and of Karlsruhe become visible. Additionally, some subjects, which were raised just in Vienna or just in Karlsruhe, are pointed out, too.

The structure of this chapter basically follows the main storylines of discussions in these four-hour sessions. In detail, we do not present all arguments in their chronological order since – like in all other real life discussions – participants took up arguments made earlier to elaborate on them later. Sometimes one might have got the impression that all the topics, which the project team has chosen as frame for the analysis of the events, were discussed by the participants at once. Thus, a single contributions of participants often comprises personal experiences with 'nanoproducts', a personal deliberation of risk versus chances and a claim for a specific regulation altogether. To allow for a better readability of this working paper, the authors occasionally took the freedom to bring the key issues into a structure that appeared to us as being more logically consistent.

According to the overall aim of the focus groups the analysis of the discussion attempts to consider the following elements: argumentation clusters, typical narratives, statements and opinions; associations, analogies and metaphors from other technologies; conceptualisations, claims and expectations.

Terms like "most", "numerous", "several", "some" and "a few" were used to give the reader an impression about the (high, medium, small) number of participants who shared an opinion in the discussion. Absolute figures are not given for methodical reasons, especially in order to avoid the impression of statistical significance. Hence the aim of the presentation in this chapter is to cover as many as possible perspectives and opinions of the citizens that took part in the focus group discussions; we have attempted to consider all relevant comments in this context. In general, the different statements and argumentations of the participants to specific subjects have been collected and expressed in an abbreviated manner. Statements, which express a shared opinion on an important topic, are cited from the transcripts.

3.1. Awareness of Products Containing Nanoparticles

The focus group discussions were started by asking which products containing nanoparticles they know, became aware of in shops or supermarkets or have already used. Most of the participants mentioned products, which claimed to contain nanoparticles. Several have already bought products which are advertised as "nano". The known 'nanoproducts' predominantly account for cleansing, impregnating and polishing products for cars and households. Products from other application fields like electronics, textiles, medicine, cosmetics and food were also specified. Table 1 presents a summary of the products or product groups mentioned in Karlsruhe and Vienna. Products which

were mentioned in both groups are displayed in the centre of the table below, other products are assigned to the respective column.

Karlsruhe	Vienna
coating and cleansing supplies waterproofing spray for shoes (bought) nano-sealing for car finish, surface protection, car wash (bought) surface coating for glassware (shower screen) cleansing agent for eyeglasses (bought) car polish (bought)	
dye, finish, paint	
floor care product (bought) surface coating for waste water pipes	lubricant for car engines
household equipment washing basin	
nano-coated toilet (bought) waterless urinal	nano-coated fridge, oven fire extinguishing foam
food	
chocolate, flow aid in ketchup anti-caking agents in packet soups future applications in milk for the determination of storage life	food in general
textiles socks	-
electronics electronic circuits in microchips	-
medicine drugs (future) medical applications	
dental fillings	carrier substance for tumour treatment nano-robots in blood circuit and for surgery
cosmetics sunscreen	
	self-tanning lotion hair shampoo

Table 1: Products or product groups mentioned in Karlsruhe and Vienna. Products which have been bought are signed specifically.

Not all products which were brought up during the discussion were identified as 'nanoproducts' collectively. Some products were assumed to be based on nanotechnology but could not be certainly identified as 'nanoproducts', like chewing gum, the Teflon-coated frying pan or the self-cleaning stove – as can be illustrated by this conversation in the Viennese group:

"For example, there has already been the self cleaning stove for ten years. This is also 'nano'." - "Is this also nano?" – "Yes, This is also nano." – "I am not aware of this. I am really not aware of this."

In both groups, during the discussion more and more products and applications where mentioned from different participants. The sum of 'nanoproducts' compiled by the participants astonished them but makes then fell unsettled and uncertain at the same time regarding to the question: Whether nanoparticles are also in other everyday life products which are not nano-labelled? Further, they are confused about the sense and relations of the different applications reaching from car finish to ketchup. One of the citizens summarized:

"We have to act on the assumption, that nanoparticles are enclosed almost everywhere."

Interestingly, the participants of both groups in Vienna and Karlsruhe showed similar dynamics and didn't take the possibility into account that the connection to nanotechnology which was performed by the individual participant could be product of a misunderstanding or a mal-information.

Many of the listed products can be related to the everyday life of the participants acting as consumers. In some cases they can be linked to their professional experiences. For example, a dentist reported about dental fillings, a mechanist about a "mini motor" and an engineering student about the coated waste water pipelines.

Another question discussed was the motivation to buy 'nanoproducts' deliberately. For some of the participants, curiosity was the most important reason:

"*We are curious regarding technology, regarding everyday products …"*

Most participants have bought 'nanoproducts' unconsciously and unintentionally due to their lack of knowledge and information. Some even told that they were persuaded by sellers to choose such products. They described situations where a 'nanoproduct' was "palmed off" on them, sometimes in relation to a special price.

Concerning the listed 'nanoproducts' some participants of the focus group in Karlsruhe described the characteristic effects and properties with key words and metaphors like "Trojan horse", "lotus effect" and "non-adhesive agent". With these jointly self-derived solutions and explanations for the characteristics of 'nanoproducts', which are obviously difficult to understand, the participants developed a heuristic to relate the different 'nanoproducts' with their benefits and reasons for application: Cleaning agents are used due to their "lotus effect", non-adhesive properties, repellent effects and glossy effects, medical applications work like a "Trojan horse". It is evident that citizens compare unknown effects with pictures and metaphors. Sometimes, they even created new application ideas using syllogisms in a humorous kind:

"Socks contain nanoparticles to reduce the smell of sweat… there are also nanoparticles in ketchup… could we apply ketchup as a kind of deodorant?"

3.2. Making Sense of the "Nano" Terminology – an Interactive Attempt

During the course of the discussions, questions occurred about what nanoparticles actually are and how 'nanoproducts' could be distinguished from 'non-nanoproducts'. In Karlsruhe this section provided valuable insights into how laypeople conceptualize nano and which challenges they encountered in this process.

Most of the participants in Karlsruhe actively tried to understand the term nanoparticle and they realized that this is very important for the present communication. Together they developed a kind of working definition for nanoparticles and the label "nano" in general starting from the initial question where "nano" is coming from and the presumption that "nano" already existed before this term was broadly used. One participant stated that the meaning of "nano" is most complicated. Sometimes it is difficult to differentiate "nano" and "nanoparticle" and it could be seen that "nano" is far more present in everyday life than "nanoparticle".

One participant in Karlsruhe held that general media publicity with regard to "nano" still does not exist and that there are rarely debates and discussions about that topic. To him, the topic seemed to be a bit intentionally "hidden". Other discussants stated that this is the reason for the lack of concrete knowledge about and the comprehension of the term "nanoparticle". Consequently, they tried to give their own views with by means of a closer look at 'nanoproducts' and their prospects and properties (cf. chapter 3.1).

For a number of discussants, the starting point for describing the term nanoparticle was the size. Participants assumed that nanoparticles are small sized particles. Some vividly said that nanoparticles are smaller than viruses. But for others, the nanoscale was not clearly differentiated from the micro-size/scale since they used the general term "microscopic size". One participant summarized that "nano" is a "somewhat malleable concept", which is solely related to the size.

While the participants from Karlsruhe tried to find a kind of definition of the meaning of nanoparticles, the Vienna discussion on the conceptualisation initially started and mainly evolved around the subjects natural versus artificial and biology versus physics etc. While some citizens associated "nano" with biology and bionics as very small parts of natural matter or a synthetic reproduction of nature, while others defined nanoparticles as purely artificial miniature-technology. One compromise was stated as follows:

> "*I would assume that it is not only artificial. I would rather mention the relation to nature, that means indeed engineered, but based on nature. I would not consider that this is only a pure man-made artificial object."*

The second important question repeatedly discussed in Karlsruhe similarly was the nature of the 'nano-substances', especially whether they are strange and different from naturally occurring substances and the detailed elemental and chemical composition:

> *"Nano means small sized, but I try to sound out [of the conversation], whether there is also a relation to the substance… a relation what it contains?"*

Several Karlsruhe attendees stated that "nano" predominantly means a specific size and not a specific substance and that nanoparticles could consist of all elements. Later on,

some participants mentioned different specific substances, which they heard as being used in nanoform like titanium dioxide, aluminium dioxide and silicon dioxide. Some attendees tried to classify nanoparticles according to different states of aggregations like aerosol or solid matter.

Most of the citizens in Vienna knew that “nano” refers to size, but it seemed to be unclear, where the difference between nano and terms like atoms or molecules was. One participant stated that the reduction of size leads to changes of material properties. With regard to this the participants did not differentiate between downsizing of technical devices due to technological progress and downsizing in order to changes of properties of materials.

The selected examples for ‘nanoproducts’ indicated the intuitive comprehension of the term nanoparticle: Most of the participants only count intentionally manufactured particles to this term. The participants in Karlsruhe thought that nanoparticles are "strange substances". Only one person asked in the remaining course of the discussion if natural compounds of chocolate reduced to a size in nanoscale are used as naturally occurring particles for the coating of chocolate. This difficult question was discussed further and another participant mentioned:

> *“[...] this cannot be mini cocoa constituents, but they use nano... it cannot be a component from a natural compound [...]”*

Unintentionally produced nanoparticles like carbon black were only mentioned in Karlsruhe to give an idea and a well known analogy for properties and problems involved with very small sized particles in general.

At the beginning, many discussants arbitrarily mixed their terminology using nanoparticles, nanotechnology and sometimes also ‘nanoproducts’ quasi synonymously. Other participants used the term (nano)technology in a broader sense, mainly for technical processes to manufacture nanoparticles. Later on, the condition for an unambiguous communication about nanoparticles was given and the members of the Karlsruhe focus group could exchange their opinions without misunderstandings. One Karlsruhe participant described this process as a rather mechanical procedure to mill and break existing particles, not assuming a chemical synthesis for building new particles. But another member thought that both aspects have to be considered for the understanding of nanotechnology. He also stated that not only particles but also certain structures should be of concern. Some citizens used the term nanotechnology in associations dealing with future technologies and technological progress. In addition, the knowledge about "nanotechnology" was compared with other technologies like genetic engineering or nuclear technology.

3.3. Perceived Benefits and Risks of ‘Nanoparticles’

3.3.1. Perceived Benefits of ‘Nanoparticles’

In general, we got the impression that the participants knew rather little about the benefits and risks of ‘nanoproducts’ from different materials. Some products are advertised with high-tech properties of nanomaterials and are labelled as ‘nanoproducts’. The citizens demanded more information about the specific benefits and potential risks of ‘nanoproducts’. While for the participants of the Karlsruhe group nanoparticles are

relatively well known for example in the form of surface coatings with so-called 'lotus effect', as well as in cleaning or care products for the home or the car the participants in Vienna hardly could make sense of the difference between nanotechnology and nanomaterials.

Most participants of the both focus groups in Vienna and Karlsruhe expressed their overall impression that nanotechnology will contribute to wealth and better living conditions. Especially, an important contribution to progress for medical applications was expected. While the Viennese group explicitly welcomed developments in the realm of "technology" (e.g. computers, multimedia applications or process technology) the Karlsruhe group rated applications as useful if practical aspects improving the everyday life (e.g. relief from tedious household activities, time saving or better handling) could be expected. For example products for fast cleaning and long lasting protection, impregnation agents and coatings or better dispersion of cosmetic products were quoted. Some participants from the group in Vienna also mentioned household products like coatings for shower walls, self-cleaning oven, spray for shoes and textiles as examples for possible benefits of nanotechnology; for instance:

> *"I would just see the advantage for articles of daily use. So to say that they will be simply more convenient; so to say windows that I don't have clean anymore because everything rinses off on its own or however."*

> *"And I see things positively, especially in medicine, with antibodies, which means in cancer research. So, it works with nanotechnology, actually the smallest particles that are osmotically permeable … for years there has been a lot of research done ... on the market too, these products."*

Benefits were explicitly mentioned in Karlsruhe for the automobile industry, wastewater technology, medical research and generally for improved future products and progress. The example of a self-cleaning car-windscreen was even mentioned as an important security advantage. In contrast to Vienna, several participants expressed general hopes for the future, trust in the nanotechnology industries and a general optimistic thinking. One participant expressed the assumption that the inventors only want the best and that 'nanoproducts' have to be used in a responsible way (for instance regarding recycling). Numerous participants would even pay a higher price for 'nanoproducts' in comparison to conventional products:

> *"[…] if I don't have to clean the kitchen for one week, I will even pay a higher price for a [nanoproduct]."*

Another kind of advantage which was discussed in Karlsruhe was the substitution of chemicals of concern and the comparison with comparable 'non-nanoproducts' which consist of hazardous substances:

> *"[…] if a nanoproduct is less harmful than other products, this will be a benefit in spite of existing concerns […]"*

Due to the fact that one participant in Vienna had taken part in a cooking course where she encountered fascinating possibilities of cooking with nanoparticles, at the beginning of the discussion in Vienna, two participants stated a positive attitude towards the use of nanoparticles in food.

3.3.2. Perceived Risks of Nanoparticles

In the course of the conversation the participants of both groups rather early mentioned general and concrete health risks. A dominant argumentation in this respect was the inhalation of nanoparticles and the related adverse effects. The statements of the Karlsruhe group were mostly combining the perceived risks with proposals for regulatory measures in order to improve the responsible handling and application of 'nanoproducts' from a viewpoint of consumers. In contrast, the Viennese group predominantly expressed their concerns without combining them to a concrete call for measures. But beyond the consumer perspective, in Karlsruhe one discussant also gave a brief outline of his investigations into the "scientific perspective". He cited scientific studies, which were published and discussed on the website of the German Federal Environmental Agency UBA:

> *"[...] The second point was the results of the Japanese and Chinese research. Chinese research concluded that pneumonia could occur and the Japanese research pointed to the influence on foetuses' growth according to animal studies. Therefore it is obvious … it is investigated scientifically […]."*

The most important point was the fact, that nanoparticles can enter the human body due to their very small size. In Vienna, the analogy to asbestos was mentioned early and it was reported that the small particles could enter into the lung. One person stated that workers who had sprayed surfaces had already been died. It was argued that the particles are so small that they could pass every filter. Refrigerators which contain nanoparticles might be dangerous, because it is unclear if and how "this is radiating".

One participant of the Karlsruhe group compared the size and the resulting health effect with viruses. It was further mentioned that nanoparticles are easily distributable in the body, could reach organs and cell compartments and may influence essential systems of the human body like the immune system:

> *"[...] if I would know if it is harmful... and reach my own DNA due to the small size."*

> *"The question is how the body will react like the example of viruses which influence the immune system."*

Some participants in Karlsruhe expressed their concern predominantly in relation to the effect of nanoparticles on specific organs like the lung or skin. In this context, a mother of two children hypothesized that the increase of pneumonia of children could probably be linked to the ubiquitous occurrence of nanoparticles.

The content of the "Info-Letter" which was presented to the participants immediately after the break and summarized on one page the current knowledge about nanoparticles, their applications including connected uncertainties concerning health and environmental risks of nanoparticles (cf. Chapter 2) caused irritation and concerns. The main reason was the fact that in the "Info-Letter" it was mentioned that there exist uncertainties and different opinions among scientists regarding possible risks of nanoparticles. Two participant of the Viennese group stated for example:

> *"It is written [in the Info-Letter], that it is already [used] … it is already used in products. But if experts don't even agree, whether … that must not be, in my*

understanding. Unfortunately it isn't that way … it is not supposed to be on the market. The experts don't know what is happening. It is unbelievable that something like that is already on the market."

"Scientists don't agree." – "Well, and I am supposed to know then?"

A further, more general argumentation was related to the lack of experience with new technologies. Moreover, almost all participants in Vienna as well as in Karlsruhe refused the application of nanoparticles in the food sector. The citizens were less reluctant to the use of nanoparticles in cosmetic products although some expressed their concerns as well:

"The skin is the biggest excretion and absorption organ. So if you smear something on it, it gets inside, too. So, I'd say keep your hands off."

In Vienna the use of nanoparticles in sunscreens has been discussed in greater detail. The discussion reveals that the participants are less dogmatic in regard to food and try to consider benefit (e.g. protection against skin cancer) versus potential risks.

Besides the concerns about health effects, several participants in Karlsruhe worried about the environmental behaviour of nanoparticles, especially about their possible occurrence in ground water and in the air. They even considered the consequences after the intended usage of 'nanoproducts' and tried to carry out a kind of life cycle assessment. One participant pointed to the problem of imaginable enrichment of nanoparticles in the food chain.

"I've got a question: What happens to the nano-coating of the toilet, when it is disposed to the junk yard?"

"The other day I've seen in a film, what plastic is floating in the oceans and how milled is it. We eat fish which has … or many fish which have swallowed that or can't excrete that. And then we eat their meat. That's bad."

Environmental risks have been discussed in Vienna mainly with respect to the waste problematic:

"Again, I have the question: Is it degradable, is there another component now so that it can't be degraded any more biologically, or if it will stay waste forever? How long does it take?"

Some participants in Vienna drew a link to nuclear power generation, a new technology that has been developed and implemented but questions regarding waste and risks have not been investigated yet, either.

3.3.3. Balancing Benefits and Risks

It seemed to be consensus within the Viennese group that new technologies bear chances as well as risks. The citizens were quite aware that both chances and risks have to be taken into account in order to make a choice for or against the application of a new technology. They appreciated consumer products and household products becoming better due to new technologies. But some of them were also sceptical about whether the

promised benefits were always really necessary and a benefit for the consumer and not only for the producer:

> *"Most stuff we are discussing isn't needed by anyone. Who needs shampoo with nano-doodah? Since dawn of mankind we have not needed that. Thus, they want to talk us into a lot, but for some purposes it's quite useful."*

This kind of balancing turned out to be most important for applications in the area of food, where nanoparticles get into the body:

> *"But regarding food it is said: No, I don't want nanotechnology inside… that's all well and good: toilet, car and whatever. But as soon as it affects the human body caution is advised."*

> *"For me, it is absolutely out of question to eat such food. But if it is applied on machine parts or on semiconductors or something like that […]."*

In this context, one participant in Karlsruhe reported about known future food technologies in milk for the determination of storage life. It was stated that this kind of application is rather a kind of game-playing than really a benefit. A similar idea was also stated in Vienna where the purpose of the innovation was questioned:

> *"If it is used for something that brings real added value, useful added value, then I understand. I am very sceptical about things like food additives. There, it isn't about saving the world and doing good for philanthropic reasons, but finally it's about gaining profit with value, that is added to products, as always in the economy."*

Some people mentioned that the higher price didn't reflect the benefit of the product. Especially related to household products some Viennese participants claimed that they are satisfied with the existing products and do not need further features.

One person in Vienna not only distinguished between the purpose of the product (medical application) but also took into account if the nanoparticles are strongly bond and could not be released. Furthermore, he drew the attention to the subject of occupational health:

> *"I think that in the user's area, where coated parts or something alike are used, where nanoparticles are in bounded form, it seems to be unproblematic, likewise in electronics and in the medical area. I think I would be concerned – I have heard a presentation – that in the area of production it isn't explored yet. So, that people, employees, who have to deal with … to my knowledge are no regulations yet, everything is translated to 'normal' working substances, but not to very small working substances. Thus, is it … it could be, I think that nobody really knows how people will reaction, like a huge field-test, as with mobile phones. Let's try. But as said, I think it seem to be unproblematic in the user's area."*

Another argumentation in order to assess nanotechnology was based on the difference between manipulation and naturally grown. Especially, concerning food, every manipulation and deviation from natural grown was considered with care and even suspicion.

"Any manipulation of nature is negative … if it is so, the comparison to a power plant is quite good, because in this context one might say, temporary it is the most environmental friendly power generation, but people don't think long term. Because in 100 years a power plant is the worst. Hence, it can be seen (used) in technology, but in nature and so forth, if manipulation takes places, it's absolutely negative."

On the other hand, it was argued that something natural which is small, shouldn't cause harm.

Interestingly, in Karlsruhe several participants rather weighted the benefits against the lack of knowledge than against concrete perceived risks. Perceived positive effects like anti-adhesive, repellent or glossy effects were considered as being less important than the lack of knowledge about risks:

"And as long as I don't know whether it is negative or positive or anything else, I'd disclaim because I don't mind if ketchup gets stuck in the bottle or not. For me, it doesn't have that big [effect…]."

In this context it should be mentioned that the citizens of both cities often do not see convincing benefits but know that there might be drawbacks related to the use of the products. Therefore, the rationality of their action is based on prudence. In case of doubt they would prefer the conventional product. Furthermore, the ignorance of concrete risks might also be the reason why the participants often gave conditional answers. A number of participants even stated clearly that due to the lack of knowledge, a reasonable balancing of chances versus risks is not possible:

"It depends on which information I get. If I get the information that 'nano' is dangerous, I will keep my hands off it. If I get the information, that 'nano' is not dangerous and if it is affordable I will use it."

Sometimes the perceived risks of 'nanoproducts' where discussed in relation to risks connected to the alternatives (as above mentioned) as a kind of weighting of "the lesser of the two evils":

"I wonder what is more damaging to nature: Something I don't know like this [nano] coating [for toilets] or this certain cleaning agent? And I take no stock in these cleaning agents either. Thus, I have decided to use [nano] coating."

While at the beginning of the Vienna discussion the attitude towards nanotechnology and applications of nanoparticles was balanced or slightly positive in the course of discussion this atmosphere changed into more critical stances. Over all, for most of the citizens of Karlsruhe as well as of Vienna the possible risks predominate the possible advantages, especially in the food area. Several participants in Karlsruhe thought that benefits exceed the disadvantages and problems connected to nanoparticles. In Vienna, there were less people with a positive stance. Only a few citizens in Karlsruhe mentioned that a decision is not possible due to the lack of information.

3.4. Governmental Measures

One aim of the focus group event was to elicit the expectations of the citizens regarding regulation and political action. Therefore, the participants were confronted with a short information letter ("Info-Letter") dealing with a description of nanoparticles, their benefits and applications and their potential of health and environmental risks. The letter underlines the uncertainties about the knowledge and scientific evidence of the risk potential on the one hand and the market presence of many 'nanoproducts' on the other hand and listed some examples to explain this dilemma in detail. On this equal knowledge base the participants were asked what governmental action they expect and what kind of governmental measures they would propose from their individual point of view.

Different measures were suggested by the participants, most of them were not conceived separately but rather a combination of different measures that complete one another. For example labelling was mostly proposed in combination with additional preliminary information or a product list could only be advantageous together with easily comprehensible information. The quality of the underlying information itself should be promoted by further research. From these answers it could be deduced that single measures depend on each other and that quite a number of activities were necessary at the same time. In this chapter the different suggested measures are described and analysed in separate chapters.

One has to keep in mind that citizens can only suggest regulatory instruments and measures which they know well from other fields of their everyday life - like labels on food packages or approval proceedings for medicals and chemicals. Specific terms like "register for nanoproducts" or "moratorium" are not common to the participants but they paraphrased them with their own words. Moreover, they proposed measures that never have been used in this context like a direct labelling of the products itself.

3.4.1. Information - Sources and Needs

Hence information is crucial for the discussion to elaborate measures, the following section provides an insight into the participants' sources and needs of information. In the invitation to both focus group events in Karlsruhe and Vienna only the keyword "nanoparticles" was given to the invited participants. Further it was stated that there is no need to bring any pre-information – because it was aimed to hear about their unbiased knowledge they bring from their everyday life. Thus, in the opening question for both groups, the participants were asked individually whether they had heard about the term "nanoparticles" and what does it tell to them. The majority didn't only answer these questions but also mentioned their source of knowledge. Interestingly, only three of each group explicitly mentioned that they performed a targeted enquiry – mostly via internet – ahead of the event. Nevertheless, all of the focus group's members already had at least heard about "nanoparticles" (see Figure 3) and most of them had at least some idea what it is. In some cases it seems to be questionable if the participants clearly distinguish between "nanoparticles" and "nanotechnology". Especially the Viennese participants have very diverse and vague perceptions of 'nano' (cf. Chapter 3.2).

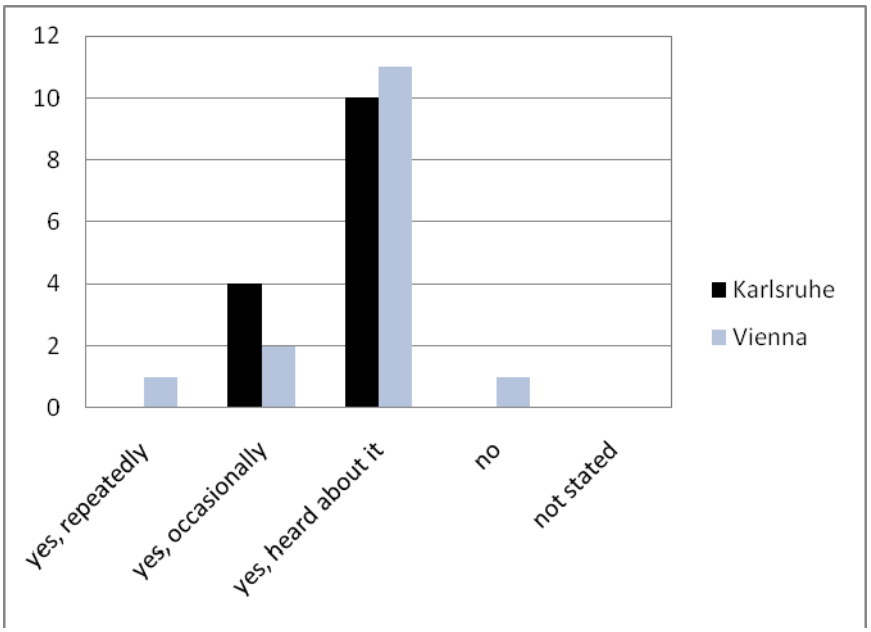

Figure 3: Evaluation of the questionnaire after the focus group event (Karlsruhe n=14, Vienna n=15). Shown are the numbers of participants that had chosen the depicted answering options for the question: "Have you been confronted with the subject area 'nanoparticle' prior to this event?"

The sources of information the Karlsruhe participants stated in this context were versatile: Some attendees of the focus group are informed about nanoparticles due to their own or friend's profession (e.g. job in the medical care sector or students of technical disciplines). Single attendees read 'nano'-related articles in the newspaper, listened to discussions rounds in the radio (station SWR 3) or public presentations of scientists in research facilities or at Fairs (Hanover Fair 2011). They talked about impressing photos and illustrations which have attracted their attention, although these are not directly related to nanoparticles. Some of the participants could remember sales promotions and commercial spots in conjunction with the label 'nano' and 'nanoproducts'. The Vienna group reported similar occasions where they came across 'nano', whereat in this context 'nanoproducts' were clearly dominating. As source of information was mentioned advertisement, one participant has heard an oral presentation by a friend, one person referred to a German infotainment magazine and even reported the use of nanotechnology in science fiction films and TV-series. Two group members of the Karlsruhe group bought nanoparticles-containing products themselves and others heard about purchases in the circle of friends or family. A further interesting observation in Karlsruhe was that the sales assistance could tell whether 'nano' is inside the product but didn't offer additional information.

The most of the Karlsruhe participants want to be informed about the things they consume, their benefits and risks. This also became clear in the evaluation of the questionnaire (see Figure 4). Thus, some participants wonder why they had not heard about nanoparticles in consumer products before they had been invited to the focus group. They expected informative articles in local newspaper, reports in other media or the public discourse. However, there is the chance that the participants simply didn't notice this information offered in the past, as admitted by one participant. Because, if one perceives an information or one ignores it depends on whether one is interested in a topic or not, as one participant stated. In contrast to the Karlsruhe participants, the

Viennese have not had a comprehensive definition of nanoparticles and nanotechnology before and also did not find one during the discussion either. Thus, the wish emerged throughout the focus group to become informed about the general definition and the nature of nanoparticles – especially since they realized that they already might be confronted with 'nano' without their knowledge. This was the main driving force for their strong request for information.

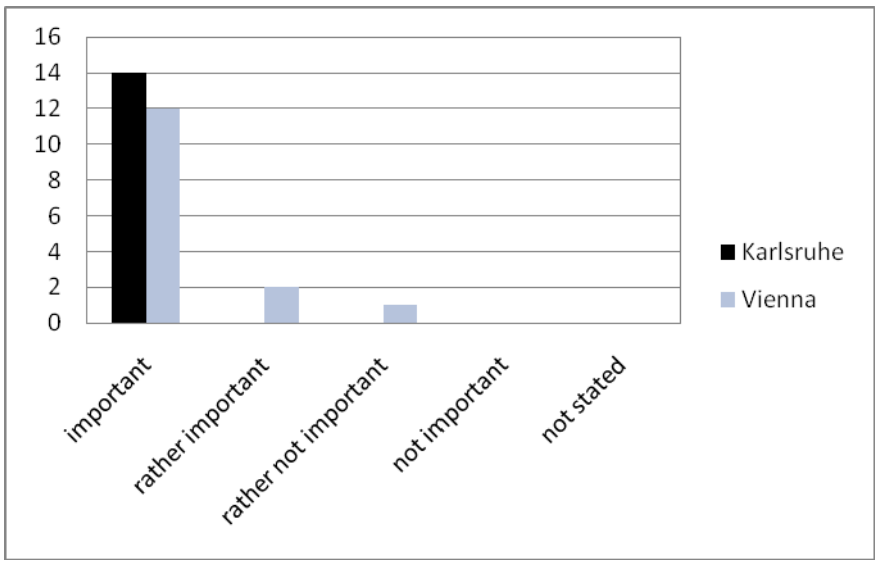

Figure 4: Evaluation of the questionnaire after the focus group event (Karlsruhe n=14, Vienna n=15). Shown are the numbers of participants that had chosen the depicted answering options for the question: "If you think about handling nanoparticles, how important will be more consumer information in your opinion?"

Remarkably the aspect of information in Karlsruhe and Vienna is closely linked to labelling and vice versa. For example, it was agreed in the group that labelling is expected if any risks are connected with the use of a certain ingredient (in this case nanoparticles) similar to hazardous substances. But they also agree that the consumer needs information ahead of the purchase decision, because the information by labelling alone is limited. Information about the hazardous nature of the nano-ingredient needs to be transferred to the consumer in order to be able to interpret the label, to allow a risk-benefit-consideration by the consumer and thus an informed purchase decision (cf. Chapter 3.4.2). Attendees of Karlsruhe and Vienna said explicitly that:

> *"What is the benefit if it' written on it, if one doesn't have the underlying information: what it means or what are the risks and benefits. Thus, if one doesn't have the information in the end, what benefits and risks (um…) how so ever – It also doesn't help me. That means I need the information ahead."*

> *"Frankly spoken, I would be more interested, if it is dangerous as in what it is."*

> *"What should be displayed? "nano- blood traces" or nano-…? (Moderator: For instance, 'containing nanomaterials.) Personally, that wouldn't help me either."*

On the other hand – independent of product labelling – some participants expect and trust in that products on the market are safe and well tested by the industry or responsible regulatory authorities. They justify this trust by practical reasons. For

example one Karlsruhe participant said she doesn't care too much what is written on the products she buys:

> *"It is so many. I just buy it – I don't have so much time to read what is standing behind."*

And the wealth of products makes it even harder for the consumer to stay up to date, as another Karlsruhe participant agreed (cf. Chapter 3.4.4).

It is important to note that the lack of knowledge and information in connection with rumour and guesses about possible risks of 'nanoproducts' (e.g. by news coverage, superficial knowledge or labelling without additional information) creates uncertainties and distrust among the consumers (cf. Chapter 3.3). Despite the fact that other product ingredients about which they also don't know much either are widely accepted by the consumers. Regarding nanotechnology this lack of knowledge and the incoherent bits of information lead to critical judgements. Those statements of a Karlsruhe and a Viennese participant might give an insight into the rationality which lay behind the judgement regarding acceptance or concern:

> *"I think, this fear of nanoparticles comes from the missing knowledge. If I knew with 100% probability: 'Ok, I can eat the ketchup which comes out of the bottle [easily] without the nanoparticles doing harm to within my body', then I would love to buy the ketchup because it comes out of the bottle better. But if I don't know: 'Ok, these nanoparticles will moves within my body somehow', then I wouldn't buy it. Thus, I think the fear is synonymous with the missing knowledge: 'What does it do with me?'"*

> *"Thus, it makes me pretty concerned, because such a thing, it seems to be a magic bullet for everything, for food, for painting, to smear into the hair and so forth. Somehow, it can't be that healthy I'd say. At least in terms of evolution, humans aren't adapted to such means, yet."*

Thus, information appears as a prerequisite for a rational and relaxed handling with 'nanoproducts', but the situation today gives the feeling "there is no information at all", as one Karlsruhe participant stated. Accordingly, the attendees of both focus groups call for more information – especially since 'nanoproducts' are already on the market. Nevertheless, the participants have mixed ideas how they want to be informed (in which way and depth) and by whom (source of information).

Two Karlsruhe participants explicitly request the scientist to inform the people and see this as one of their natural duties. Two others rather think that the producer of the individual product may be the best source of information. While individual participants trust in the industry, others are not sure whether the producers would tell risks of their product frankly due to their selling interest – nevertheless they do not insinuate bad intentions. However they wish to access neutral information.

The online information service of the German federal environment office were used by two Karlsruhe participants to inform themselves ahead of the focus group and also others proposed the state (ministries and authorities) as a source of information. The state represents a trustworthy source for the most of them which was also the case in Vienna.

A few Viennese participants stated that it is the duty of the government to deliver information on new technologies and new materials especially if they are used in consumer products end even most important if they are used in food.

Although some Karlsruhe attendees rather preferred sources independent from industry or the state, several participants of both groups requested the state to work out regulations in order to initiate the information flow. The Viennese attendees even urged for a superior institution to provide information (cf. Chapter 3.2). In this case, the government is regarded to be the responsible authority:

> *"So in principle I would like to get an information from Austria, from the state, so that the citizen becomes informed at all about 'nano' – this would be the basis to assess whether I want it or not."*

> *"However, I believe that the responsibility is up to the state. If nanotechnology is already around, and it might be dangerous, then information would have been appropriate long since. Thus, since I haven't notice anything by now, I assumed that it is harmless."*

Notably, the attendees of both groups realized the international dimension of the problem to regulate e.g. information responsibilities and thus even think about the EU as a responsible actor. Also public media was expected to be a source of information; one even mentioned that this would be their duty. As mentioned before, the Karlsruhe attendees recognized that the media coverage is astonishingly negligible. Thus, they discussed that probably the interest of the public is that small that the public media (press and TV) don't pick up this topic. Some Karlsruhe participants also named also NGOs like the German BUND, an environmental organisation, or consumer organizations as trustworthy source of information. Besides all requests to scientists, the state, the EU, media and the industry many participants of both groups saw themselves as responsible citizens and consumers too, as soon as they know what they are dealing with. Well, two Karlsruhe attendees either don't care at all or feel that unsettled that they trust anyone.

Talking about the format of information, the attendees of Karlsruhe had clear ideas how it should look like. The consumer information should be comprehensible to the general public, which was also reflected in the evaluation of the questionnaire (see Figure 5). Also the information should be easily available for the consumers when they need them. Several attendees expressed that they would like to have information about nanoparticles ahead of the purchase of 'nanoproducts'. Some of them would like to have this preliminary information in general (e.g. by public media) and others – especially women – rather prefer this at the point of sale. Therefore, quick guides or booklets and a kind of a telephone book-like register which is open to inspection in the supermarket were proposed. One participant put it very well as he said:

> "*Step by step. Thus, a hint would be helpful, above all preliminary information to sensitize the people to nanoparticles or this 'lotus effect' and what it means in car varnish; that one already knows about it. With this background knowledge it is easier to react on the label like 'car-windscreen with nano-coating' and to look for further information about this product later on*."

Interestingly, the internet was not the most preferred platform for information because, as one Karlsruhe attendee argued, without preliminary knowledge one wouldn't even

think about searching for the information. However, as an additional source the internet was not rejected - as long as the information provided is easy to understand, clear, up-to-date and by a trustworthy source (e.g. ministries and authorities, but also industry due to a legal obligation).

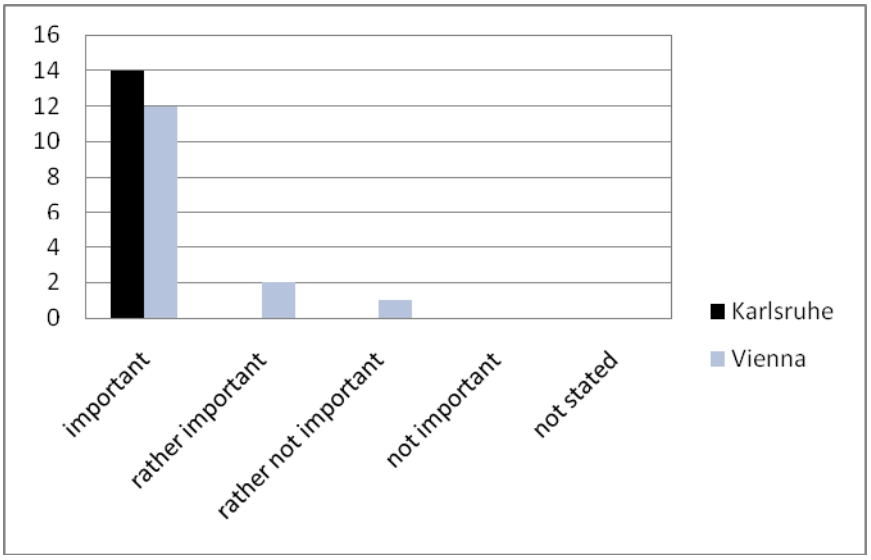

Figure 5: Evaluation of the questionnaire after the focus group event (Karlsruhe n=14, Vienna n=15). Shown are the numbers of participants that had chosen the depicted answering options for the question: "If you think about handling nanoparticles, how important will be commonly comprehensible consumer information in your opinion?"

Several Karlsruhe attendees stated that information especially about 'nano-risks' should be available similar to medicine's package insert – maybe even in appearance and content. In the case of nanoparticle-containing sunscreen, to which one Karlsruhe participant referred to concerning the information that the particles may pass through damaged skin, this should include a direction for use. Further the Karlsruhe attendees care about the fate of the nanoparticles throughout the product lifecycle. Thus, several of them ask for "total information" also covering abrasion and recycling. One Karlsruhe attendee also proposes a kind of safety sheets (similar to hazardous substances) where all relevant information is gathered – of course in connection with a labelling of the products.

3.4.2. Product Labelling

A general labelling obligation for nano products does not exist at the moment. Thus, there are no official labels on consumer products. However, on some products the statement 'nano' can be found for advertising purposes as some attendees of the Karlsruhe focus group reported. As mentioned above, the majority of both Karlsruhe and Viennese participants were astounded by the amount of the 'nanoproducts' on the market and irritated by the little information they have on nanoparticles. Thus, they discussed where nanoparticulate materials are already included. Labelling was the most important measure suggested by the participants of both groups and came up already in an early stage of the discussion. Some of the Karlsruhe participants even believe that labelling of 'nanoproducts' should be a matter of course. Labelling is a pre-condition for them to become more sensitive to particulate nanomaterials and to obtain additional information on their use, risk and appropriate disposal (cf. Chapter 3.4.1). Several of

them wish to decide themselves whether they come in contact with nanoparticles or not. And they wish to make their own decision based on information and labelling, as Karlsruhe and Viennese attendees stated:

> "*So, if I have information, I have the opportunity to choose. I would like to have a choice. But if I haven't got any information or if it is not declared on the outside, then I cannot choose. Then I simply get confronted with it.*"

> *"[...] The consumer must have the chance to get to know what he want, takes, what he buys, what is insight."*

Thus, labelling serves as a basis for deliberation and choice. However, only in connection with information, as mentioned above, that consumers are able to "read" the label and deduce instructions, e.g. for application or disposal, which might even come together with the label on the product (cf. Chapter 3.4.1).

Another argument in Karlsruhe why the labelling of particulate nanomaterials in products is necessary was that nobody can detect them by its senses: It is impossible to see, smell or taste them, similar to electromagnetic fields of mobile phones. Several Karlsruhe and Viennese participants wish to estimate the risk and choose by themselves whether they buy a specific 'nanoproduct' or not (cf. Chapter 3.4.1). And thus, the majority of both groups would be in favour of "labelling". In addition, one Karlsruhe participant recognized that the discussion about labelling of 'nanoproduct' has reached already political spheres:

> *"I looked at the German Federal Environment Office. And the first thing after the short description was the demand for labelling."*

Although a majority of the attendees would like to recognize 'nanoproducts' by a label, the question of the properties of such a label lead to a controversial debate. One important part of the discussion in Karlsruhe was concerning voluntariness or obligation – in other words: the credibility of the label. The claim 'nano' on products which some participants had already seen is regarded critical. For example, one Karlsruhe attendee stated:

> "*So trust is important. But I think for the industry there is simply commerce behind it [...]. It would need a higher authority which controls [...] and follows up. Because everything else, I think, which has a lobby [like] car industry [or] food industry - we get some kind of labelling or some kind of information, but I would not trust [in it].*"

Thus, a superior authority which would assure a mandatory and monitored label would increase the trustworthiness of a 'nanolabel'. The Karlsruhe focus group attendees assume that a reliable 'nanolabel' should be assigned by an independent regulatory body, like the German Federal Centre for Consumer Protection, an authority, a neutral office, a state or federal agency. Voluntary labelling by the manufacturers was perceived as insufficient by the citizens in Karlsruhe and Vienna. Therefore they demanded an obligatory labelling for 'nanoproducts'. This result of the discussion was also reflected in the answering of the questionnaire subsequent to the focus group (see Figure 6). Interestingly, the answers for "Voluntary labelling of nanoproducts" are perceived differently by citizen of Karlsruhe and Vienna. In contrast to Karlsruhe, more participants

of the Vienna focus group event thought that voluntary labelling of 'nanoproducts' (beside mandatory) is also important (see Figure 7). Because in Vienna the difference of both approaches was not an explicit subject of the discussion, one cannot exclude that the Viennese did not differentiate between mandatory and voluntary labelling.

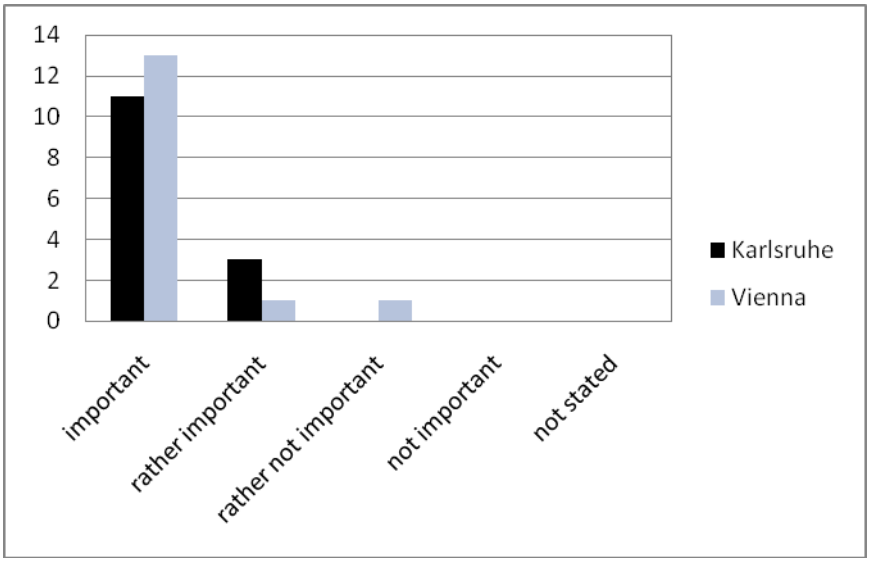

Figure 6: Evaluation of the questionnaire after the focus group event (Karlsruhe n=14, Vienna: n=15). Shown are the numbers of participants that had chosen the depicted answering options for the question: "If you think about handling nanoparticles, how important will be mandatory labelling of 'nanoproducts' in your opinion?"

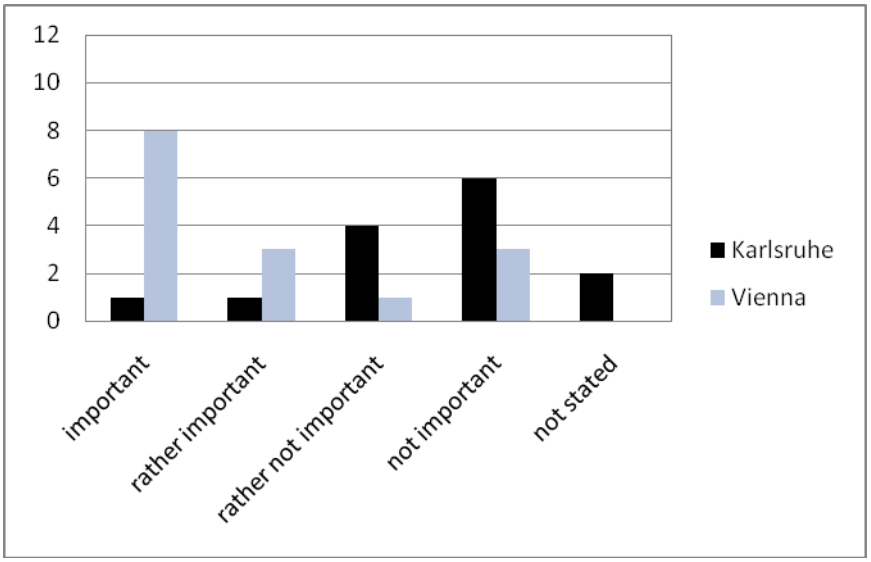

Figure 7: Evaluation of the questionnaire past the focus group event (Karlsruhe n=14, Vienna: n=15). Shown are the numbers of participants that had chosen the depicted answering options for the question: "If you think about handling nanoparticles, how important will be voluntary labelling of 'nanoproducts' in your opinion?"

Moreover, the participants of both groups agreed that a 'nanolabel' should be consistent and precise. Several of the Karlsruhe attendees would support the idea that all manufactures use the same kind of label which again implicates a mandatory labelling. A few Viennese participants suggest that a norm has to be developed and one participant

claimed that the criteria for a labelling must be disclosed. Especially in the food sector, where ‘nano’ is seen most critical, they are afraid of confusing or even missing labels. Thus, some of the Karlsruhe participants even thought of the alternative to put a "without nano" label to be sure.

In the Viennese focus group the discussion about labelling turns back to the question of the concept of nanotechnology and nanoparticles. Both questions refer to each other and a labelling which offers the consumer useful information cannot be solved without a clear definition of what is labelled. For example a participant in Vienna argues that she would relate ‘nano’ to a production technology and not to ingredients (cf. Chapter 3.2). Therefore, it would make no sense to display on the product that it was produced by nanotechnology.

Another interesting aspect that was discussed in Karlsruhe revolved around the question which effect a ‘nanolabel’ would have on the consumers. For example, it was discussed whether the consumers’ interest in ‘nano’ might grow or what reaction would be triggered on the manufacturers side; e.g. would they give more information about their ‘nanoproducts’. One Karlsruhe participant warned that labelling of ‘nano’ might decrease the interest of the consumer in scrutinizes of the respective product. Other attendees in contrast argued that a label would strengthen the awareness and responsibility of the consumer and thus, encourage them to search actively for more information. Anyway, a ‘nanolabel’ always would have a signal effect to the majority of the Karlsruhe participants. The label must be neutral and not negative or positive - one attendee stated. Nevertheless, in contrast to the “organic logo” which elicits positive associations, a ‘nanolabel’ would rather be a neutral or even a warning signal (similar to the hazard symbols) for some participants. In contrast to organic food which is connected with beneficial property for the Karlsruhe participants, several of them stated that they don’t see ‘nano’ in the same way. One even compared ‘nano’ with ingredients from genetic modified organisms and another said that organic is incompatible with ‘nano’, in terms of „an organic product includes nano”. However, one Karlsruhe participant said that for her ‘nano’ – if it’s beneficial for the product – very well goes together with an “organic logo”. Thus, the label per se is value free, but the effect of the label is strongly dependent on the information that is delivered together with it.

In the discussion the citizens of Karlsruhe differ between an eye-catching logo on the front of the product or a prominent place of the package and a small hint e.g. in the ingredient list, respectively. The majority of the Karlsruhe participants argue for the logo concept, because a catchy logo would bring the “malleable nano-concept” closer and more tangible to consumers. Further, a demonstrative and prominent placed symbol – one Karlsruhe attendee used the comparison to the hazardous substances symbol - would raise the attention of consumers in the moment of the purchasing decision.

In contrast, it would be rather arduous to look for hints of nanoparticles used in the product via the ingredients list. Several attendees in Karlsruhe argue that this takes time and requires a minimum awareness for the issue. As an example they call on the concept of “E-numbers” which, they feel, hedges information behind clauses and legal language, so that the consumer cannot understand it “without a reference book”.

Regarding the list of ingredients as a kind of labelling it was critically noted within the Vienna focus group that the disclosure of the components of the product could come in conflict with the principle of competition in a market economy. As a solution they

proposed an independent institution that gathers the information of the producers. Most of the Viennese participants thought that universities should take over this task, because they feel that these are in fact the only independent and competent organisation.

An alternative proposal in Karlsruhe was a kind of traffic light concept like it is discussed for food package labelling. This has the benefit of striking and clear information with the colours green, yellow and red.

Interestingly, the Karlsruhe participants also thought about the situation where no product package with the according label is available like products that usually come without a package (e.g. plastics products) or later stages of the product lifecycle. Thus, they came up with the idea to use an imprint label as it is found on eggs or car tires. The number code should be engraved to the product itself and not on the packaging.

3.4.3. A Registry for 'Nanoproducts' or 'Nanomaterials'

One of the hottest topics of the political debate around risk government of nanoparticles is the establishment of 'nano' registries for products or materials as proposed by the German Environment Minister and the Belgian Presidency of the Council of the European Union, respectively. Notwithstanding, in none of both groups a registry was a central theme in the discussions. Moreover, the participants didn't even use the word "registry". But as mentioned above, the citizens can only suggest regulatory instruments that are familiar to them. Thus, the topic was touched only indirectly. In Vienna, the idea of a registry didn't come up during the discussion.

For example, several citizens of Karlsruhe developed in connection with labelling an idea for a direct product labelling with a kind of number code which have to be specific for nanoparticles (cf. Chapter 3.4.2). Therefore they call on a system they know from car tiers which allows tracking the manufacture and manufacturing details. The aim of this kind of number code should be a fast recognition and tracking of 'nanoproducts'. All number-coded 'nanoproducts' should be listed by a central, neutral and objective office. The list is described as a kind of "Red List" known form medicals or as a kind of phone book, which will be provided for free or be available in shops.

Interestingly, the attendees preferred this kind of list to be printed rather than electronic or online. Additionally, it should contain additional information like manufacturer and manufacturing date. Moreover, the entries should be easily comprehensible. Nevertheless, not all agreed with this idea. One Karlsruhe participant stated that a product list seems to be laborious and inconvenient for a direct buying decision. Compared with a classic labelling like a list, he feels that would be a "high waste of money".

This proposed list has similar characteristics and goals as a so-called register of 'nanoproducts', which seems to be not familiar to citizens. In Vienna, the idea of a registry didn't come up during the discussion. In spite of that, most of the citizens from Karlsruhe and Vienna indicated in the questionnaire subsequent to the focus group event that register of 'nanoproducts' for agencies (see Figure 8) as well as a register for consumers (see Figure 9) is important to them. Comparing both figures the preference for a register for consumers is obvious. The results from the questionnaire don't reflect the doubts and objections of the focus group participants as discussed above. It has to be noted that the method of a questionnaire differs significantly from the focus group

event. The proposed measures are given at the end of the discussion and the participants only have to vote without further inputs and associations.

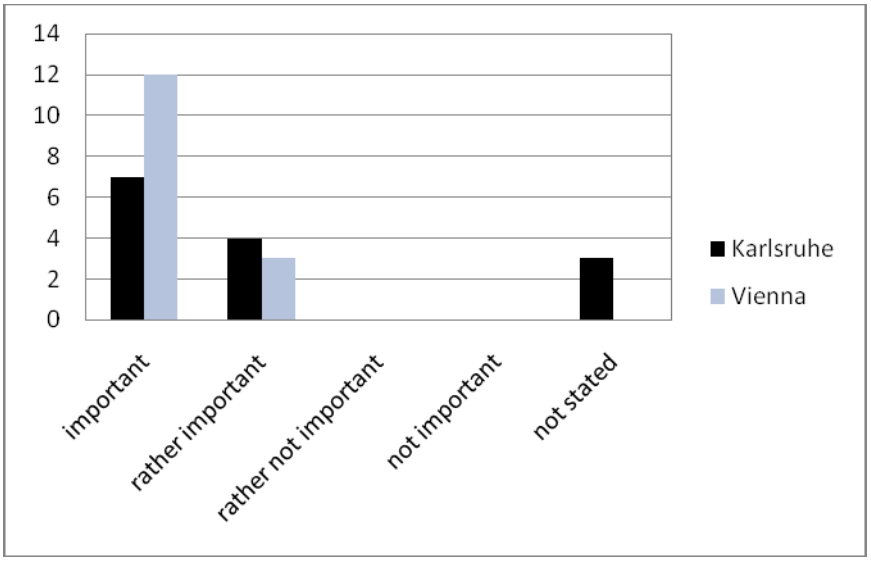

Figure 8: Evaluation of the questionnaire after the focus group event (Karlsruhe: n=14, Vienna: n=15). Shown are the numbers of participants that had chosen the depicted answering options for the question: "How important will be a register of 'nanoproducts' for agencies in your opinion?"

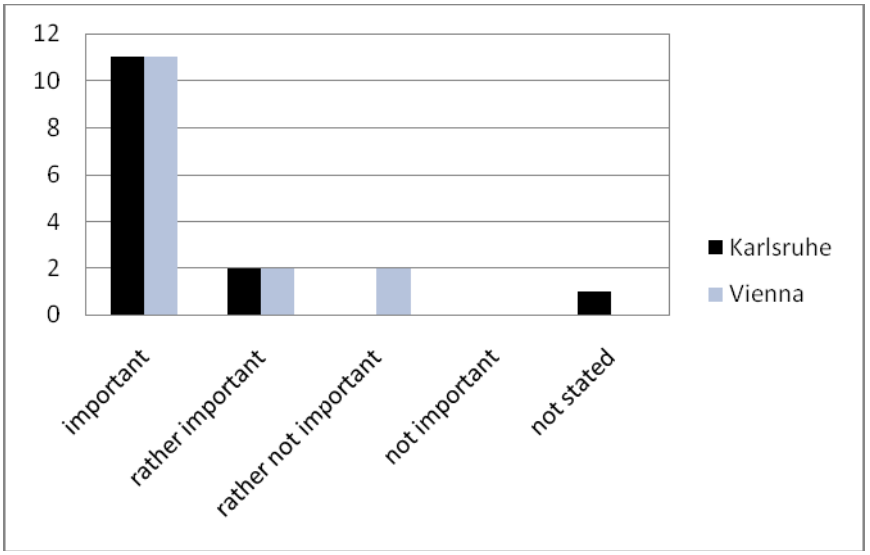

Figure 9: Evaluation of the questionnaire after the focus group event (Karlsruhe: n=14, Vienna: n=15). Shown are the numbers of participants that had chosen the depicted answering options for the question: "How important will be a register of 'nanoproducts' for consumers in your opinion?"

3.4.4. Approval, Authorisation, Moratorium

Throughout the whole discussion in both focus groups in Vienna and Karlsruhe, the safety of consumer products was one of the most important issues for the participants. In the face of uncertainty concerning the effects on human health and the environment of nanoparticles that derive from 'nanoproduct', the participants react in very different

ways. Several participants, especially in Karlsruhe, demand a general preventive ban of ‘nano’ in consumer products because the uncertainty makes them feel that uneasy that they reject everything associated with ‘nano’. The dilemma of uncertainty and lack of knowledge on the one hand and the great number of ‘nanoproducts’ already on the market on the other hand was discussed with particular emphasis. In this context, the concept of a general prohibition of ‘nanoproducts’ in terms of a moratorium was discussed. Two Karlsruhe citizens explicitly demanded a definitive ban with unambiguous expressions like: “This has to be forbidden”.

Other participants of the Karlsruhe group weren’t that strict. They thought of the possibility to subjected ‘nanoproduct’ to permission after they were proven to be harmlessness (cf. Chapter 3.4.5). One participant stated the precautionary principle, which should be interpreted in a strong sense: ‘nanoproducts’ should not enter the market until definitive and evident studies are presented. And another citizen was surprised about the extent that ‘nanoproducts’ already appear on the market. He stated:

> *“[…] the precaution of the government, the obligation for governmental precaution like this exists for medicals would be meaningful for nanoproducts in spite of only thinking: Let it be, we try it until someone will shout.”*

Thus, the Karlsruhe attendees proposed inter alia that this proof of safety should be carried out by the manufacturers before the products enter the market. Subsequently, those tests should be the basis for a governmental approval of the product, whereas the participants call on the analogue authorization process like it is compulsory for medicals including long term studies. They conclude that an authorisation process and the obligation of long term studies make a moratorium unnecessary. Thus, participants stated:

> *“In my opinion, the government could propose, that the manufacturers have to prove the harmlessness prior to the application of a nanoproduct.”*

> *“[…] before they have not proven with long-term studies that it is not harmful for humans, the government should not give an approval.”*

In this context the responsibility for improved studies was allocated first to the manufacturers. The government however has the duty to introduce a regulatory framework. This introduces another important actor besides the government. Citizen stated also that they consider the industry trustworthy, but only if there exist a supervisory obligation from a governmental legislator.

In addition, a moratorium was estimated as a method, which is generally not useful in a globalised world. And even more important, the freedom of choice for consumers was estimated more important than a general ban (cf. Chapter 3.4.1). Thus Karlsruhe participants said:

> *“I don’t want to boycott nanoproducts!”*

> *“The consumer has to choose. We have a lot of harmful products on the market, which is not forbidden and where the consumer can decide for himself. We have talked about ketchup, which contains a high amount of carbohydrates. This is also not healthy and it is available on the market.”*

The Viennese participants discussed in a similar way. They were dealing with a seal of quality - similar to the “Fair Trade” seal - that represents a risk assessment procedure which guaranties the safety of the product. They also discussed if there was any institution that could take over this a task, because most of them doubt that there is one existing that is competent as well as incorruptible (cf. Chapter 3.4.2). In addition, one participant, who had already worked with seals, was very sceptical concerning their reliability:

> “*Well, I see such seals more critically, as they exist at the moment. Because there is really a seal for everything and could also be approved. Even myself I have to look after seals. This is simply not trustworthy to say, yes, if a seal is put on, it can this or that. We have experienced that in the food history, how there can be cheated, turned and can legally argued. There, everything fits into a seal. Therefore, that must be a trustier one, as we have at the moment.”*

Related to a seal of quality, in Vienna a few participants suggested that the state should give economic incentives such as tax reduction for enterprises using the seal. In this context some attendees became were critical regarding this approach, because it would distort the competition - and might be rejected by the European Union. One Viennese attendee was afraid that only big enterprises could afford such a seal and smaller businesses would be disadvantaged by such a regulation.

One Viennese participant suggested implementing an independent testing agency which performs product testing in order to guarantee the safety and harmlessness of the products. Additionally the European Union was suggested to establish such an institution. Nevertheless, the Viennese participants have very little trust in the work of the European Union at the same time.

Thus, it seems that most of the Viennese participants have not been aware that products have to be tested regarding safety issues by the producer before they are launched. In this respect it was interesting to see that the participants in Vienna have very little trust in the producer. Instead, most of them expected that possible risks of a product would be concealed as long as possible by the producers. Thus, a Viennese participant brought up the idea that tightened liability might strengthen the safety of ‘nanoproducts’. And another participant added that competent attorneys would be required as well to prevent the weakening of this measure. Only a few participants believe in the positive image and responsibility brands entail:

> *“Yes, but an industrial enterprise with a good name will take care, that they will keep their reputation. Because all [of their] products will be negatively co-noted, if they bring one bad product on the market.”*

In the questionnaire which was answered after the focus group events the governmental marketing authorisation of ‘nanoproducts’ and nanoparticles was thought to be an important measure from the point of view of the citizens from Karlsruhe as well as Vienna.

3.4.5. Increased Funding of Research

Most of the participants in Karlsruhe called for an increase of research funding in the area of toxicology, eco-toxicology or food research. Several citizens mentioned a support for research just at the beginning of the discussion in combination with labelling and an increase of information. One citizen of Karlsruhe even stated that this is a governmental obligation. Another reminded that research can also include benefits and positive possibilities to manufactures and consumes. Summarizing the different aspects research funding was a generally agreed action against uncertainties, improving knowledge and evidence. Especially long-term studies and comparative studies were proposed enabling a concrete comparison of 'nano'- and 'non-nanoproducts'. Both in Karlsruhe and in Vienna the aim of increased research should not only scientific based but also for detailed consumer information.

> *"Effects of substances should be tested for research fields which are not yet taken into account … reaching research areas, which are not considered and that the effects on the environment will be tested […]."*

In Vienna evolved a lively discussion about the role of research. The second part of the event was clearly dominated by the discussion of how the research landscape for nanotechnology should look like. Hence, the focus was more on who should perform research than on the area of research. As mentioned before, proper and neutral information about risks was rated very high by most of the participants. The "Info-letter" which was handed out during the event reinforced the wish for information, because potential risks were traced back to the current lack of knowledge and uncertainties.

The participants of the Viennese group extensively agreed that research needs to be done by independent, state-run or university institutions to guarantee unbiased findings. State-run research via universities was considered as a chance for the state to align different interests. Additionally, business corporations are called in to do research on the products they launch, too. It was explicitly pointed out that nanotechnology research is not solely an issue of Austria but should be carried out and coordinated on the level of the European Union. One participant brought the urge of research to the bottom line:

> *"[…] but I think, now it is important that as many institutions work on that in an interdisciplinary way, to obtain results quickly."*

As funding strategy for research, a fund was suggested in which the companies that manufacture 'nanoproducts' or produce nanoparticles are forced to emit a certain quotient of their profits to pay for independent research. Some attendees liked the idea of the fund, but saw research as a governmental issue and didn't know how to obligate the industry without losing neutrality.

It should be pointed out that the citizens of both cities, Vienna and Karlsruhe, rather trust in independent research. Because they feel that independent research is not driven by motives like gaining or lobbying. Besides the fund as payment plan, the involvement of citizens as tax-payers remained unsettled.

The general agreement to more research and an increase of funding health and environmental research as also mirrored in the results of the questionnaire subsequent to the focus groups. Attendees of both groups quote that this is an important issue for them.

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