Making social and natural sciences meet

Implications for the introduction of nanotechnology into society

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Summary

Nanotechnology is an emerging technology that is expected to make a considerable impact on society in the near future. Public attitudes towards nanotechnology are as yet uncrystallised, but this may change as products become available and the societal debate increases. The introduction of many new technologies has been accompanied by negative societal reactions, a clear example of which is the introduction of genetically modified foods in Europe. This illustrates the need for understanding the determinants of public response to nanotechnology, preferably in an early stage of technology development.

Identification of knowledge gaps and principles of best practice to be applied to nanotechnology requires integration and harmonisation of existing knowledge on public acceptance. Besides identification of societal issues relevant to technology acceptance, alignment of nanotechnology development with societal needs requires true interaction between the natural and social sciences.

Therefore, this report aims
i. to review which social science methodologies have been employed to understand the level of public acceptance of emerging technologies,
ii. to survey previous efforts to integrate social and natural sciences by interdisciplinary collaboration,
iii. to identify the current status of public acceptance of nanotechnology and its determinants.
Finally, this report aims to give recommendations for nanotechnology management and stakeholder dialogue strategies for the development and application of nanotechnology.

Chapter 2 explained why the method of the systematic literature review was ap) plied throughout the report, as it enables the synthesis of literature sources of various sorts into a robust, reproducible overview. The major advantage of this method is its reduction of subjectivity of the review. The systematic development and application of clear guidelines are essential parts of the method, following the phases of research question specification, data collection, study appraisal, synthesis and report. After application, this method is evaluated in chapter 6.

Chapter 3 describes the review of societal aspects to technology acceptance. It shows that models based on the rational actor assumption and developed in the information technology (IT) domain are generally applied, but have the caveat that potentially important determinants outside this rational actor model are insufficiently incorporated. In the study of technologies with an introduction history comparable to nanotechnology (such as biotechnology) affective determinants are broadly used; while a generally accepted theoretical frame work is absent. This leads to the conclusion that we should aim for generally accepted theoretical frameworks that include affective and risk perception

factors. If such a theoretical framework could be created, ideally complemented with dynamic elements, strengths of both the IT and the biotechnology approaches to societal acceptance of technology could be focussed for the case of nanotechnology.

In chapter 4, collaboration between natural and social sciences is systematically reviewed. It showed that the number of collaborations between the natural and social sciences has been increasing, especially over the last two decades. Papers on these collaborations, however, are scattered over almost as many outlets as there are papers, indicating a lack of proper publication platform and lack of focus in the field. Areas that particularly benefit from collaboration, such as environmental sciences, can be characterised by a complex, multidimensional nature. Technology introduction into society shows many characteristics of such a multi)dimensional problem, as lack of understanding of societal responses may impact further development of the science, while a technology integrated with societal demand is more likely to be successful. The chapter also provides an overview of opportunities (funding of collaboration initiatives, and the creation of truly interdisciplinary sciences or scientists) and barriers communication issues such as different paradigms, jargon, lack of respect, and the difficulty to publish) for successful collaboration.

Chapter 5 presents the current research on nanotechnology acceptance. The results suggest that in general, the study into public acceptance of nanotechnology is starting to take off. Preliminary preparations have been made in more policy oriented acceptance programs aimed at setting up the societal debate, diffusing knowledge and instilling a level of ethical awareness within the natural sciences. Thorough accounts of how the public will respond, with a strong theoretical basis, or truly collaborative appraisal shared between social and natural scientists appear to be rare to date. While we acknowledge these preliminary steps were essential to take us to the current level of our knowledge of acceptance, it is important not to wait too long in making the next step towards more comprehensive understanding of acceptance of nanotechnology. Funding of substantial, high quality research into this area is a prerequisite for this understanding as such research, following from the number of publications, has largely been lacking to date. Finally, chapter 7 discusses the findings of this report in general and from an actor perspective. Additionally, as nanotechnology can be considered an issue,i.e. an unresolved subject of societal discontent leading to controversies which can have an impact on a company or organisation and its reputation, the principles of issues management are introduced to further understand the status of nanotechnology in society. The need for proactive issue identification through dialogue and principles for strategic dialogue are explained.

In conclusion
This report has systematically studied major building blocks to start addressing the issue of nanotechnology introduction. The identification of the relevant literature and what this can teach us provides input for further steps to be taken to facilitate a nanotechnology introduction that is regarded as societally desirable.

Nanotechnology has many characteristics that make this technology a likely one to become a societal issue. Nonetheless, little is known about the demand made on nanotechnology applications, nor the concern from non)experts, as empirical research among end)users is scarce. The review on technology acceptance in general gives directions on important societal issues to include in such study, e.g. risk perception and trust, as well as usefulness and ease of using nanotechnology. By studying end)users wishes and concerns an important determinant of societal nanotechnology introduction would be covered. However, the end)user is not the only stakeholder in this high)potential technology. Athorough stakeholder analysis could identify the relevant parties and their interests. An important element in such analysis and a prerequisite for a fruitful discussion is to acknowledge the differences in paradigms that probably exist between the different stakeholders.