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The budgetary allocation for accompanying research on nanotechnology in Germany, Great Britain and the EU research program

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Summary

Compared to other technologies, research accompanying R&D activities has been demanded for nanotechnology relatively early. The overall aim of such research is mostly consensual, namely the prevention of hazards for human health and the environment and of other possible adverse effects of nanotechnology. However, the kind of research or the activities to reach this goal were, and still are, highly disputed, in particular the amount of necessary funding. Often a rate of 5 % of the overall budget was considered adequate, while some parliaments demanded an even higher rate (Germany 10 %, Netherlands 15 %).

The controversies summarised in this dossier exemplarily show that due to a lack of a national and a European reporting system on the budget of nanotechnology research, the amount of funding for accompanying research cannot be determined unambiguously. The reason for this shortcoming is the very concept of nanotechnology bridging various disciplines and technologies as well as its character as a cross-sectional enabling technology. Thus, nanotechnology is orthogonal to department affiliations and administrative structures. Since research is organized mostly along administrative competencies, and because funding is not listed according to the purpose of the research, the implementation of a meaningful reporting system is a huge challenge. However, without such a reporting system a discussion on the orientation of and the financial support for accompanying research does not make much sense.

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Introduction

In the eyes of many experts, nanotechnology is a key technology of the 21st century. According to their opinion, this technology will lead to many innovations and in the end results in radical technological and societal changes. Therefore, and against the background of experiences made with regard to genetic engineering, there have been requests since the beginning to develop accompanying research on nanotechnology. The expectations and ideas on the goal of such accompanying research vary to a large degree or have not even been stated. Nevertheless, there is a general consensus at the political level that funding shall be provided therefore. While objectives, focus, strategy and methodology of accompanying research could theoretically trigger a wide spectrum of political disagreements, the debate most often concentrates on the question of the budget share which shall be allocated accordingly. Some industrialized states as well as the concerned research departments of the European Union (EU) have proposed an amount between 5 % and 15 % of the budget.[1]

This dossier is the third on this issue[2] and concentrates on the discussions surrounding the budgetary allocation for accompanying research in two exemplarily chosen EU states (Germany and UK) as well as in the European research framework program.

What is accompanying research?

The term "accompanying research" is not clearly defined[3]. It is a relational expression which refers to the relationship between efforts made as regards technology development on the one hand and those research activities called for by society which accompany technology developments on the other hand. The term "accompanying research" cannot be understood from a purely disciplinary perspective. It only makes sense in the context of research policy where it serves as a reference point and projection space for demands. In the following, we understand accompanying research as *all societally requested research activities which are focused on a technology but do not directly regard its development*. English speaking regions do not use any comparable category. There, accompanying research is understood as EHS (**e**nvironment, **h**ealth, **s**afety) and as ELSI (**e**thical, **l**egal, and **s**ocial **i**ssues). Nevertheless, in this series of dossiers we keep to this *terminus* as it does not merely relate to certain topics but is geared at specific intentions. It is essential that the concerned research reacts to an anticipated or explicitly articulated societal demand.

Germany

The necessity and extent of accompanying research was discussed at the Bundestag in 2004[4]. In the course of the debate, a proposal by the red-green federal government was accepted by the Bundestag. This proposal requested that 5 % of funding designated for nanotechnology research be designated for accompanying research on nanotechnology[1]. As there is no central reporting system regarding funding on nanotechnology and its specific designation, it is difficult to determine whether this promise has been kept. In 2006, the answer[5] to a "brief enquiry" ("Kleine Anfrage") by the Greens for the first time provided for a bit of transparency. According to this answer, the Federal Ministry for Education and Research *(Bundesministerium für Bildung*

und Forschung, BMBF) had allocated 134 M € for R&D with regard to nanotechnology. In addition, there was funding of 36 M € by two other ministries (Federal Ministry of Economics and Technology (BMWi), Federal Ministry of Transport (BMV)) and of 162 M € by the big research foundations (Max Planck Society, Fraunhofer Society, Helmholtz Society, Leibniz Society). Thus, the total funding with regard to nanotechnology amounted to 330 M € in 2006. 6,5 M € were allocated for accompanying research, from which 1,5 M € were designated for "scientific research on chances and risks", 3,8 Mio € for "innovation-supporting measures" and 1,2 M € for "education, training and social aspects". The amount for accompanying research therefore amounted to ca. 2 %, however including innovation-supporting measures which *inter alia* also include funding of national networks of competence and the national contact point on nanotechnology, therefore not constituting accompanying research in the strict sense. It is also questionable whether "education, training and social aspects" can even be counted as accompanying *research*.

The question as to an appropriate risk strategy and to the therewith connected need of regulatory measures was addressed in 2007, following a parliamentary enquiry by the Greens from March 21, 2007[6]. The speaking contributions made during the plenary session evidence a wide margin of interpretation concerning the allocation and, to a majority, referred to the divergence between the aspired 5 % and the actual designated funding regarding accompanying research. In August 2007, the report the enquiry requested was presented. However, this six page report did not contain any information on the volume of funding – except for a reference to three large projects, NanoCare, INOS, TRACER, which were comprised under the name NanoCare and funded with 7,6 Mio €[5].

In April 2009, the federal government again made a proposal concerning the research policy with regard to nanotechnology[7], which was accepted by the Bundestag in July. The proposal stipulates: *"die Risikoforschung noch stärker als bisher finanziell zu fördern, indem der Anteil der Risikoforschung an den gemäß Haushalts- bzw. Finanzplanung bis 2012 vorgesehenen Mitteln bedarfsgerecht erhöht wird, wobei hier ein Wert von mindestens zehn Prozent angestrebt werden sollte."*[8] ("to financially support risk research stronger than so far by suitably increasing the apportioned share of risk research in the foreseen means allocated by the budgetary and financial plans, whereby at minimum ten per cent shall be aspired to"). In particular, 15 Mio € were mentioned for the continuation of the NanoCare project cooperation. 20 M € were foreseen for the program "NanoNature" which, however, was primarily designated to explore and utilize the possibilities of nanotechnology with regard to environmental protection. In the middle of November 2010, the federal government again presented numbers in their answer[9] to a "brief enquiry" by the SPD (Social Democrat Party) concerning research funding and funding of accompanying research. According to this, funding[10] was increased from 245 M € in 2005 to 400 M € in 2010[11]. Accompanying research will be funded from 2009 to 2012 with about 14,2 Mio € per year, which according to the answer of the government will amount to about 6,2 %. However, this cannot be deduced from the mentioned numbers[20]. Instead, for 2009 (R&D: 382 M €) a quota of 3,7 % and for 2010 (R&D: 400 M Euro) of 3,6 % is accounted for. The spending on accompanying research is also not broken down in more detail – as it was at least partly the case in the answer from 2006. The same numbers are mentioned by the NanoCommission in their final report of the second phase in February 2011, and they refer to the abovementioned answer by the federal government. And finally, even though they mention the quota of 6,2 %, they again recommend a significant increase of funding for risk and accompanying research[12].

Great Britain (UK)

Already in 2004, the Royal Society and the Royal Academy of Engineering (RS/RAEng) in an extensive report on nanotechnology referred to the possible dangers which might be caused by synthetic nanoparticles and recommended a number of concrete measures[13]. *Inter alia* they recommended to fund scientific research on health risks and negative environmental effects with 6-7 M € per year over the next ten years. However, while the government responded in the end of February 2005 with acknowledging that a better coordination of accompanying research was necessary, it failed to announce any new funding[14]. In the same year, the government tasked the British Council for Science and Technology, CST, with the evaluation of the implementation of the recommendations made in 2004. In its report from March 2007, the CST made a very critical analysis of the current level of accompanying research[15] and strongly requested the development and implementation of a program to study the environmental and health risks of nanotechnology. In particular, the report criticized that from 2002-2006 only 15 M € were being spent on the scientific research of possible risks of synthetic nanomaterials, of which 12 M € were being used for measurement developments. The CST concluded that only 3,6 M € were spent on the scientific research of toxicological aspects and its consequences on environment and health. In comparison, about 78 M € were spent on research and development (R&D) per year as well as in support of the commercialization of nanotechnology.

In answering to this criticism, the "Ministerial Group on Nanotechnologies" published a statement in 2008, extensively introducing objectives, activities and coordination of accompanying research[16]. However, there was no mention of any aggregated numbers, making it impossible to assess whether accompanying research would be equipped better.

At the end of 2008, the Royal Commission on Environmental Pollution (RCEP) again referred to the precarious gap between the increase in products which contained nanomaterials and the lack of EHS data[17].

The RCEP also called for the implementation of an accompanying research program focused on health and environmental risks. The government's answer from June 2009 again attempted to avoid the impression of insufficient coordination by presenting the – in the meantime – impressive coordination apparatus with its scientific assessment committees (see Box)[18]. Instead of addressing the poor financing of accompanying research, they discussed and elaborated on the specific substantive recommendations by the Commission and to what extent the existing activities adhered to these recommendations.

The results of an extensive study by the House of Lords on possible risks of nanotechnology in the food industry was presented in January 2010[19]. In this context, the question regarding the scientific research of health and environmental risks arose again. Despite the previous criticism and the promise of the government to transpose the recommendations, this report remained critical. According to the House of Lords, the conclusions of the government from 2009 regarding the standard of knowledge in relation to health risks[20] was troubling and the lacking progress of knowledge concerning the exposure routes was alarming. With regard to the financing of ac-

companying research, the experts of the House of Lords stated that the extent of funding was unclear. However, it was clear that the expenditures were minimal in relation to the amounts spent on R&D and far lower than the requested 6-7 M € which had been called for by RS/RAEng.

In March 2010 the Ministerial Group on Nanotechnologies presented another report (see Box)[21]. It contained the entire research program on nanotechnology, including the areas economy (innovation, industry), EHS, and regulation and therefore was comparable with the German action plans. Instead of addressing the volume of the funding for accompanying research the report discussed substantive aspects. As there still was no overview which would reveal how much funding was spent for which purposes it was impossible to discern whether the financial resources of accompanying research had been improved since 2004.

Institutions of research politics on nanotechnology in Great Britain

As nanotechnology transversely crosses the administrative structures of the government as well as research funding agencies, an ever-growing network of institutions which should coordinate the various specific programs and projects has evolved in the UK, similar to it has been the case in the US. Such coordination efforts had also been requested by numerous studies and especially those deriving from accompanying research[22]. In the following, the most important UK institutions and the role they play concerning the promotion of research on nanotechnology will be introduced[23].

Research Councils

The preponderant part of state funding on nanotechnology is distributed by Research Councils[24], whereby four of the seven Councils are especially active: Engineering and Physical Sciences Research Council (EPSRC), Biotechnology and Biological Sciences Research Council (BBSRC), Medical Research Council (MRC) and Natural Environment Research Council. In support of overlapping research projects, the umbrella organization, Research Councils UK (RCUK), established a Nanotechnology Group[25]. Examples of such projects are e.g. "Nanoscience: Through Engineering to Application" (2007-2009), the Environmental Nanoscience Initiative (ENI)[26] and two Interdisciplinary Research Collaborations (IRCs, 2003-2009).

Nanotechnology Research Strategy Group (NRSG) (until 2009 Nanotechnology Research Co-ordination Group (NRCG))

This body was established in 2005 as a reaction to the recommendations made in the report of the Royal Society/Royal Academy of Engineering (RS/RAEng)[24] and is composed of representatives of 20 institutions (Research Councils, ministries and authorities tasked with EHS issues, NGOs, etc). It is chaired by the Department for Environment, Food and Rural Affairs (DEFRA). The reports made by this body are addressed to the Nanotechnology Issue Dialog Group (NIDG), which also is responsible for monitoring the body's work.

Nanotechnology Issue Dialog Group (NIDG)

The NIDG was established together with the NRCG in 2005. Unlike the NRCG, its tasks are not only limited to accompanying research. It also has the task to coordinate and monitor the implementation of the program and ensure that the work of the NRCG is in coherence with other aspects of the program[27].

The NIDG also serves as a forum for the exchange of information between the different government institutions as well as the Research Councils[15]. It is chaired by the Government Office of Science (GO-Science) of the Department for Business, Innovation and Skills (BIS); all ministries and government departments may participate. The represented institutions to a large degree overlap with the those represented in the NRCG.

Ministerial Group of Nanotechnologies

To improve the coordination of the entire research program on nanotechnology the Ministerial Group of Nanotechnologies was founded in 2007. In comparison with the NIDG the Ministerial Group only comprises representatives of the Department for Environment, Food and Rural Affairs (DEFRA), Department for Business, Innovation and Skills (BIS), Department for Work and Pensions (DWP) and Department of Health (DH). Its main task is to create the strategic orientation of the research activities on nanotechnology[15]. Its first activity was the presentation of a research program in 2008[15] and the National Nanotechnology Strategy 2010[20].

The Ministerial Group is supported by the NIDG. However, the responsibility for the distribution of funding for accompanying research remains with the research councils, ministries and authorities[15].

European Union

The European Commission emphasized the importance of accompanying research relatively soon in the context of its research policy on nanotechnology. While documents until about 2002 only focussed on economic advantages, as of 2003/2004 accompanying research also constituted an inherent part of the promotion of research[28]. A decisive contribution thereto was given by the discussions led in the US on societal implications of nanotechnology. These entered European policies *inter alia* through a joint conference of the EU Commission and the US National Science Foundation (NSF) in 2002[29] and through a workshop organized by the Greens and NGOs in the European Parliament in June 2003[30]: *"Atomtechnology: Nanotechnology and Converging Technologies – The Implications for Europe and the World"*. Already the first publication by the Commission on the European research strategy on nanotechnology in 2004 contained a separate chapter dedicated to possible health and environmental risks of nanotechnology[31]. In the same year, the Directorate General DG-SANCO instituted a scientific committee (Scientific Committee on Emerging and Newly Identified Health Risks, SCENIHR) to identify health risks. In 2005 the Commission presented an action plan on the promotion of research on nanotechnology[32]. Similar to the Council[33], the Parliament endorsed the action plan, however, not without referring to knowledge gaps regarding the risks of nanomaterials and emphasising that – in accordance with the precautionary principle – one should examine health and environmental risk before any market introduction[34].

In 2008, the European Trade Union Confederation (ETUC) presented a resolution[35] which referred to the lack of reliable information on the release of nanomaterials, especially the exposure of workers, as well as environmental and health effects. It demanded a strict implementation of the precautionary principle, the consideration of nanomaterials in REACH and 15 % of the total expenditures for the scientific research of environmental and health risks of nanomaterials.

In the same year a study commissioned by the Commission was published regarding possible adaptations of existing regulations to the specific characteristics of nanotechnology[36]. The Commission arrived at the conclusion that the existing regulations covered the challenges posed by nanotechnology and that new regulations were therefore not necessary. This prompted the Parliament to pass a resolution in 2009 which proclaimed a significant need for scientific research, information and regulation in relation to nanotechnology[37].

The Commission then presented a second progress report on the implementation of the action plan in October 2009 which, in comparison to earlier documents, contained more detailed information on the funding of nanotechnology and its accompanying research[38]. According to this, in the course of the 6th framework program (FP6), which went from 2002 until 2006, a total of 1,4 BN € were spent on scientific research on nanotechnology. In comparison, during FP4 (1994-1998) only 120 M € were foreseen and during FP5 (1998-2002) only 220 M €. However, one must bear in mind that the practice of attribution changed considerably in this time period. For example, large areas of microelectronics were now described as nanoelectronics[39]. But as nanotechnology is transversal to the topics of the research programs[40], it is unclear how expenditures are attributed to nanotechnology.

According to the accompanying document to the abovementioned second progress report, in the first two years of FP7 already 1,1 BN € were invested, and in total the framework program (2007-2013) shall have 3,5 BN € spent on nano research. Approximations of the Commission and the management consultancy Lux Research estimated the worldwide total funding (private and state) from 2005-2006 at 15 BN € and from 2007-2008 at 25 BN €[41].

However, no state of the EU has a reporting system which differentiates between nanotechnological and other research; as far as the authors can tell, only the US partly adheres to this differentiation[2]. Despite a quite detailed reporting in the second implementation report, there are hardly any aggregated data available on the expenditures for accompanying research. The report mentions a sum of 25 M € for the time period 2003-2006 which was spent on risk assessment including the development and research of methods and instruments. In the first two years of FP7 (2007-2008) 50 M € were invested on risk assessment. According to the Commission, this amounts to 4,55 % of the total expenditures[42]. However, if one analyses FP6 (2003-2006), then one can see that 1,4 BN € total expenditures stand against 25 M € for EHS research, which results in a quota of 1,8 %.

While the petition of the Parliament also calls for a better coordination of R&D funding as well as accompanying research, the coordination of research activities is less a topic of discussion than in the US[2] or UK.

Discussion

It was recognized relatively early that accompanying research constitutes a necessity, as was also determined in research programs on nanotechnology. While there seems to be a general consensus on the overall objective – prevention of dangers for health and environment as well as other negative effects of nanotechnology – it often remains unclear which research or methods are necessary to reach this objective. Thus, in the course of discussion regarding appropriate accompanying research there are different sub-objectives. These range from the closing of knowledge gaps regarding eco- as well as human-toxicological evaluation to the studying of usage of nanomaterials and the therewith connected exposure, from the research of ethical challenges and regulatory gaps to innovation-supporting measures. In the last years the spectrum has concentrated on the examination of toxicological effects.

This dossier has shown that the attribution of funding to accompanying research in general as well as to specific focal points is only possible to a limited extent. However, such an attribution is essential for a new research program as it puts the different research objectives into perspective and sets research focusses. Any discussion on the contents of an accompanying research program, however, can only lead to a result if the extent of the funding for the different parts of the accompanying research program is known. Hence, alongside the discussions regarding the direction of accompanying research was always also a discussion regarding the amount of funding. The minimum level seems to have been set at 5 % of the total funding.

In connection with the question of suitable budgeting the coordination of the various research activities was also always discussed. This is also where scientific advisory committees have maintained significant defects. Reasons for this are, for one, the multi-technical and interdisciplinary characteristics of nanotechnology[43], for another, its transversal nature, i.e. that one and the same nanotechnology is used in many different contexts. Consequently, the area also is transversal to the departments which usually are orientated on policy areas such as research, defence or agriculture, or on topics such as environment, health and traffic. The challenge therefore does not only consist in the inter-institutional (universities, academies as well as research centres) but also in an inter-ministerial coordination. Thus, as research funding is separated between different ministries and institutions, there are no aggregated numbers on the distribution of the financial means.

In the US the funding of nanotechnology has been established as a coordination program from the start. Hence, it was not concerned with acquiring funding for a new research direction but with newly concentrating existing funding. As a result, the attribution – despite the wide margin for interpretation – is more transparent than in Europe. There only few research institutions can present any meaningful numbers. Moreover, ministries most often even lack reporting systems which could list expenditures according to the different purposes. In addition, the attribution of the various funding according to the specific purposes is often not clear and can be interpreted – depending on the political perspectives – differently.

Conclusions

In summary, one can conclude that, despite considerable efforts in co-ordination, no reporting system providing an overview over the budgetary allocation to the different research activities in nanotechnology and accompanying research has been developed at the EU level or at the national level. As long as funding is organised according to administrative structures, which do not differentiate research according to goals but list expenditures along institutions (universities, research centres, grants etc.), and without a harmonized reporting system the discussion about focus and rate of accompanying research will stay at the level of claims and unsubstantiated promises.

Notes and References

[1] The proposal SPD/Greens, 2004, *"Aufbruch in den Nanokosmos – Chancen nutzen, Risiken abschätzen"* requests that 5 % of nano research funding shall be used for accompanying research, Bundesdrucksache 15/3051. The Dutch action plan even calls for 15 % of research funding to be reserved for risk assessment in the course of the next five years. (Dutch Government, 2008, Nanotechnology Action Plan, p. 3).

[2] NanoTrust-Dossier 011en defines and discusses the term accompanying research and NanoTrust-Dossier 013 presents the structure, objectives and extent of accompanying research in the framework of the US research program on nanotechnology (National Nanotechnology Initiative, NNI).

[3] Compare note 2.

[4] Deutscher Bundestag, 2004, *Protokoll der 148. Sitzung des Dt. BT am 16.12.2004.*

[5] Deutsche Bundesregierung, 2006, *Potenziale und Risiken der Nanotechnologie – Antwort der Bundesregierung,* Nr. 16/2322.

[6] Bündnis90/Die Grünen, 2007, *Antrag: Nanotechnologie-Bericht vorlegen:* Bundesdrucksache 16/4757.

[7] CDU/CSU and SPD, 2009, *Antrag: Nanotechnologie – Gezielte Forschungsförderung für zukunftsträchtige Innovationen und Wachstumsfelder:* Bundesdrucksache 16/12695.

[8] *Ibid,* p. 6.

[9] Deutsche Bundesregierung, 2010, *Antwort der Bundesregierung auf die Kleine Anfrage der Fraktion der SPD,* Nr. 17/3771.

[10] The answer of the federal government does not reveal whether the mentioned funding already cover expenditures on accompanying research.

[11] For other years: 2006: 264 M€, 2007: 309 M€, 2008: 339 M €, 2009: 382 M €. The difference for 2006 (from the response in June 2006 (330 M €) and from 2010 (245 M €)) is probably to be traced back that for one, the response from 2006 also recognizes funding by the Laender as institutional funding of the research societies, and for another, that the year had not ended yet.

[12] Catenhusen, W.-M./Grobe, A., 2011, *Verantwortlicher Umgang mit Nanotechnologien. Bericht und Empfehlungen der NanoKommission der deutschen Bundesregierung 2011:* BMU, p. 12.

[13] The Royal Society/Royal Academy of Engineering, 2004, *Nanoscience and Nanotechnologies: Opportunities and Uncertainties,* pp. 85-87.

[14] HM Government, 2005, *Response to the Royal Society and Royal Academy of Engineering Report: 'Nanoscience and nanotechnologies: opportunities and uncertainties':* DTI.

[15] CST, 2007, *Nanosciences and Nanotechnologies: A Review of Government's Progress on its Policy Commitments,* p. 5 and 15ff.

[16] UK Government, 2008, *Statement by the UK Government about Nanotechnologies.*

[17] RCEP, 2008, *Novel Materials in the Environment: The case of nanotechnology,* pp. 29/30.

[18] UK Government, 2009, *Response to the CEP Report "Novel Materials in the Environment – The Case Of Nanotechnology",* especially p. 8ff.

[19] House of Lords – Science and Technology Committee, 2010, *Nanotechnologies and Food. 1st Report of Session 2009-10 – Volume I: Report,* Nr. HL Paper 22-I.

[20] Aitken, R. J., et al., 2009, *EMERGNANO: A review of completed and near completed environment, health and safety research on nanomaterials and nanotechnology.* Defra Project CB0409.

[21] HM Government, 2010, *UK Nanotechnologies Strategy – Small Technologies, Great Opportunities.*

[22] To deduce from the institutional differentiation that research coordination in more important in England than e.g. in Germany is falls a bit short. Other reasons could be, for example, the different political systems or the actual (at least linguistic) closeness to the US.

[23] Compare note 15, p. 32 and DEFRA, 2007, Characterising the potential risks posed by engineered nanoparticles. A second UK Government Research Report. HM Government NRCG, pp. 39, 49.

[24] www.rcuk.ac.uk/news/2010news/Pages/100108.aspx.

[25] EPSRC, 2006, *Report of the Nanotechnology Strategy Group,* p. 43.

[26] ENI, 2009, *Small World:* NERC, DEFRA, EPSRC, EA.

[27] http://webarchive.nationalarchives.gov.uk/+/http://www.dius.gov.uk/office_for_science/science_in_government/key_issues/nanotechnologies/nidg.

[28] EC, 2004, Towards a European Strategy for Nanotechnology, COM(2004)338 final.

[29] Roco, M. C./Tomellini, R., 2002, Nanotechnology – Revolutionary Opportunities and Societal Implications, *3rd JOINT EC-NSF Workshop on Nanotechnology.*

[30] Fiedeler, U., 2003, Atomtechnology: Nanotechnology and converging technologies, *Technikfolgenabschätzung – Theorie und Praxis 12(3/4),* 122-125.

[31] Compare note 27.

[32] EC, 2005, Nanoscience and nanotechnologies – An action plan for Europe 2005-2009, COM(2005)243.

[33] European Council, 2004, *Council Conclusion on Nanotechnologies, 2605th EU-Council Meeting on Competitiveness/Internal Market, Industry and Research, Press Release,* S. 24-36.

[34] European Parliament, 2006, *Report on Nanosciences and nanotechnologies: An action plan for Europe 2005-2009* (2006/2004(INI)), pp. 6-7.

[35] ETUC, 2008, *Resolution on Nanotechnologies and Nanomaterials,* 25 June 2008.

[36] EC, 2008, Regulatory Aspects of Nanomaterials COM(2008) 366 final.

[37] European Parliament, 2009, *Resolution of 24 April 2009 on regulatory aspects of nanomaterials* (2008/2208(INI)).

[38] EC, 2009, Nanosciences and Nanotechnologies: An action plan for Europe 2005-2009. Second Implementation Report 2007-2009. COM(2009)607 final.

[39] Dudenhausen, W.-D., 2003, *BMBF-Staatssekretär Dudenhausen: Nanoelektronik made in Europe ist einer der wichtigsten Innovationsmotoren,* 25.11.03.

[40] Among all the subject areas, the subject "Nanoscience, nanotechnologies, materials, and new production technologies" (NMP) is the area most closely specialized on nanotechnology. Whether this subject area also funds non-nanotechnological research is hard to discern, especially in light of a lacking nano-specific reporting system.

[41] Compare note 37, p. 10.

[42] Compare note 37, p. 4.

[43] The coordination impediments discussed in the following not only relate to accompanying research but also generally to R&D programs on nanotechnology.

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