NanoTechnology Assessment

Exploring Potentials of Nanotechnologies, Avoiding Pitfalls of Ignored Risk Perception

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ITAS at a Glance

- One of more than 20 scientific institutes within the Forschungszentrum Karlsruhe (Research Centre Karlsruhe)

- Largest TA unit within Helmholtz Association (HGF), Germany‘s largest research organization

- Mission: Comprehensive analysis and evaluation of the development and application of technology and its interrelationship with processes of societal change

- Currently three research areas:
  - Environment and resource management
  - New technologies, innovation processes, technology impacts
  - Knowledge society, knowledge systems, knowledge policy

- Research Group ‘TA for Nanotechnologies‘

- Operates the TA units of the German (TAB, since 1990) and the European (STOA, since 2005) Parliament

- Member of ETEPS – The Network for European Techno-Economic Policy Support
Technology Assessment – The ITAS Perspective

Technology Assessment

scientific

communicative

factual knowledge

procedural knowledge

methods development

research questions

science-based info

methodological reflection

Natural Sciences
Engineering
Social Sciences
Economics
Political Sciences
Innovation Research
(...)

Politics
(Admin., Parliament)
Science Management
Industry
NGO
NanoTA at ITAS

Nanotechnology & Society

Nanoscale Materials (Nanoparticles), Toxicology & Risk

Nanotechnology for Energy Applications

Nanotechnology for Biological Applications, Converging Technologies

General TA & Methods
Technology Foresight
Perception & Communication
Nanotechnology: Challenges for TA

- neither clear definition nor common language
- wide range of approaches, different timescales
- **emerging** technologies, most activities closer to science than to technologies
- mostly ‘**enabling** technologies’
- strategies mainly technology-driven
- analytically: a set of different technologies for different applications → no single general assessment
Nanotechnology – Four Layers of Interdependence

Various paths of interaction between NT and society
Different issues for S&T policy (and TA)
→ necessity to link current (research) activities with future potential applications of Nanotechnologies
Potential Analyses for Technology Assessment

- Variety of technology forecasts, foresight reports, market studies – general or sectoral – available

- Huge market figures – questionable (methods, timescales, boundaries) but effective (politics, media, …)

- Creating a hype can establish a business – neutral positions are rare

Since NanoTA deals with emerging enabling technologies, novel methodical approaches are needed:

a) a tool to link R&D activities with visions for applications

b) a ‘support layer’ for the technological interpretation of (political) scenarios including future technology options
Roadmapping methodology can be adapted for TA for emerging enabling technologies

Traditionally used to gather, structure and communicate information about technologies and products, and to link them to options for the future in companies and industries.

More recently used as decision aids to design public policies related to research and development (de Laat 2004).

For NT, a number of roadmaps exists - produced by small groups of experts with a “technology push” perspective - most remain unnoticed or ignored in R&D policies.

Hypothesis: For the acceptance and the relevance of a roadmap, process aspects (design, participants, modes of communication, …) are as important as the technical product (the roadmap) itself.

When integrated into a TA process, roadmapping may serve as a powerful tool to provide empirical and structural knowledge and to produce consensus on strategies.
Diffusion: TA adds a broader perspective

- Diffusion / Commercialization are key to success.
- Perspectives often disciplinary (business management, engineering) but commercialization is an complex process.
- Integrated view may offer deeper insights – avoidance of failures, more coherent policies and innovation strategies
- Example: Biases in diffusion research – ‘Pro-innovation’ and ‘Individual-blame’ (E.M. Rogers)
- Underestimation of the social dimension of innovation – Need to study ignorance, rejection or discontinuance of innovation, re-invention, anti-diffusion programs
- Failure of innovation is discussed as a problem of the individual rather than from a systemic perspective but systemic failures are targets for political interventions

→ TA provides knowledge on many of these aspects, historical processes (analogies), roles and interplays of actors, …
Public Attitudes to Nanotechnology

- Only few empirical studies, isolated. Preliminary results. Trends seem to be similar in U.S. and Europe.

- General public does not know very much about nanotech
  
  GB 2004: 29% have heard about NT, 19% can give some kind of definition
  D 2004: 30% have heard about NT, 15% can link it to specific developments
  USA 2004: >80% had heard “little” or “nothing” about NT, most could not correctly answer factual questions about it

- Majority (~90%) is not interested in NT (or does not care)
  
  EU25 2005: Most interested in medicine (61%), environment (47%), humanities (30%), internet (29%), … – nano 8%.

- Among those who are interested, argumentation of proponents often perceived as asymmetric:
  
  - Developments will bring ‘revolutionary breakthroughs’ but no significant implications are to be expected
  - Benefits are attributed to ‘nano’, related risks are described as problems of application technologies
(Popular) Pictures of ‘Nanotechnology’
Currently three layers (chronologically):

- Risks of visions: Visions show real consequences regardless of their seriousness
- Risks of unknown material properties at the nanoscale
- Risks of (failed) communication and of public engagement
Impacts of Visions

- Visions (positive and negative) are an important topic in the public communication of NT (‘Bill Joy-Debate’, visualizations in magazines, popular culture: ‘Prey’, ‘Matrix’, …)

- Visions may shape acceptance and further development of this field

- Visions are ambivalent: high potentials often include high risks

→ TA could include a ‘vision assessment’

→ Goal: transparent, knowledge-based discussion about imaginations of the future

→ Vision assessment within a TA process could prevent ‘fear of fears’ and help to avoid damages for the development of S&T and for the culture of democratic decisions
Risks of New Material Properties

- New (surprising and partially still unknown) properties of materials at the nanoscale
- Example: Behaviour of nanoparticles in the human body and the environment – extensive research needs, but already on the market
- NanoToxicology – first results, knowledge still insufficient, challenges for conventional methods of toxicological research
- „new forms of known chemicals“ or „new chemicals because of different chemistry“?

→ TA knowledge supports development of policy approaches and business strategies
→ Precautionary principle (Call for Moratorium), Regulation, preventive measures? – Balance with innovation policy? – 'Übermaßverbot (prohibition of excess)' as limiting principle
→ Examples: 'Asbestos Experience' as a parallel and warning sign, Positions and roles of (re-)insurance companies
Societal debates about Nanotechnology

- NT attracted (some) interest from media and civil society groups, but not (yet?) from the public at large
- Lack of specificity of NT – open to (misleading) analogies and false generalizations – asymmetric perspectives of proponents – impact on public perception of NT?
- Currently, three discourses (of different types) evolve:

  **Unknown material properties and their impact on humans and the environment:** Some peculiarities, but in general similar to other chemical risks – ‘classic’ regulatory policy debates.

  **Implications of NT-enabled technologies:** IT (privacy, surveillance), medicine (biopolitics, neuroethics), food technology, … – adapted TA.

  **NT as another representative of ‘risk technologies’ in general STS debates:** Societal control of science, trust in scientists, lack of influence in decision-making in S&T, …

- Reflexive science distinguishes here, most researchers, policymakers and the media do not. Will the public?
Communication and Public Engagement

- Reluctance of (many) scientists to engage in public debates about benefits, challenges and uncertainties surrounding NT

- Focus on providing information and education – necessary, but not sufficient. Listen to and address public concerns.

- (Risk) Communication is mainly about trust! Balance, honesty, responsiveness. Concede uncertainties. Accept fears of unknown.

- Nanotech is what people think it is.

- Accept and involve the public as a partner, especially in discourses about potentially controversial risk issues

  → TA provides procedural knowledge on risk communication and experiences from public and political debates about other ‘risk technologies’ (nuclear, genetic, …)

  → TA as a process contributes to societal opinion forming, addresses public concerns, supports public understanding of science and technology
Innovations can be successful without previously considering their societal impacts, but …

… many innovations failed because societal needs & impacts were not adequately addressed in the development process.

TA provides knowledge and methods to avoid mistakes, to reduce uncertainties and support diffusion:

- **Needs / Problems**: Identification of societal needs, problems requiring innovation, promising markets, vision assessment.
- **Basic Research**: Strategic decision-making, Strengthen national R&D capacities, Support R&D priority setting, Provide techno-market insights.
- **Applied R&D**: Investigate socio-technical feasibility, Moderate university-industry-government interactions, Coordinate National Innovation System.
- **Product Development & Engineering**: Standards policies, Government as buyer-innovator, Regulatory policy, Environmental impacts.
- **Production & Marketing**: S&T communication, Risk communication & perception, Risk Assessment, Acceptance, LCA, Consumer protection.
- **Incremental R&D**: Sustaining and adapting innovations, Create long term value.
Summary (2)

- Public involvement in dialogue and risk evaluation:
  - incorporate views from the general public in decision-making, improve the knowledge base and quality of decisions
  - establish trust and legitimacy, identify issues, mediate and resolve conflicts, reduce risk of rejection
  - educate and inform

- Some issues:
  - don’t confuse stakeholders with ‘the public’
  - the ‘public’ is highly differentiated (background, values, attitudes, …) – broad consensus? – selection, evidence, legitimacy?
  - applications of NT still vague – object of engagement, foresight?
  - controversial among scientists and policymakers – boundaries between positions, recommendations and decisions?

Not consulting the public early may lead NT into a “next GMO crisis” – what forms of engagement could avoid it?

Best practices? Institutional issues? Imaginative approaches?
Thank You