

Complexities of labelling of nano-products on the consumer markets

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Cite as: Throne-Holst, H. and Rip, Arie., 'Complexities of labelling of nano-products on the consumer markets', European Journal of Law and Technology, Vol. 2, No.3, 2011

1. Introduction

The introduction of products based on emerging technologies are often contested, and even the preceding research and development stage of such products have raised discussions and invoked actions, as when field trials of GM crops were destroyed. For nanotechnology, the uncertainty about health and environmental risks is widely recognized, and different responses, up to a moratorium on products containing nanoparticles, have been proposed and contested. One such response is the labelling of consumer products with a nanotechnology component, so that consumers can be informed in their choices. NGOs as well as citizens/consumers appear to welcome such labelling schemes [2]. But labelling of products as containing 'nano' is not straightforward. Actually, consumers/citizens recognize some of the complexity. What does this tell us about the wider framing of emerging technologies like nanotechnology, and how citizens/consumers perceive their role in these developments? A key point is responsibility: how it is organised at the societal level, which institutions are involved in such arrangements, and who can legitimately assign or take responsibility?

The availability of consumer products with a nanotechnology component has increased significantly over the last years, with a mean rate of three to four new products per week according to the PEN inventory of nanotechnology-based consumer products. These products span a number of uses, but cosmetics and sporting equipment are thus far the largest product categories (PEN 2011). However, the definition of nanotechnology is not self-evident. Several definitions have been put forward, but there is no consensus. In this article nanotechnology is understood as a set of technologies that aim at imaging, measuring, manipulating and modeling at the nanoscale. Nanomaterials with novel properties and functionalities are made. These account for the main use of nanotechnology in products.

The rapid introduction of this set of technologies in consumer products over the last five to seven years has contributed to a heightened focus on possible adverse effects. These effects include environmental toxicity and persistence, indications of nanoparticles crossing the blood-brain barrier, deep penetration into the lungs and cellular damage due to oxidative stress (Oberdörster 2005, Balbus et al 2006, RCEP 2008). This focus has been further sharpened by the uncertainties surrounding such possible adverse effects on health or environment (RCEP 2009), and on the uncertainties to what degree the current regulatory framework is suitable for such novel products. The European Commission has concluded that their present framework is sufficient, but some modifications might be necessary and that implementation of current legislation should be enhanced (EC 2008). The US Food and Drug Administration came to a similar conclusion in their assessment (FDA 2007).

Partly because of their dissatisfaction with these positions, a number of consumer organisations and environmental groups have demanded an introduction of mandatory labelling of nanomaterials in consumer products (Falkner et al 2009a; D'Silva and Bowman 2010; Miller and Scrinis 2010). Such groups have pushed for other labelling as well, like eco-labelling. There is a longer tradition of labelling to indicate ingredients of consumer products in general, and the pushing by consumer organizations and environmental groups is part of the explanation of the wide variety of labels we find on consumer products nowadays. Labelling schemes can be divided in two main categories: mandatory and voluntary [3]. In this contribution we will mainly be concerned with the discussions and implementations of mandatory labels on consumer products with a nanotechnology component. Examples of mandatory information schemes are declaration of contents, usage and disposal information, products labelling and certificate of conformity (Stø et al 2005, 34.)

Although there are some initiatives on voluntary labelling of nanomaterials in consumer products (Fiedeler et al 2010), the political proposals and initiatives for mandatory labelling are front stage, and create dynamic interactions between political actors, regulatory authorities, manufacturers, NGOs and consumers. Parts of this dynamic are how some political actors, and in particular the European Parliament, have pressed for the labelling of nanomaterials in consumer products, especially cosmetics (Eisenberger et al 2010). This is motivated by a concern about the lack of transparency regarding the presence of such ingredients (ENVI 2009, EC 2009, Bowman et al 2010).

Despite the European Commission's earlier conclusion on the current regulatory framework being sufficient, a new regulatory framework for cosmetics was introduced which included mandatory labelling of nanomaterials as ingredients when it entered into force in January 2010 [4]. The names of such ingredients must be followed by the word 'nano' in brackets (EC 2009) [5]. The adoption of this regulation was significant as Bowman et al (2010) argue '... not least because it is the first piece of national or supranational legislation to incorporate rules relating specifically to the use of nanomaterials in any products' [6]. Related requirements, spurred by the same concern for transparency, are proposed for regulation of Novel Foods (D'Silva and Bowman 2010), which recently have been accepted 'in principle' by the European Commission (EC 2011).

Such labelling indicates the physical occurrence of ingredients, and nothing is claimed about possible risks (or benefits). This contrasts with labels like 'organic', 'fair-trade' or 'environmental-friendly', where claims are made about the functionalities of the ingredients or final product.

Labelling efforts find support in publics, as evidenced in a variety of deliberative processes about nanotechnology. More than 60 such processes have been organized since 2004 (Kaufmann et al 2010), involving between 20 and more than 100 participants (Scholl and Petschow 2008). The majority of these deliberative processes has taken place in Europe, the remainder primarily took place in the US and Australia (Stø et al 2010). They were often inspired by a wish to avoid the backlashes of genetically modified (GM) food on the European market, which resulted in the difficulties in World Trade Organisation and eventually in the labelling of GM products. This was to be achieved by engaging the public in debates about different aspects of nanotechnology. These deliberative processes were organised by a wide spectrum of organisations. The processes were different in scope, ambition, number of participants, and whether targeted or random sampling of participants was used. When participants were asked to come up with positions, concerns and plan for action, labelling of consumer products with a nanotechnology component regularly figured as one of their top requests (NanoCitoyens 2007; Opinion Leader 2008; Stø et al 2010).

So far we have shown that there are various actors that are pressing for the labelling of consumer products with a nanotechnology component. The European Commission is not alone in the decision making process for development of regulations [7], but they will implement the scheme. And labelling is one of the top concerns of citizens and consumers in deliberative processes. These observations taken together may seem to add up to a clear recommendation to support labelling of these products.

Although labelling of consumer products with a nanotechnology component does have some appealing features, it is surrounded by complexities. We will indicate, in Section 2, three such complexities for labelling of products with a nanotechnology component on the consumer markets.

These complexities motivate us to look for alternatives to labelling. In the focus group studies from Norway on nanotechnology, we identified elements that can help reduce the complexities of labelling: The focus group participants supported labelling, but they also had interesting reservations. In the concluding Section 5, we will use their discussions to explore and position possible alternatives. Focus group methodology and the empirical findings will be presented in Sections 3 and 4.

2. Three complexities

There are currently no harmonized, international definitions of nanotechnology or nanomaterials [complexity 1]. Assuming this will be achieved; there is still the question of responsibility. Labelling schemes transfer the responsibility for choices that shape further development of nanotechnology to the individual consumer [complexity 2]. This is probably the least informed actor, as surveys show low levels of knowledge on nanotechnology in the general population [complexity 3].

The purpose of definitions of nanotechnology is to assist business-to-business transactions [cf. ISO, OECD], but also to improve efficient communications. Labelling is a kind of communication, and is rendered difficult, perhaps meaningless if there are no common definitions of what they are expected to communicate. This is especially the case for nanomaterials where there is a myriad of definitions on national, regional and international level (Lövestam et al 2010; SCENIHR 2010).

In the report 'Considerations on a Definition of Nanomaterial for Regulatory Purposes' from the Joint Research Centre, Lövestam et al (2010) address the elements of a science-based definition of nanomaterials. Not only does the current multitude confuse market actors and make labelling difficult. The current variety of definitions also undermines and counteracts the power of each individual definition, since each of them then become applicable only in a very specific sector or in very specific settings within specific organizations (Lövestam et al 2010).

Such a variety could have its advantages though, especially in light of the argument that one should not try to regulate nanotechnology as such, but rather regulate each of the many applications of nanotechnology on a case-by-case basis (Renn and Roco 2006). Tailored definitions would then have their place as the different applications could fall under different regulatory areas. On the other hand, the result of such tailored definitions could cause the same substance under one regulation to be regarded as a nanomaterial, but not so under another regulation. This would create confusion, not only for consumers, but also for manufacturers and regulators (Lövestam et al 2010).

In spite of these considerations, there will now be mandatory labelling of nanoscale ingredients (nanomaterials) in the new Cosmetics Regulation for Europe. A definition of nanomaterial is given in the regulation (cf. note 4). The regulation text also noted that there currently is not a uniform definition for nanomaterials at the international level, but when such an agreement arises, the definition in the regulation should be updated accordingly (EC 2009, s. 29).

To define nanomaterial, one also would have to address the question: What is the size range? There seems to be more of a consensus on the lower limit being one nm, than the upper limit where 100 nm is suggested (SCENIHR 2010; Lövestam et al 2010). One of the issues is that particles of nanomaterials can form aggregates or agglomerates, with the particles retaining their nanoscale properties, while the size of the agglomerate can be far above 100 nm (Lövestam et al 2010). Friends of the Earth have argued that physiological effects of nanomaterials below 100 nm also occur for materials above 100 nm. Accordingly they recommend moving the upper limit to 300 nm (Miller and Senjen 2008).

Defining nanomaterials and the nanoscale is not straightforward, and it reasonable to follow Lövestam et al (2010) when they emphasise that there are choices to be made regarding the definition of terms like material and the nanoscale limits, and that these choices do involve policy choices, which make political decisions necessary. Otherwise, especially on regional and international level, the multitude of definitions will continue to persist.

The second complexity starts with the idea that product labelling offers consumers the possibility to make informed products choices. In general this is a good thing, and supplying the consumers with the relevant information through such labels is believed to strengthen the position of the consumers in the market place. This is the emancipatory effect of products labelling, as consumers for a long time have suffered under not having enough information about the products offered on a market place as it developed from personal relations with the local shopkeeper to less personal, more anonymous relations in supermarkets (Cochoy 2005; Jacobsen and Dulsrud 2007).

Information to the consumers, like labelling has accelerated to such an extent that some fear information overload (Klapp 1986; Buse 1996), and that the variety of labels may appear like a jungle for consumers, in the sense that it is a chaos of symbols, images, logos and text (Heidenstrøm et al 2010). This is of concern also in the discussion on European level regarding the possible labelling of products with a nanotechnology component, where frequent mention is made to the possibility labelling offers for consumer to make informed product choices (EC 2009, ENVI 2009).

There is an additional problematic aspect of labelling that we will highlight here. In the Cosmetics Regulation for Europe it is admitted that 'At present, there is inadequate information on the risks associated with nanomaterials' (EC 2009, s30). Thus, the involved European institutions had the possibility to regulate by referring to the precautionary principle, but instead they adopted labelling to offer information to consumers.

This raises the concern that information schemes like labelling in effect means that responsibility is shifted to consumers. This is a general point even for labels like 'organic', 'fair trade' or 'eco-friendly', but in these cases the manufacturer is made accountable for following certain standards and rules. For the case we are looking into here, with a 'contains nano' label, the shifting of responsibility to the consumers is more definite. Under such schemes the producer can be viewed as being accountable 'only' for correct characterization of the ingredient. Wider assessment of potential risks and benefits, and whether nanomaterials are desirable in particular products or in general are left with the consumer.

The requirement of labelling consumer products with a nanotechnology component is a way to transfer the responsibility for the further developments of nanotechnology away from political actors and to the individual consumer [8]. In summary: Although it is hard to argue against more information to consumers in the form of labels, one should be careful and consider the extent of responsibility shifting.

The third complexity derives from the level of knowledge about nanotechnology with general publics. As most Western countries have invested heavily in nanotechnology over the last decade [9], led by the US (Sargent 2008, Schiermeier 2009), several attempts have been made to measure the public awareness and perception of nanotechnology, especially through consumer surveys and public opinion polls [10] (Satterfield 2009). In Europe, since 2002, nanotechnology has been included in Eurobarometer surveys which chart the public's general attitudes to science and technology. At that time '... in 2002 it is unlikely that many people will have had a clear representation of nanotechnology, it was included in the survey with a view to establishing a base line for studies in the future'. (Gaskell et al 2003, p.8). In 2002, more than half of the respondents (53 per cent) reported they 'did not know' what impact nanotechnology would have on their way of life. 42 per cent of the respondents reported the same in 2005. This year was also the first were the respondents were asked 'Have you heard of nanotechnology?', and here 44 per cent answered 'yes'. (Gaskell 2006). In 2010 the question was adjusted somewhat, so the respondents were asked 'Have you ever heard of nanotechnology before?' A majority of 54 per cent had never heard of it (TNS 2010).

In surveys in the US and Germany since 2004, respondents were asked 'How much have you heard about nanotechnology?' (Reisch et al 2011). For the US the share of respondents that have heard nothing at all was at its lowest in 2009, with 35 per cent - which is still substantial when we take into consideration both the range of products available at the consumer market which claim to have a nanotechnology component, and the significant investments that have been made in nanotechnology by both the public and private sector over the last decade. For Germany, the latest survey (in 2010) found that close to 40 per cent reported to have heard nothing at all (Reisch et al 2011).

In a Norwegian survey in 2008, 41 per cent of the respondents reported having heard nothing at all about nanotechnology (see Throne-Holst and Strandbakken 2009). In 2011, the Norstat agency did a survey for the Norwegian

insurance company 'if'. Here Norwegian respondents were asked 'Imagine 10-20 years into the future, to what degree would you say you fear [issues]?' [11] 42 per cent of the respondents had 'no opinion' when asked about nanotechnology, which can be taken as an indication that they had not heard of nanotechnology (if 2011)

The sizable investments in nanotechnology by both nation states and private firms, do not seem to have captured the attention of citizens/consumers. The knowledge level found in consumer surveys and public opinion polls continue to indicate that up to half of the respondents do not know anything about nanotechnology.

3. Focus groups

The complexities that we outlined are reflected in focus groups exercises, which have become increasingly common (cf. also Seitz and Jahnel 2011). We draw on empirical findings on reflections, perceptions and evaluations by Norwegian consumers in two focus group studies on nanotechnology that took place in 2006 and 2008 [12]. These two studies were parts of two different research projects at SIFO. The project in 2006 was a collaborative project between SIFO and DNV Research. The point of departure of the project was the question 'Who should be precautionary?', with the further question 'Who has the legitimacy to decide this?'. For the project in 2008, SIFO collaborated with University of Manchester in a project on the value chain of two product categories, cosmetics and textiles that at the time had several available products with claimed nanomaterial ingredients. The questions were about the main messages in, and channels for, business-to-consumer dialogue about such products, and the extent to which this message was understood and trusted by consumers.

We will concentrate on the parts of the focus group studies that addressed themes of the possibility and desirability of labelling of consumer products with a nanotechnology component. Before we present the findings, we offer brief comments on focus group methodologies and the set-up used in our studies.

3.1 Focus group methodology

Since the mid-80s focus group studies have grown in popularity among social scientists in general (Krueger 1988), and sociologists in particular (Halkier 2010). This is rooted in the possibilities the approach offer for active participation, over the more passive role participants are assigned in structured one-on-one interviews. The focus group is a non-directional procedure with open-ended questions. This allows the participants to comment, to explain and to share - preferably in a permissive group environment.

Focus groups are in one sense a form of group interview led by a moderator; a central feature is the interaction between participants. A challenge for other methodological approaches, both quantitative and qualitative, is that they presume that people already know how they feel about a product, a service or a societal aspect. These other approaches also seem to presuppose that people form their opinions in isolation (Krueger 1988). One of the hallmarks of the focus group is the combination of group interactions and a focus on certain topics selected by a social scientist (researcher). This combination results in a data material that can inform us on the formation of opinions and meanings in groups of people (Halkier 2010). Opinion formation is a part of our everyday life, so certain aspects of it become self-evident and tacit. Focus groups give the participants the possibility to express explicitly how their opinions form. Thus, the analyst gets an impression of their perceptions, thoughts and opinions in how they participate in the conversation.

One cannot validate focus group findings by using an 'identical' set-up and participant selection: The interactions that occur are unique for that particular time and space. Our goal, however, was not to generalize, but to explore the range of meanings, understandings and reflections the participants offer on the particular subject (Macnaghten and Jacobs 1997). Empirically, one may find similarities in the lines of reasoning between focus groups.

3.2 The set-up of the focus group studies

The participants in the focus groups in 2006 and 2008 were differentiated according to age and gender. We suspected that in discussions on technology in mixed-gender groups, men would come to dominate the conversation. Regarding age, we suspected that familiarity with and interest in modern technology would be different with younger and older people. This resulted in four groups each year: two female groups - young (25-45 years) and old (46-65 years), and with corresponding age groups for two male groups.

The participants for the focus groups were identified by a market research agency - TNS Gallup, from their registry of potential focus group participants. A criterion for the selection from this registry was that all focus participants in both studies were supposed to have at least 3 years education after compulsory primary and secondary school. We assumed this would give greater ability of participants to formulate personal reflections and viewpoints. To reduce the chances that anyone would work in the nanotechnology field we excluded those with education in chemistry, physics or biology. In both years four small focus groups were set up, with five to six participants in each [13]. There were practical reasons to go for small groups, but these were also considered favourable to create an intimate, permissive environment.

We expected that the participants would have limited knowledge about nanotechnology. After some initial questions to the focus groups on different aspects of modern technology, the moderator asked if the participants had heard or knew anything about nanotechnology. The moderator then introduced a researcher who gave a 20 minutes introduction on nanotechnology. After questions of clarification, the moderator invited the participants to reflect on what they had just heard, with subsequent questions on how the participants viewed the responsibility of different societal and value chain actors.

4. Empirical findings

Labelling was a recurring theme in all focus groups. Initially they all tended to favour labels, but most groups soon started to discuss what the effect of such a label actually would be. In their opinion, most consumers hardly know anything about nanotechnology (or nanomaterials). The label might be perceived as a negative marking, but as a participant in the young female age group in 2008 remarked, if nano turns out to be really great, then other products that carry such a label would be associated with something very positive. The participants have hesitations about the possible effects of such labelling, but they do not turn down the idea. Some of the ambiguities are visible in the following quote [14]:

Moderator: -This assumes that this runs in parallel with an information...

Participant 1: -Yes. That should definitely take place. I agree completely. It should be labelled.

Participant 2: -I must have to admit to I do not read [product labels] to any great extent.

Participant 1: -No, but [you would] if you were concerned about it. (Females 46-65, 2006)

Nano-labelling could be interpreted as a warning:

Participant:- It's almost like a stigma, labeled with nano. ... and no one knows if it is dangerous. (Males 25-45, 2008)

There are practical considerations as well:

Participant: But most important is the store's range of choice; that you might chose something else if you do not want it. (Males 25-45, 2008)

Then the key reservation about level of knowledge appears (as in the following quote from a different focus group):

Participant: -But even if you do label products; if half the population has never heard about nano, they just read: yes, here is nano. OK... You have to have some knowledge of it in order to... which most people will not have. So labelling alone will not be sufficient. Some research on negative aspects should have been undertaken. (Females 25-45, 2006)

Even though participants in the focus groups thought that labelling was desirable, there was a further reservation whether labelling would delegate too much to the consumers:

Participant 1 [15]:- We demand too much. These are ordinary consumers; you will not expect them to possess deep knowledge of such matters. That's why I mean that political authorities should come in and act as a watchdog on behalf of consumers.

Participant 2: -The nano technology advisory board. Yes, we already have something called the biotechnology advisory board.

Participant 1: -Yes, yes, just like that. A good analogy. And say that now we have accepted this specific technology, it can be used in this and that connection, but we do not accept products used in a third connection, because it has not been thoroughly researched, or we are uncertain of possible long term effects. (Males 46-65, 2008)

Thus, there is a call for a competent body with appointed qualified members (and no ties to commercial interests) that should come up with advice to political authorities on what to do. Such a body will create transparency, and be accountable. This links up with a call for independence of research:

Participant: - To me, it is important that research is as independent as possible, even if there always will be interests that we are not able to uncover. The government should regulate it, at least to a degree. It is best if the state finances and initiates research, not the pharmaceutical corporations who intend to use research (in their own interests). (Females 25-45, 2006)

The idea of a competent body that can be referred to resonates with the recurrent expectation that there will be somebody, somehow, which is responsible, and can be trusted to be responsible:

Participant: - I believe that I, as a consumer, tend to think that as long as it is marketed, it probably has gone through a series of quality assessments; hence it is a safe product. I am probably a bit naïve about the safety of it, more than I should be. The availability of it kind of blinds me (Males 25-45, 2008)

If things go wrong, somebody will notice and take the required actions. This is apparently anticipated to work like a safety net, and limit eventual damage

Participant: - Today, everything changes so fast that you will probably... if it is really dangerous to the environment and so on, it will be prohibited; it will be stopped real fast these days. Everything happens very quickly in society today. (Males 46-65, 2006)

This sentiment is echoed, but also nuanced in another focus group:

Participant 1 [16]: -I tend to trust products in the Norwegian market, that someone watches them.

Participant 2:- To a certain degree I do too, but not completely, since Norwegian authorities have recommended a number of products that have turned out to be dubious. (Females 25-45, 2008)

While this implies a need to be vigilant on the part of consumers, this will not be easy, because it requires effort and competence. The basic response remains the projection of responsibility on some authority:

Participant: -I think we already have touched upon labelling and that we expect that someone tell us and that [they] take that kind of responsibility. We talked earlier that the Government and the Norwegian Board of Health Supervision and Food Safety Authority and Veterinary and such...That is what I am thinking. And I expect that our society informs us and provide us the labelling and the explanation we need to be able to make our choices. That is what I expect. (Females 25-45, 2006)

Industrial corporations, while important as knowledgeable actors, were exempted from specific responsibility:

Participant: - I do not think this is a responsibility we should lay on them as... as individuals or as single enterprises... it will have to be imposed from the outside, as laws and regulations. Either as labelling or as mandatory information or something like that. (Males 25-45, 2008)

As we noted, it is hard to argue against better availability of consumer information. Information is viewed as a good thing, and not wanting to get more information for situations where you have to make a choice, is viewed as archaic and anti-modern. This might well be the reason why the focus group participants in the two Norwegian studies ended up with supporting labelling, even in the light of the reservations they did articulate. Could the hesitation the participants express, together with their conviction that labelling is desired, be met by alternative schemes? What sort of alternative schemes would do the job?

Three concerns appear in the focus group participants' discussions of labelling. Transparency was highlighted: those that would be involved in labelling would have to be transparent in their motivations and criteria. Accountability was another concern: those who would be involved in setting up and looking after a potential labelling scheme are expected to be responsible and should be prepared to justify their actions. A third concern was that someone should be responsible [17]. This implied an asymmetry, as the participants generally envisioned a rather passive role for themselves, hoping that things eventually would be sorted out without the participants in their role as consumers necessarily being involved [18].

In section 2, we identified three complexities indicating reasons for being hesitant about labelling schemes. Reservations were also expressed by the focus group participants, and these concerns taken together suggest there are good reasons to consider alternatives. In doing so, the three concerns identified here as motivating the focus group participants to support labelling schemes, transparency, accountability and the need for someone to be responsible, can lead us. How can such concerns be addressed without recourse to (simple) labelling schemes?

5. Alternatives to labelling

We identified three aspects behind the participants' eventual positive appraisal of labelling. Labelling appeared to serve accountability, transparency, and the need for someone to be responsible. However, these concerns can be addressed in other ways than through labelling. We will use the concern about 'someone' to carry responsibility as our entrance point to discuss concrete examples of one or another actor carrying such responsibility, which will allow us to speculate about future possibilities.

Responsibility carried by the regulatory agency is exemplified in GRAS - generally recognised as safe - a designation used by the US Food and Drug administration (FDA) for food additives that are exempted from the food additive tolerance requirements on the ground that they are considered safe by experts under the conditions of their intended use. It is those who wish to have an additive designated as GRAS that has the burden of proof to show that there indeed is a consensus among experts regarding the safety of use (FDA 1997). But it is FDA which carries the responsibility for putting a food component on the GRAS list. In the case of substances that were used as additives in food prior to January 1, 1958, they can be listed as GRAS based on either scientific procedures or through experience on the basis of a history of safe use in food (Falkner et al 2009b).

Products containing GRAS ingredients can be marketed by producers without informing or seeking review by the FDA, while food additives that are not on the GRAS list are subject to pre-market review and approval by the FDA (Falkner et al 2009b, Mattia and Merker 2008, FDA 1997). Responsibility thus lies with the regulatory agency. The relative success of this scheme has led to proposals to have similar GRAS schemes in other areas/sectors, for example the environment. There have been no such proposals for nanoparticles and nanomaterials in consumer products, but it is definitely a possibility. Under the current uncertainties regarding the risks of nanomaterials, however, it seems unlikely that any nanomaterial could be listed as GRAS. Implementing this scheme for consumer products now, would in effect be a moratorium for their use.

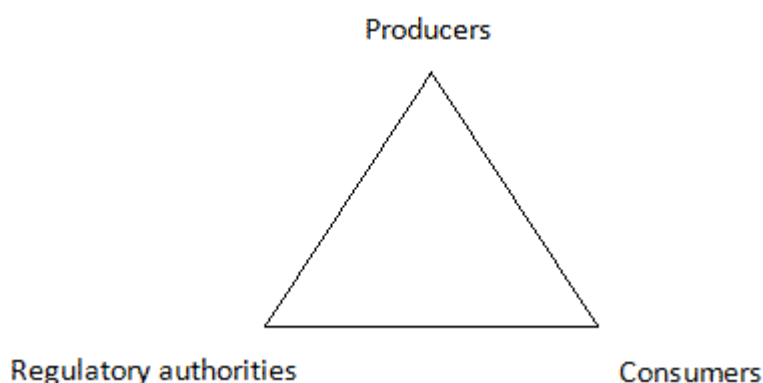
Responsibility carried by the producer is exemplified by the legal doctrine of implied warranty. This is a long-standing legal approach to responsibility about consumer products (in the USA, but increasingly taken up in Europe [19]) where responsibility is located with the producer. There are two types of implied warranties that involve consumer products: an implied warranty of fitness for a particular purpose, and an implied warrant of merchantability (Nolo 2011, see also Serra 1997).

The first of these two applies when a product is bought to serve a specific purpose. If one has specified this purpose to the seller (for instance a sleeping bag for sub-zero use), the sleeping bag s/he sells comes with an implicit warrant that it can be expected to keep one warm under such conditions (Nolo 2011). This warranty does not help to resolve the responsibility for risks regarding consumer products with a nanotechnology component, because the functionalities are determined by the overall system, not by the nanotechnology component. The second warrant is applicable, the implied warrant of merchantability. This type of warrant is an assurance that the items you have bought can be expected to work and are reasonable fit for the purposes that the product reasonably can be expected to be used for. Under this warranty the producers carry a significant responsibility.

Under this jurisdiction, it is up to the producer to decide whether to offer a product with a nanotechnology component to the consumer. In some sectors, like the building sector, there is a long tradition of using coatings and materials with a nano-component (even before the label nanotechnology became important) (Andersen 2011). In other sectors, firms may have second thoughts about offering consumer products once they realize there is an implied warranty.

We noted that labelling schemes transfer responsibility for choices about consumer products to the consumer. GRAS provisions assign the final responsibility to the regulatory authorities, while under implied warranty of merchantability, producers will carry the responsibility. We also noted that such arrangements may not be productive in terms of realizing the potential benefits of nano-enabled consumer products without suffering unnecessarily from possible harm and damage. As such they are all 'extreme' possibilities where responsibility is carried by one actor.

With this discussion in mind one can draw a triangle depicting responsibilities carried by the three types of actors.



For the arrangements we have discussed so far (GRAS, implied warranty and labelling of consumer products), responsibility mainly rested in one or another of the three corners of the triangle. The triangle opens up spaces for other possibilities than one of the three corners. These will be shared responsibilities. There are such moves already, as in the European legislative framework on chemicals REACH [20], where the burden of proof is shifted from regulatory agencies and to producers: part of the responsibility is now with the producers.

In Ulrich Beck's (1992) diagnosis of a Risk Society, the notion of shared responsibility is our fate in late modern societies. But it is also an opportunity and a challenge. In Risk Society, Beck describes how responsibility for manufactured risks has tended to dissolve. Everyone is a producer and a consumer of risk - 'Everyone is cause and effect, and thus non-cause' (Beck 1992:33). Even if responsibility for risks has dissolved, it has not disappeared. Rather a situation of 'organised irresponsibility' prevails. All societal actors and stakeholders have qualms to take responsibility for risks, and given the complexities of late modern societies, it is actually difficult for them to define a responsibility. The question of 'Who will take the hot potato?' has no obvious answers (Beck 1992:33).

Now turn this diagnosis around. Organized irresponsibility occurs all the time, but attempts are made to reduce it, with some success. New technologies like nanotechnology create additional complexities, but the basic challenge is the same. It is not a matter of just improving regulation, or just introduce labelling of consumer products or not, but to locate all of these as attempts to reduce organized irresponsibility. In terms of our triangle, the problem for new technologies and society (including consumers) is located in the middle of the triangle: the notion of organized irresponsibility captures our difficulty of handling shared responsibilities productively. To address this problem one should consider the division of labour and the division of responsibility between the three types of actors [21].

Western societies have grown into complex societies, and development of long value chains, global trade and outsourcing have made oversight complicated. Rather than viewing the current state of affairs as unwillingness of actors and stakeholders to take any responsibility, the problem and challenge is that no-one can be solely responsible for a given situation. Thus, arrangements for new and productive divisions of responsibilities are necessary. In this article, we cannot discuss specific possibilities, and the legal difficulties of working with shared responsibilities. But we can briefly discuss what the two other concerns in the focus groups: accountability and transparency, imply for alternative arrangements to labelling.

Transparency, as a concern of consumers, tends to be phrased asymmetrically: producers (and retailers) have to be transparent, while consumers can do whatever they wish. This resonates with complaints by producers about volatility of consumer preferences and reactions. This is not the whole story, however: consumers can follow larger concerns (e.g. sustainability) and be articulate in their preferences (cf. political consumption [22]). It does imply that a shared responsibility is recognized, and can be taken up in transparent arrangements. A concrete possibility would be to make the decisions about labelling nano-enabled consumer products a joint responsibility of producers and consumer organizations, with some support from regulatory agencies.

Accountability also starts as an asymmetrical concern: producers (and further relevant actors) should be accountable when they put nano-enabled consumer products on the market. Actually, the legal doctrine of implied warranty already stipulates accountability. The problem there is that the doctrine only applies in cases where damage or harm has occurred, so after the fact. In terms of responsibilities, also prospective responsibilities should be considered, where producers would try to anticipate and prevent damage/harm to occur. Such a 'good faith' effort would then be a consideration in eventual liability claims. This is a real possibility: there is an interesting precedent in technology forcing through (environmental) regulation (Rip et al 1987; Schot and Rip 1997). To have a more symmetrical arrangement, one can consider adding vigilance from the side of consumers to the scheme. For nano-enabled consumer products, producers cannot foresee all possible damage/harm, even when there is a 'good faith' effort. So consumers might bear part of the burden, by accepting nano-enabled consumer products without a full warranty (and thus not hold producers accountable if something untoward happens), and be vigilant about possible negative side-effects, as an early-warning arrangement. Again, there is a precedent: for medical drugs there is post-introduction monitoring, but by medical doctors, not by the patients.

We started by commenting on the complexities that surrounds labelling of consumer products with 'nano' ingredients. We suggested that addressing those complexities, or exploring alternatives, must include a sharing of responsibility. We indicated an overall approach to do so. For alternatives to be viable the three concerns we identified on the basis of our focus groups studies: transparency, accountability and the need for someone to be responsible, should be taken into account. New and innovative labelling schemes that address the complexities, the three concerns and sharing of responsibilities, would qualify as such an alternative.

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[2] Citizens and consumers are not two different groups, but rather two different roles: Traditionally the consumer is the role associated with the market and market transactions, whereas the citizen is associated with the political sphere and voting.

[3] There are also other distinctions, like positive (containing X) and negative (not containing X).

[4] Here, nanomaterial is defined as 'an insoluble or biopersistent and intentionally manufactured material with one or more external dimensions, or an internal structure, on the scale from 1 to 100 nm' (Paragraph 1, point k (EC 2009)).

[5] Some Member States had hesitations during the preparation of this regulation, most notably Germany. They raised the issue of whether such a labelling would be understood by consumers as a warning. They wanted to reserve the labelling for instances where 'the particle size results in altered properties' (COD 2008).

[6] Bowman et al (2010:92)

[7] It is part of the so-called 'co-decision' process with the European Parliament and The Council of the European Union. See for example Hix (2005) and Scott and Trubek (2002).

[8] Producers and retailers still have responsibilities, e.g. under tort law (issue of negligence).

[9] Global public investments in nanotechnology was in 2006 estimated to be \$6.4 billion, and investments by private \$6.0 billion (Sargent 2008), but global R&D investment data on nanotechnology are incomplete due to the reasons discussed earlier in this section, there is a lack of commonly agreed definitions, as well as statistical frameworks (Palmberg et al 2009). The accumulated US public investments since 2001 are more than \$16.5 billion, including the 2012 request (National Science and Technology Council 2012).

[10] The surveys and opinion polls referenced in general had representative samples of 1000 respondents, with the exceptions of the German study in 2010, which had 750, and the Eurobarometer, which have approximately 1000 in each country, but 16500 in total. The data were collected by CATI or web surveys.

[11] In addition to nanotechnology, these issues were radioactive radiation, natural disasters, chemicals in food and clothing, and IT security.

[12] In more recent focus group exercises in Germany in 2011, the overall thrust of the discussions was similar. And participants highlighted that labelling (Kennzeichnung) is no more than signalling, and that positive effects of such labelling require more information being available about the risks and benefits. (Seitz and Jahnel 2011)

[13] The maximum number of participants in focus groups is usually considered to be 12. Above this the interactions between the participants easily splits into subgroups which will pose a challenge for the documentation. With three participants or less, the interactions between participants can be hard to sustain.

[14] The numbering of the participants in this quote, as well as in two later quotes in this section, is not meant as identifiers, they just keep the two participants in such an interaction visible.

[15] Cf. endnote 14

[16] Cf. endnote 14

[17] One might claim that tort law operates to ensure such responsibility, but it is liability for damage, so harm or injury must have occurred. Responsibility has a prospective aspect, and the idea would be to avoid harm or injury.

[18] If this unique to Norway is an open question. But the political culture in Norway is consensual, consumers are to be protected, and they do not represent an influential political or public voice, compared to Germany or Great Britain where the political culture is more conflictual, at least when it comes to food issues (Kjærnes 2010).

[19] On July 25, 1985 the European Economic Community adopted the Product Liability Directive (85/374/EEC), and in May 18, 1999 the Consumer Guarantees Directive (1999/44/EC) (Hamilton and Petty 2001). Implied warranty is mentioned (in the article and in the Directives), but not thematised. There is definitely a sense that consumer's interests have to be protected better, and that US legal doctrines and actual laws can be a model, even if they should not be followed slavishly.

[20] REACH - the Regulation for Registration, Evaluation, Authorisation and Restriction of Chemicals. It entered into force on 1st June 2007 to streamline and improve the former legislative framework on chemicals of the European Union (ECHA 2011).

[21] There are also third parties like insurance companies who have some responsibility, notably so in health care.

[22] On political consumption, see Micheletti (2003) and Dulsrud and Jacobsen (2007).

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