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# Nanologue Mapping Study

Summary of key findings from a literature study on  
ethical, legal and social aspects of nanotechnologies

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This paper is a joint publication of the Wuppertal Institute (WI), EMPA, Forum for the Future (FFF) and triple innova (TI). It was written by Volker Türk, Sören Stöber, Dr. Christa Liedtke (WI), Dr. Hans Kastenholz, Andreas Köhler (EMPA), Hugh Knowles, Tim Aldrich (FFF), Michael Kuhndt, Stephan Schaller (TI).



## 1. What is this paper about?

Nanologue's overarching objective is to facilitate a dialogue among researchers, business and civil society about the benefits and potential impacts of nanoscience and nanotechnology applications.

The first work package of the project was designed to prepare the ground for the subsequent discussion, providing an overview of current research into the ethical, legal and social aspects (ELSA) of nanoscience and nanotechnologies (NT) and identifying applications to be scrutinised in depth with regard to ELSA in the course of the Nanologue project.

This mapping study is one of the two deliverables from the first work package.<sup>1</sup> It was carried out as an information input for the Nanologue project, with the aim of selecting specific NT applications and a core set of relevant ELSA. Additionally, the results serve as basis for the analysis of the selected applications and their relationship to ELSA (see Nanologue Background Paper).

In the following the mapping procedure and methodology used to choose the NT applications and the set of ELSA will be introduced. Chapter 3 presents the main results. Chapter 4 will give some background information on the Nanologue project. Finally, the appendix provides a synopsis of the reports, which were analysed as well as references on the mapped publications.

It should be mentioned that this mapping study, including its appendix, is a compilation of information and sources that primarily serves to inform the subsequent work packages of the Nanologue project. We do not claim to provide a comprehensive overview on NT applications and their relationship to ELSA, nor to have conducted a thorough analysis. However, the authors would like to share the current state of investigation with a wider audience in case they might find it useful.

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<sup>1</sup> For the other deliverable check: Nanologue Background Paper on selected nanotechnology applications and their ethical, legal and social implications. A joint publication of the Wuppertal Institute, EMPA, Forum for the Future and triple innova. Available at [www.nanologue.net](http://www.nanologue.net).

The Nanologue project aims at raising awareness and stimulating discussion, not because we have a particular view about the potential opportunities and risks that NT presents. Our role is to encourage dialogue between stakeholders, facilitating constructive approaches for addressing the implications of NT.

## 2. Our approach

From the outset, the Nanologue project intended to base the dialogue on specific nanotechnology applications rather than on “Nanotechnology” in general. In line with the European Commission’s strategy for nanotechnology, we understand “Nanotechnology” as a collective term, encompassing the various branches of nanosciences and nanotechnologies.<sup>2</sup> Instead of discussing the ethical, legal or social aspects of such a broad area, we chose a **step-by-step approach** to narrow down the project’s scope.

At the beginning of the project, we agreed on working definitions for nanotechnology, nanoscience, and ELSA. It was decided not to focus on ELSA from a specific discipline’s approach, but to use ELSA as a proxy of all different kinds of opportunities and threats the applications of nanotechnologies can pose to society (see the next chapter for more details). As a basis for discussion, the following definitions of nanoscience and nanotechnologies will be used:<sup>3</sup>

**"Nanoscience** is the study of phenomena and manipulation of materials at atomic, molecular and macromolecular scales, where properties differ significantly from those at a larger scale.

**Nanotechnologies** are the design, characterisation, production and application of structures, devices and systems by controlling shape and size at nanometre scale".

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<sup>2</sup> Commission of the European Communities (2004). Communication from the Commission. Towards a European Strategy for Nanotechnology. Brussels. p.4.

<sup>3</sup> The Royal Society (2004). Nanoscience and nanotechnologies: opportunities and uncertainties. RS Policy document 19/04. London, p.5.

In a **first step** each consortium partner carried out a mapping of current literature to identify NT application areas of potential relevance for the project. The literature revealed a variety of categorisation schemes for NT application areas, many of them with a smaller or larger overlap. With the aim of initiating a dialogue based on applications close to the market and with relevance to various ethical, legal and social aspects, the areas materials, medicine & life-sciences, electronics & ICT as well as energy were pre-selected as priority areas for the project. Within each NT application area, a multitude of specific NT applications was identified and listed.

In parallel, a first preliminary analysis of the ethical, legal, and social aspects of NT applications discussed in the literature was carried out. More than hundred nanoscience- and nanotechnologies-related publications (studies, project descriptions, articles and websites) were mapped in order to provide a first overview of the state of the art and the ongoing debate.<sup>4</sup> Studies and projects funded by the European Commission, national funding organisations in leading NT countries and other organisations were also considered.

In a **second step** 15 recently published overview reports related to NT were chosen for more detailed analysis. Aiming to get an overview of the current state of discussion as well as the different perceptions, views and positions held, a broad mix of reports was chosen<sup>5</sup>. Selection criteria were:

- authors with different backgrounds, such as academia, business and civil society;
- different foci should be highlighted, such as ELSA, economic issues, public perception of NT;
- studies that received a high attention as well as less known publications should be covered.

Finally, based on the findings and further in-depth research (desk research, expert interviews), the consortium partners selected and narrowed down in a **third step** three application areas for NT and a core set of the most relevant ELSA for more detailed investigation.

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<sup>4</sup> A list of the mapped publications is presented in the appendix.

<sup>5</sup> Summaries of the reports analysed are presented in the appendix.

Following up on the pre-selection of broad NT application areas in the first step, specific application areas have been chosen based on the following criteria:

- public availability of information;
- current state of R&D. Only applications with prototypes already on the market or expected to be on the market within the next 5 years qualify;
- nomination by consulted experts;
- relevance to a variety of ELSA, as identified in the first two steps;
- applications should be expected to be widely used and/or have a large economic potential.

In addition, when selecting application areas it was aimed at covering areas that are related to both, public expectations (hopes, benefits) as well as concerns (fears, risks). Recent stakeholder activities or press coverage should have indicated public awareness of the selected NT-application areas.

Following the projects understanding of ELSA as a proxy for opportunities and threats that NT applications can pose to society, seven aspects have been identified that captured the vast majority of potential benefits and impacts found in the first two steps.

### 3. Key Results

Based on the literature mapping, a detailed analysis of the 15 reports, further desk research, expert interviews and supported by some members of the project's Expert Advisory Board, the consortium selected three specific NT-application areas as well as a core set of seven ELSA as objects for investigation and dialogue for the course of the project. These are:

- **Selected NT application areas:**
  - energy conversion and storage;
  - food packaging;
  - medical diagnostics.
  
- **Selected ELSA:**
  - environmental performance;
  - human health;
  - privacy;
  - access;
  - acceptance;
  - liability;
  - regulation & control.

In a next step each of the NT application areas mentioned above and their relationship to the selected ELSA will be analysed in detail. The results are published in the "Nanologue Background Paper on selected nanotechnology applications and their ethical, legal and social implications".<sup>6</sup>

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<sup>6</sup> Nanologue Background Paper on selected nanotechnology applications and their ethical, legal and social implications. A joint publication of the Wuppertal Institute, EMPA, Forum for the Future and triple innova. Available at [www.nanologue.net](http://www.nanologue.net).

## 4. Nanologue Project Description

### Introduction

Nanologue brings together leading researchers from across Europe to facilitate an international dialogue on the social, ethical and legal benefits and potential impacts of nanosciences and nanotechnologies.

In the aftermath of the controversy and debate on genetically modified organisms it has become abundantly clear that in order to harness new technologies for economic and social benefit, governments and businesses will have to address a wide range of social, ethical and regulatory concerns. Nanologue will bring together current leading research on the social, ethical and legal implications of nanotechnologies, facilitate dialogue and produce guidance for stakeholders and developers of nanotechnologies, in particular on how to address the issues uncovered to the benefit of both society and the economy.

Nanologue aims at providing a common ground for discussion between actors from the civil society, academia and business. A deliberate consideration and elaboration of different positions regarding the opportunities and risks of nanotechnology is a keystone of the Nanologue project.

### Project steps

The project comprises three main steps.

1. A mapping study on recent developments regarding selected nanotechnology applications is currently undertaken to lay a common ground for the subsequent discussions.
2. Moderated dialogue sessions will be held allowing for an inclusive and neutral platform for information and opinion exchange and discussion. Interviews with experts will contribute to substantiate findings and opinions.
3. Insights will be translated into scenarios allowing for easy communication of the potential implications of these emerging technologies.



## Dissemination

Results of the project will be disseminated by a variety of means, ranging from media workshops, a website and an online quick checker, to a project pamphlet and conference attendances.

## The partners

Nanologue is led by the Wuppertal Institute (Germany) and conducted in cooperation with its consortium partners EMPA (the Swiss Federal Laboratories for Materials Testing and Research) in Switzerland, Forum for the Future in the UK and triple innova of Germany.

The project is a Specific Support Action in the NMP work programme (Nanotechnology and nanosciences, knowledge-based multifunctional materials, new production processes and devices) of the European Commissions sixth Framework Programme.

## Further information

For further information on the Nanologue project check [www.nanologue.net](http://www.nanologue.net).

## 5. Appendix

See separate document