Identification of innovative standardisation fields in Germany: Methodology and Results for Nanotechnology

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Background

- strong focus of R&D funding in innovation policies, especially in emerging technologies
- but: reduced focus on standardisation and standards as part of the innovation process and the innovation system
- numerous technology transfer programmes
- but: almost no acknowledgment of standardisation and standards as instrument of technology transfer
- consequently frictions in the innovation process and inefficient exploitation of public resources
- recent case: nanotechnology in Germany

Background

- the efforts to research nanoscale phenomena have drastically increased worldwide
- in Germany, almost € 300m poured into public R&D programmes, in the European Union, the expenditure of € 750m almost matches that of the USA
- consequently, significant advances were made in recent years, not only regarding the understanding of the structures and processes on the atomic and molecular level (nanoscience), but also concerning the utilisation of these nanoscale phenomena for certain commercial purposes (nanotechnology).
- Germany was not able to leverage excellent position in nanotechnology research into a leading position in nanotechnology standardisation due to missing acknowledgment of the need for nanotechnology standards in research funding
- little success of the catching-up efforts in getting influence on European and international nanotechnology standardisation in the short run, e.g. by applying for chair and secretaries
- impacts on success of future nanotechnology research and commercialisation unclear
- but: the programme "Promotion of Innovation and Marketability through Standardisation (INS)" on behalf of the German Institute for Standardisation and funded by the Federal Ministry of Economic Affairs and Technology fosters the integration of innovation and standardisation more efficiently also by detecting in time new fields of standardisation relevant for German researchers and industry

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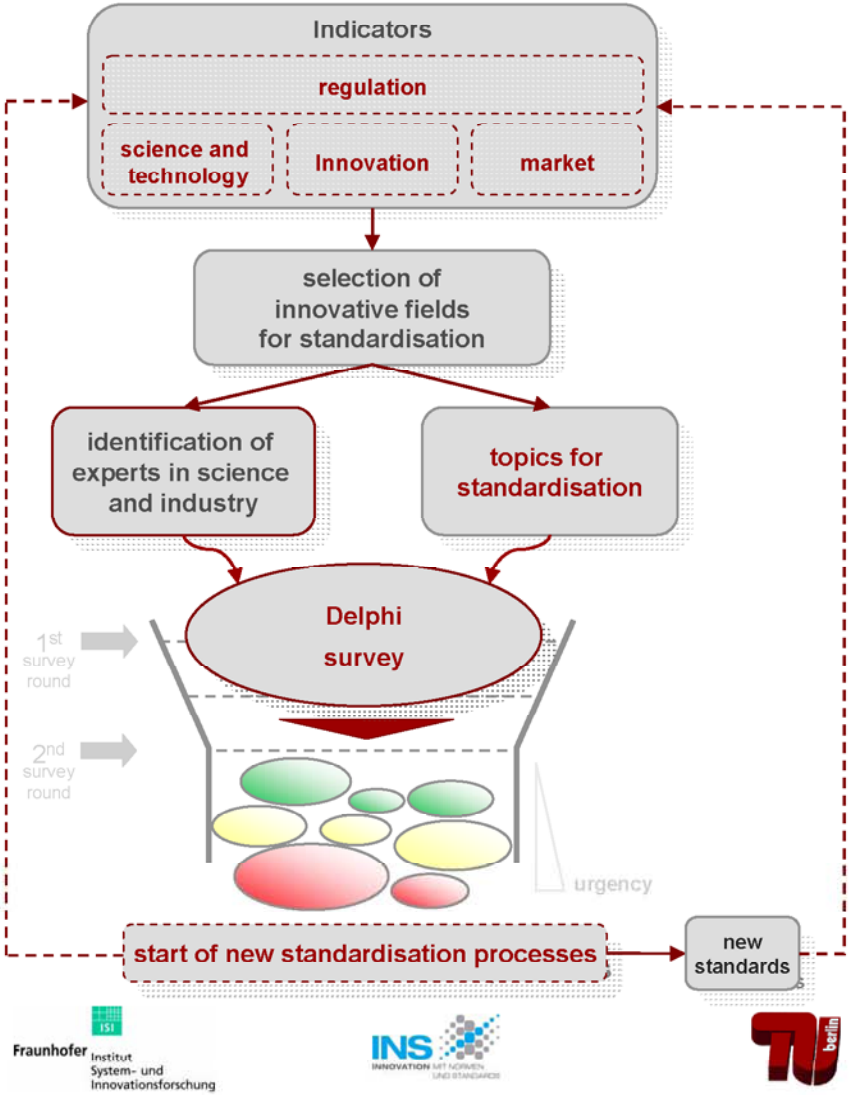
Approach for the identification of innovative standardisation fields

- Objectives:
  - Identification of promising standardisation themes
  - Awareness building among researchers and research organisations, because standardisation bodies have to take a proactive “Pull-Function”, e.g. ITU, ETSI



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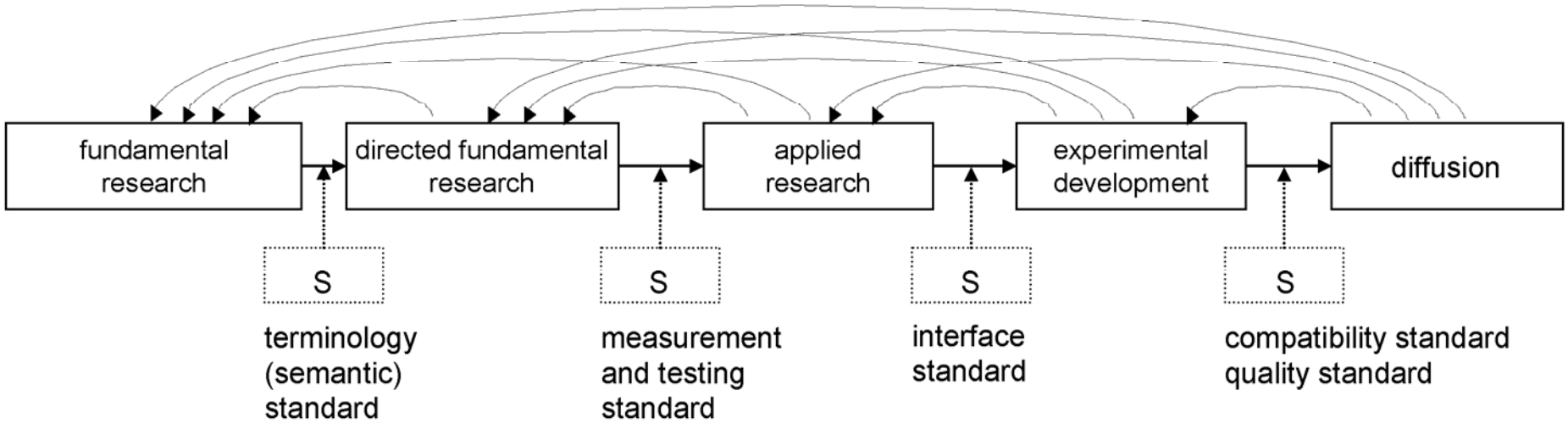
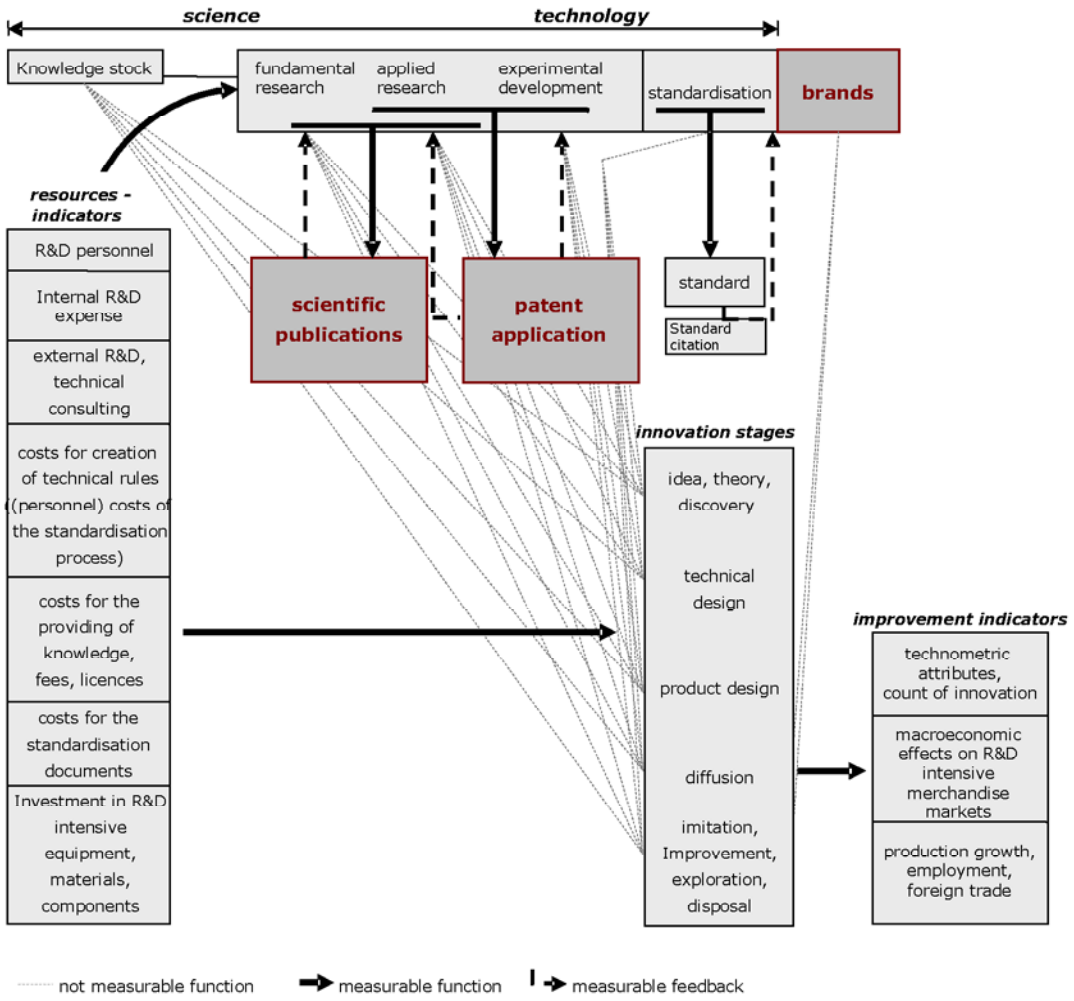
Standards in the research and innovation process



function	Reduction of information costs Reduction of transaction costs	interoperability between components reduction of adaption costs	higher quality reduction of health risks safety and privacy generation of critical mass returns to scale networking effects interoperability between products

Source: Blind and Gauch JTT 2008

System of science and technology indicators

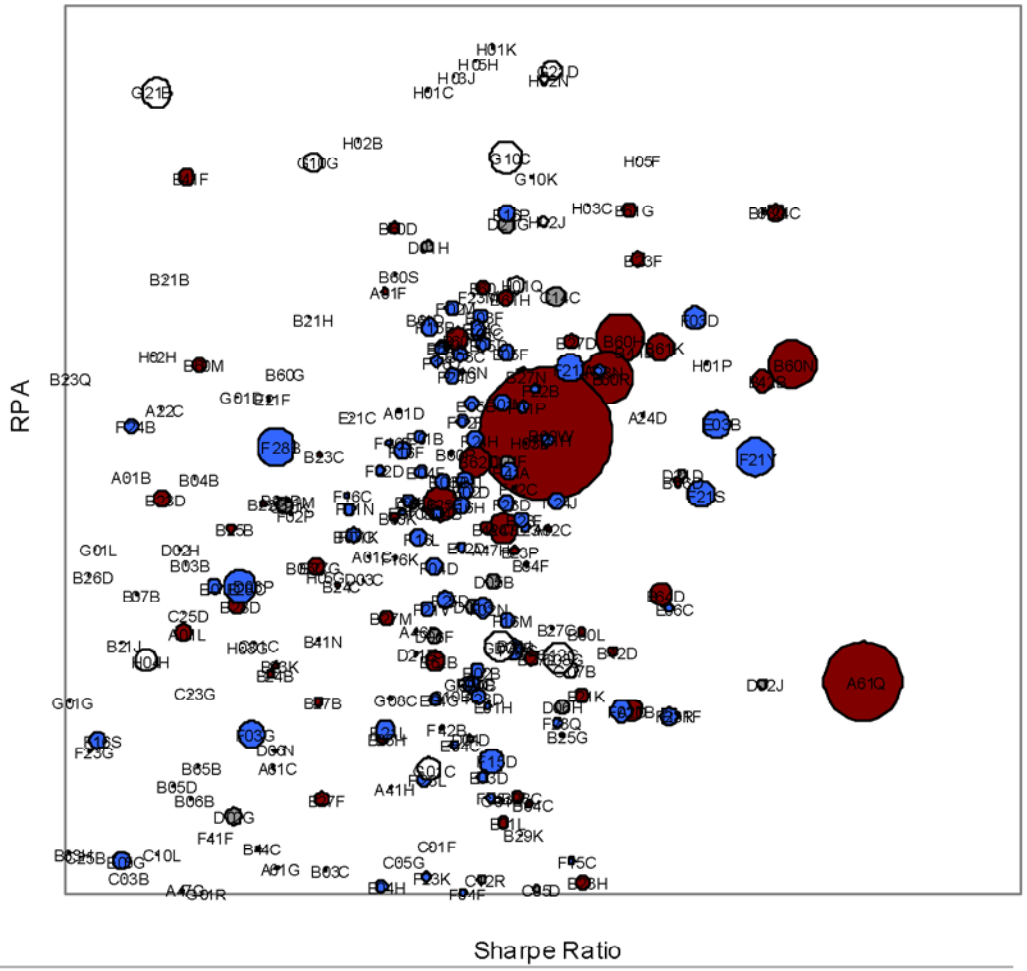


Source: modification of Grupp 1998

Comparative patent rate (RPA) vs. Sharpe Ratios for German patent applications for 628 IPC classes for publications between 1990 an 2004

$$RPA = 100 * \tanh \ln \left[\left(P_{ij} / \sum_i P_{ij} \right) / \left(\sum_j P_{ij} / \sum_{ij} P_{ij} \right) \right]$$

$$SharpeRatio = (W_F - W_G) / S_{WF}$$



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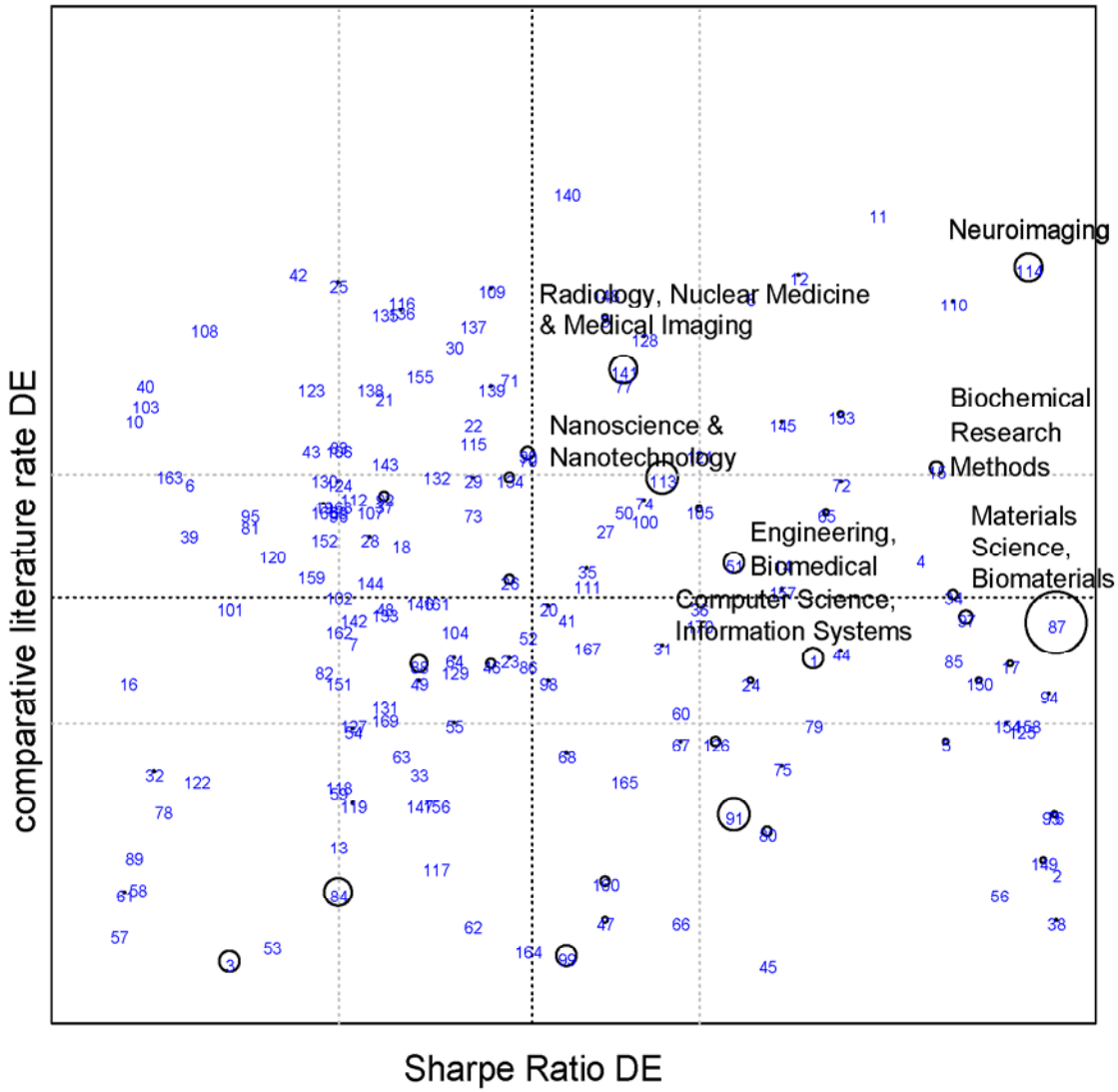
IPC classes with top positions of Germany both in comparative patent rate (RPA) and Sharpe Ratios

A61C	DENTISTRY; ORAL OR DENTAL HYGIENE
A61Q	USE OF COSMETICS OR SIMILAR TOILET PREPARATIONS
B60D	VEHICLE CONNECTIONS
B60J	WINDOWS, WINDSCREENS, NON-FIXED ROOFS
B60S	SERVICING, CLEANING, REPAIRING, SUPPORTING, LIFTING, OR MANOEUVRING OF VEHICLES, NOT OTHERWISE PROVIDED FOR
B61C	LOCOMOTIVES; MOTOR RAILCARS
B61G	COUPLINGS; DRAUGHT OR BUFFING APPLIANCES
C10B	DESTRUCTIVE DISTILLATION OF CARBONACEOUS MATERIALS FOR PRODUCTION OF GAS, COKE, TAR
C10K	PURIFYING OR MODIFYING THE CHEMICAL COMPOSITION OF COMBUSTIBLE GASES CONTAINING CARBON MONOXIDE
D01H	SPINNING OR TWISTING
D06P	DYEING OR PRINTING TEXTILES; DYEING LEATHER, FURS, OR SOLID MACROMOLECULAR SUBSTANCES IN ANY FORM
E03F	SEWERS; CESSPOOLS
F03D	WIND MOTORS
F16P	SAFETY DEVICES IN GENERAL
F28B	STEAM OR VAPOUR CONDENSERS

Comparative literature rate vs. Sharpe Ratios for German scientific publications for 170 research areas from 2003 to 2005



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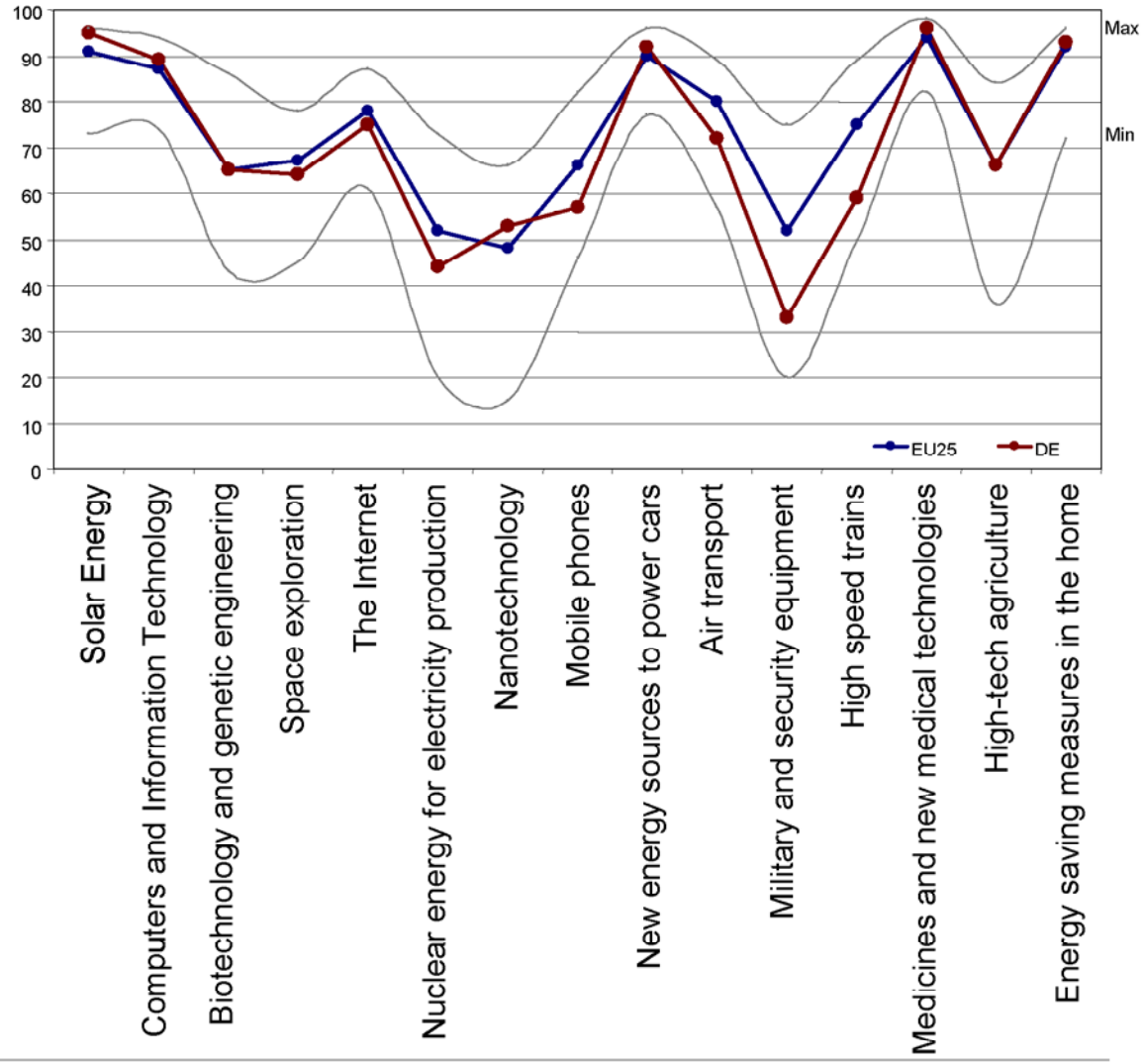
Expected Impact of New Technologies on Citizens' Life (Source: Eurobarometer 2005, own calculations)



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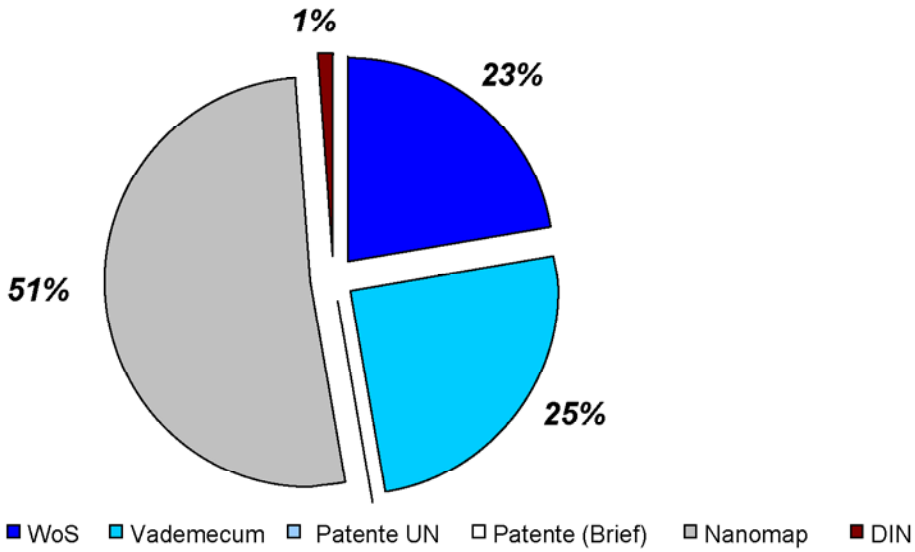
Topics of Delphi survey

- Nanoparticles / Nanopowder / Nanolayers
- Measurement and Testing
- Impacts on Health
- Impacts on Safety
- Environmental Impacts
- Product and Process Standards
- Applications (Food, Biotechnology / Medicine / Cosmetics, Information and Communication Technology / Electronics, Material Research, Automotive Industry, Agriculture)

Composition of expert sample

- Identification of 1500 experts via:
  - scientific publications
  - European patent and brand applications
  - different databases and networks
  - representatives of relevant establishments, such as environmental associations, consumer organizations, professional associations, unions and regulation bodies

- Number of responses
  - 147 responses
  - 98 completed surveys
- Composition of responses



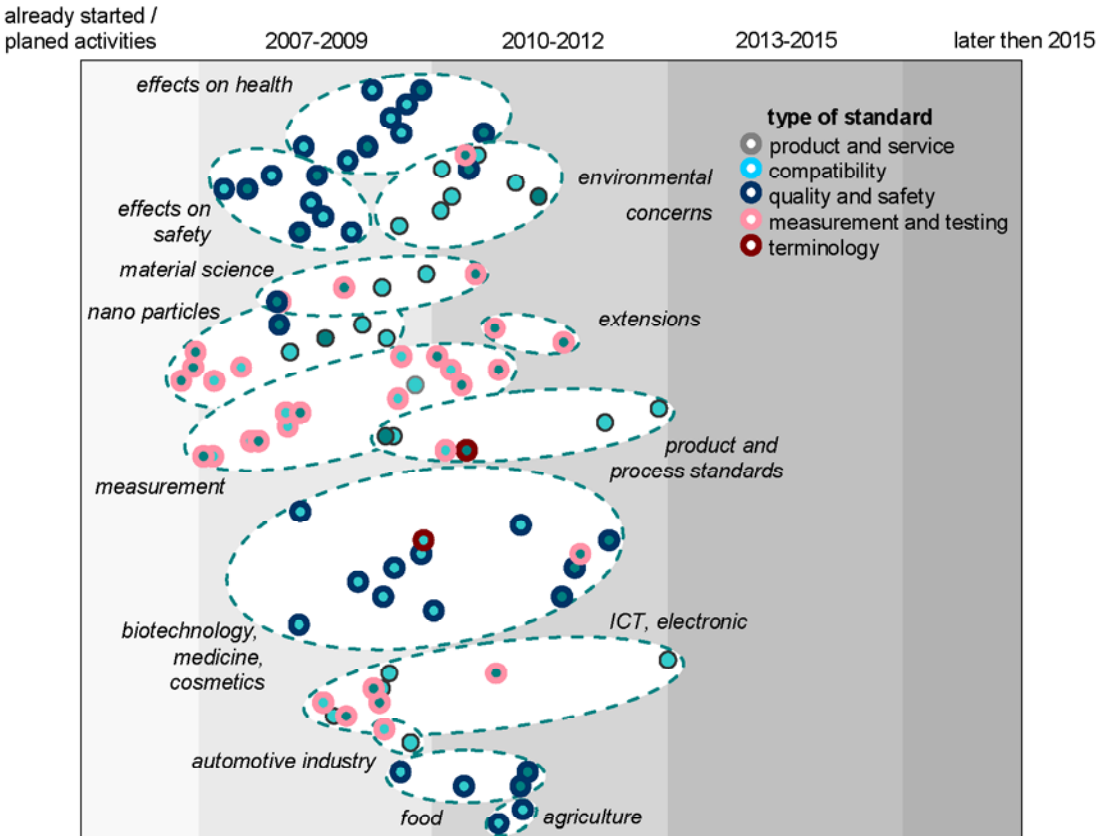
Structure of the questionnaire

- General information about the expert, incl, involvement in standardisation
- Assessment of potential of standards and standardisation for their work
- Use of standards for their work
- Assessment of standardisation needs for more than 50 items according
  - to time
  - importance for technological development, economic development, solution of environmental problems, protection of health and safety
  - type of standards, i. e. standards for terminology and classification, measurement and testing, quality and safety, compatibility, final products and services, or no standard
  - level: national, European or international

Main results

- standards in the area of nanotechnology are necessary for environmental and safety concerns, whereas they are not so important for the technical and economic development.
- fields are of highest priority
  - material composition
  - surface analysis
  - multiple coordination probing and positioning, position indicating systems
  - size and geometric specifications for sample probing
  - destruction-free measuring
- measurement and testing standards, but also quality standards are needed in particular in the field of nanotechnology, still a significant need for terminology standards; compatibility final product standards are of low priority

Assessment of the topics by time and type of standard



First assessment of standards foresight

- Indicator and survey approach are in general adequate
- Integration of both approaches important for the survey related to the identification of experts, but also themes further synergies possible
- further differentiation of the indicator, but also of the survey approach necessary in order to identify relevant fields, but also to focus with shorter questionnaires on more specific target groups, which increases the representative ness and therefore the validity of the results
- simple transfer of technology foresight experiences to standardisation foresight not possible, because of much more heterogeneous stakeholders and different objectives
- further complementary awareness raising necessary, e. g. by funding researchers for their standardisation activities or by changing their incentives schemes
- in general: more integration between
  - technology and standardisation foresight
  - research and standardisation funding
  - incentives in the research and the standardisation system