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What is Accompanying Research on Nanotechnology?

Summary

The German expression “*Begleitforschung*” has no equivalent in English. It could be directly translated as “accompanying research”, and is often used synonymously with research activities which are commonly covered by the abbreviations EHS (Environment, Health, and Safety) and ELSI (ethical, legal, and social issues). The concept is contested and associated with multiple meanings. Although there is no direct translation, research with the purpose of “*Begleitforschung*” is financed and carried out in almost all industrialised countries. In this dossier the variety of the meanings and uses of “accompanying research” is elaborated. As the outcome of this analysis, it is argued that the concept only makes sense in a particular political context and cannot be deduced from any disciplinary perspective. It is a relational notion which seeks to express the ratio between the efforts applied to R&D and the efforts made to explore and analyse social aspects which could be related to this technology. Despite practical difficulties, due to the fact that a general criterion (such as origin of funding) is not sufficient, it is only possible to decide on a case by case basis whether or not a research activity can be identified as “accompanying research”. The dossier ends with a plea for a differentiated use of the notion and for an explicit specification of what kind of research is meant.

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Introduction

Technical innovations involve both risks and opportunities. Their long-term potential can only be established if the risks as well as the opportunities are recognised, and if these risks are taken into consideration in an appropriate way when technology and its environment are being shaped. During the initial phase of a technological development, especially during the period when commercial applications are still some way off, it is inevitable that the main focus will be on sounding out its likely potential. Attention only shifts to potential dangers and risks, in general terms to all kinds of unintended consequences, when the first products based on the technology are coming onto the market. This point has already been reached in some areas of the diverse field of nanotechnology. Some cosmetics, foodstuffs, and varieties of paint in which nanotechnologies are used are already on sale.¹

For this reason, there are increasing demands from society that investigations should be carried out of what may be the “other side of the coin” in relation to nanotechnology. A number of different actors have been addressing this issue: not only critical scholars, NGOs, and commentators in the media, but also public administrative bodies – authorities, agencies, and ministries with responsibilities in the areas of workplace safety, consumer protection, preventive health measures, and environmental protection, and also public bodies involved in research. Researchers themselves and the relevant industries also have an interest in an early clarification of questions connected with these issues, and expect that products will appear on the market without any difficulties and accompanied by the necessary communication. All activities serving these purposes, or in some cases only some of them, are often described vaguely as “accompanying research”, but it is rarely made clear what exactly this term means.

This dossier attempts to contribute to the clarification of this concept, and does so with the following goal in mind: The general demand for accompanying research mentioned above becomes concrete in the political discourse about new technologies. In the framework of research programmes designed to lead to new technologies, financial resources are as a rule reserved for a range of purposes. At the top of the list, needless to say, comes expenditure on technological developments. These funds can be allotted to basic research, concrete engineering tasks, or the implementation of the technologies developed. Alongside these expenses, especially in large research programmes, funds are reserved for accompanying research. Accompanying research usually seeks to investigate possible risks and other effects of technology, or as we have already said, the “other side of the coin”.

The political debates in this area revolve around the question of the relationship between the sums assigned to these different research activities. The demand that a certain proportion (percentage) of expenditure should be spent on accompanying research (which has already been accepted and fixed in some states²) has to be accompanied by a classification of the funding that makes practical sense. In other words, it must be made clear what is to count as accompanying research. If this is not done, there is no way of evaluating whether the research policy goals announced have been attained.

The structure of the dossier is as follows. We begin by showing the broad spectrum of uses of the term “accompanying research” that can be identified. On the basis of this analysis, we propose a working definition which will provide the foundation of further investigations of this issue in the NanoTrust project.

The Babel of Accompanying Research

The terms “accompanying research”, and “accompanying measures” (and also “impact research” and “risk assessment”) are not defined in any unambiguous way, and they can be used in very different ways in different contexts. The following overview summarises briefly the different contexts in which these terms are used, and we then elucidate the terms in more detail.

Uses of the term “accompanying research”

- (1) Environmental and health-related effects, security aspects
- (2) Ethical, legal and social issues
- (3) Aspects related to the theory of science and cultural sociology
- (4) Technology assessment
- (5) Perception of risks, communication of risks
- (6) Information and communication projects
- (7) The application of technology
- (8) Education
- (9) Networking activities

There is no equivalent in English to the German term *Begleitforschung*, used as an overarching category to cover a wide field.³ Instead, two main issue areas are identified.

(1) The first of these comprises what are known as EHS issues – research on the **e**nvironment, **h**ealth, and **s**afety. The EHS abbreviation covers both basic research, such as studies of human and ecological toxicology, and applied research such as work on measurement procedures and instruments. In the area of nanotechnology, this kind of research receives by far the largest proportion of research funding reserved for accompanying research.

The term “risk assessment” is also frequently used in this context. Strictly speaking, though, one should distinguish between risk assessment and EHS research. Risk assessment involves well established and highly differentiated procedures for the assessment of risks that are not exclusively related to technology. For example, insurance companies (e.g. Allianz) and reinsurance companies (e.g. Swiss-Re) also analyse and assess economic risks and those arising from bad weather. There are considerable differences between the procedures used in risk assess-

ment, depending on the context in which they are used – foodstuffs, medicinal products, chemicals, entire production facilities, or natural disasters. The examination of issues in the framework of EHS investigations of new technologies, such as nanotechnology, does not amount to a risk assessment as the term is properly understood; it provides a basis for such an assessment, but does so in a usually fragmentary and as yet unsystematic manner.

The activities of manufacturers from the private sector designed to guarantee product and workplace safety are a further significant branch of risk assessment. Even though the research work carried out by a company in order to ensure that, for example, a new chemical compound will be authorised are very similar to the research activities being carried out at present as part of EHS research in connection with nanotechnology, they are not included in the concept of accompanying research.⁴

(2) The second issue area is that of what is known as the ELSI issues – ethical, legal, and social (sometimes societal) issues (sometimes implications). The issues that fall under this heading are even broader, and range from the acceptance of technologies and the potential for their misuse, via ethical and moral assessments and questions of future regulation, to technological foresight issues and analyses of market potential. They also include studies of “nanopolitics” by political scientists (either addressing the substance of the issue or looking at it from a governance perspective) and the very diverse field of Science and Technology Studies (STS).

Having surveyed the published literature and material published online, we find that in German-speaking countries the term *Begleitforschung* is more frequently, though not always, used in connection with the ELSI issues and, as a rule, given a more concrete form as “accompanying research from the perspective of cultural studies” or “social-scientific accompanying research”.

(3) One also often finds research projects counted as part of the ELSI field mentioned above which reflect the programme of technology research carried out from the perspective of the *science studies* or *cultural sociology*. The issues dealt with here include the role and significance of scientific visualisation procedures in the development of theories or in the way dominant research questions become established. Innovation research is not usually treated as part of ELSI research, though there is no clear boundary between innovation research and questions related to the theory of science.

(4) Technology Assessment (TA) may be the field that is most clearly an example of accompanying research. TA examines the consequences of scientific and technological developments, which means that the object being investigated is as a rule tied to a particular technology. However, the research activities of the field do not contribute to the further technical development of that technology in any narrow sense. It would be more accurate to say that TA resembles STS as a reflection on technological development, but it orients itself towards questions arising from outside science and takes the essence of these questions from the political system. Because of this transdisciplinary orientation, mostly directed towards specific problems, both TA’s object of investigation and the core questions it asks can be described as “extra-scientific”. This places TA at a tangent to the disciplines or research fields described so far. Consequently, the findings of other disciplines and research fields provide material for TA’s own investigations, whether these are the results of toxicological investigations, the findings of extensive analyses of life cycles, or conclusions derived from studies carried out within STS.

(5) Alongside research on potential risks (in the EHS sense), the investigation of *risk perceptions* and *risk communication* is also sometimes described as accompanying research. This involves studies carried out using tools from communication studies, sociology, or political science, and these studies can be classified either as basic research (if one wants to find out, for example, how risks are perceived and what this involves) or as something close to applied research with an advisory character (what can we learn from this with regard to potential controversies about technology?). The term “risk assessment” is frequently used as an abbreviated way of referring to this kind of research as well. As we have seen, though, this term is more accurately used to refer to the analysis and assessment of risks themselves (i.e. EHS research), and this is not the same thing as risk communication and risk perceptions.

(6) It is quite frequently the case that the concept of accompanying research is interpreted so widely that *information* and *communication projects* directed at a broader public are also included.⁵ However, these activities, as contributions to the “public understanding of science”, often have more to do with boosting the acceptance of a given technology than with the prevention of potential dangers. They sometimes have the character of PR measures which present, almost exclusively, the possible positive effects of the

technology in question.⁶ On occasions, these projects are accordingly described not as “accompanying research” but rather as “accompanying measures”.⁷

(7) Another element which contributes to confusion and a lack of clarity is the fact that research activities related to the *application of technology* for environmental purposes (e.g. soil remediation, water purification using nanotechnologies) are frequently subsumed under the category of EHS. If one followed this logic it would be possible to include a large part of nanomedicine here too, since this involves the use of nanotechnologies for purposes of preventive health measures and/or the restoration of health.

(8) From time to time, a category appears in the research budgets and action plans which can be summarised as *education*. This lists expenditure on the setting up of new interdisciplinary degree courses or the development and provision of teaching materials, or which covers individual support measures such as prizes and scholarships. Some institutions, however, also use this category to cover the measures mentioned above which provide information to a broader public.⁸

(9) Finally, the general term “accompanying measures” is sometimes used to cover *networking activities*, especially activities within a particular research community. Strategic analyses of the (substantive) orientation of technology promotion programmes are also included here.⁹

One can sum up by saying that all accompanying research investigates the interaction between technology and/or science on the one hand, and society on the other. As a rule, accompanying research concentrates on the impact of a given technology. The main focus is on unintended effects, but these are not the only aspects investigated.¹⁰ Foresight processes and market assessments can also be part of accompanying research.

Accompanying research as a non-formal, relational and political concept

In our view, there are two main ways in which one can grasp the concept of accompanying research: *formally*, or in terms of substantive *content*. From a formal perspective, accompanying research would be all research paid for from funds reserved for this

purpose, regardless of the kind of research question actually investigated. Something would be accompanying research because it is funded as accompanying research. By contrast, an attribution related to content would mean that a given research activity would be characterised as accompanying research on the basis of certain criteria. One would be able to tell by looking at it, so to speak.¹¹

The distinction we are making here between formal and substantive criteria as a way of including something in the category of accompanying research may seem a matter of hair-splitting, since one can assume that in any case the only projects funded out of the budget for accompanying research will be ones that do in fact serve the purpose of closely examining risks and other effects of technology. But if one look at this the other way round, a problem arises: Can one also count as accompanying research work dealing with a certain technological development which pursues the same goal but is not financed by funds set aside for this purpose? The background consideration here is that in everyday political life, responses to the call for accompanying research (or an increase in the resources devoted to it) as a way of warding off possible dangers arising from new technologies sometimes take the form of saying that this research is already being carried out, so there is no need to devote additional funds to it. But one also hears the reverse of this argument – more accompanying research is demanded, on the grounds that at present money is being spent on supposedly “accompanying” research which is not impact research at all. This problem makes it clear that in relation to this political debate, there is no way to avoid a substantive attribution of certain research activities to the category of accompanying research, identifying this in terms of its relationship to some special form of technological promotion. *For this reason, we advocate a substantive definition of the concept of accompanying research.*

We therefore wish to propose the following working definition, the elements of which we will then elucidate: *The term “accompanying research” refers to all research activities demanded by society¹² that are not designed to serve the direct purpose of technological development.*

It is evident that the concept of accompanying research makes no sense from the disciplinary perspectives of those carrying out the research, whether they are working in the natural sciences or elsewhere. Those doing the research do not see themselves as “ac-

companying” the research of others but rather, as a rule, carrying out their own independent research in accordance with discipline-specific habits, rhythms, and methods.¹³ Nevertheless, the concept is relevant to the political debate about the allocation of research funding, as one can see from its frequent use in this context (which is to be distinguished from its use in academic articles, where it rarely appears¹⁴). In this sense accompanying research is always *political*, even if those carrying it out in concrete cases perceive it as pure research, because it involves an attribution by the political system in the broadest sense of the term.¹⁵ The research is political because it is embedded in the political system and classified by actors from within that system, and because its purpose is a goal being pursued by the political system – in the sense that it is carrying out a demand expressed in the public sphere. And it is also political because it is itself a subject of debate.¹⁶ The most obvious example of this is research on climate change.

Accompanying research is a *relational* concept which places one research activity in a relationship to another one. One important element of our working definition is the word *accompanying*. What this means is that as a rule, this research takes place parallel to, or rather (for practical reasons) shortly after, research designed to lead to technological development. It is also accompanying in the sense that it essentially takes the relevant technological development as its point of reference: toxicological investigations of nano particles take their object of investigation from nanotechnologies; the discussion of ethical issues arising from possible future nanomedicinal applications would be no more than a glass bead game without the concrete perspectives provided by nanomedicine; industrial medical research on nano particles only makes sense when these materials are already in use, or about to be used, in factories; investigations of how a given research programme came into existence presuppose the existence of that programme, and so on. Accompanying research can be connected directly with a concrete natural-scientific or technological project, and it can also be part of such a project.¹⁷ But it can also be independent of concrete R&D projects, and in this sense it can, so to speak, accompany the research indirectly.

We are aware that the definition we have proposed may not be as precise as one could wish. There is certainly room for debate about how one distinguishes between research that serves the purpose of technological development and research which does

not “serve the direct purpose of technological development”. However, when one looks at concrete research activities it is usually possible to distinguish very clearly between projects conducted with the goal of realising an idea for the application of a technology (e.g. the modification of the surface condition of certain nano particles in order to improve a drug delivery system) and those which examine other aspects of the technology (e.g. the spread of the same nano particles in surface water).

In our view, the question of whether something qualifies as accompanying research has very little to do with the distinction between *basic research* and application-oriented research; in principle, both kinds of research can be accompanying research. In this context, the only important question is the purpose of the research: if it involves a search for fundamental knowledge that is a precondition of any further assessment of concrete risks, there is no reason why we should not consider this basic research as a form of accompanying research. In this case, there is an indirect relation to an application. It would be essential, however, for this basic work to stand in a concrete relation to the risk assessment, i.e. for it to be “inspired” by the risk assessment in the sense of being carried out with that in mind. This is an important restriction of the term, since otherwise one could see any basic research as essential for risk assessment in a broader sense; it is self-evident that risk assessment always rests on basic research. Without doubt, this restriction leads to difficult demarcation problems, but this is always the case when one is using a substantive definition like the one we have proposed.

Notes and References

- 1 See NanoTrust-Dossier 009 epub.oew.ac.at/ita/nanotrust-dossiers/dossier009.pdf.
- 2 The parliamentary motion tabled by the German SPD and Green parties, “Aufbruch in den Nanokosmos – Chancen nutzen, Risiken abschätzen” (Bundesdrucksache 15/3051, dip.bundestag.de/btd/15/030/1503051.pdf) calls for 5 % of research funding for nanotechnology to be spent on accompanying research. This motion was passed by the Bundestag on 16.12.04. The Nanotechnology Action Plan of the Dutch government even calls for 15 % of research funding in this area in the next five years to be reserved for risk assessment (Dutch Government, 2008, Nanotechnology Action Plan, p.3 www.nanoimpactnet.eu/object_binary/o2865_Dutch%20Actionplan%20Nanotechnology.pdf.)

Conclusions

“Begleitforschung” (accompanying research) is a concept which only makes sense in the context of research policy, where it serves as a projection screen for claims. A more precise analysis reveals that the meaning of the term is multiple, fuzzy, and not at all clearly defined. However, a clarification of the concept is in principle possible and is provided in this dossier. The suggested definition with regard to content (in contrast to a formal one) leads to practical problems related to attribution. It should be mentioned that our definition is not commonly used, and thus the available data on expenditure related to accompanying research are not collected according to our definition. Therefore, if general data about accompanying research expenditure are presented, there needs to be a careful investigation of what exactly is meant. For this reason it is suggested that use should be made in the related debate of the differentiated notions elaborated in this dossier. If possible there should be an explicit indication of what kind of accompanying research is the subject of the argument. At least, a distinction should be made between accompanying research on EHS and other accompanying research, and both should be differentiated from accompanying measures such as communication activities.

- 3 The qualification “accompanying” is sometimes used, especially in EU contexts (as in “accompanying research” or “accompanying measures”), but this usually refers to additional activities related to other, concrete (research) projects.
- 4 However, if one looks at some EU projects (CELLNANOTOX, NANOINTERACT, and SAPHIR) or at the German NanoCare project, one can identify some clear overlaps between product safety research carried out by firms and state-financed EHS research.
- 5 Examples of this include the “Nanotruck” (www.nanotruck.de) and the „NANODIALOGUE” exhibition, at (ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=502).
- 6 Some examples of this: the EC’s educational films „Nano – The next dimension” (2002) and „Nanotechnology” (2003), and the activities related to nanotechnology in the framework of the Austrian project „Forschung macht Schule”.
- 7 For example: in the framework of the “NANO Initiative” (the BMVIT’s research programme on nanotechnology), see the material on „Netzwerke und Vertrauensbildung” (Networks and creating trust), „Maßnahmen zur Aus- und Wei-

terbildung” (Educational measures), and „Begleitmaßnahmen” (Accompanying measures).

- 8 See, for example, NSTC (National Science and Technology Council Subcommittee on Nanoscale Science Engineering and Technology), 2003, *National Nanotechnology Initiative. Research and Development Supporting the next Industrial Revolution. Supplement to the President’s FY 2004 Budget*, Washington, D. C.: www.nano.gov/html/res/fy04-pdf/fy04%20-%20large%20parts/NNI-FY04_front_matter.pdf, p. 37.
- 9 There is one other context in which the concept of accompanying research is used. Urban development measures such as the building of new council-owned housing in a particular area, or the construction of a shopping centre, are sometimes accompanied by social-scientific research investigating the effects of these measures.
- 10 See F. Glöde, Unfolgsame Folgen. Begründungen und Implikationen der Fokussierung auf Nebenfolgen bei TA, *Technikfolgenabschätzung. Theorie und Praxis*, Nr. 1/2007, pp. 45-54.
- 11 We would remind readers that the question of whether or not something is accompanying research can only be understood from a political perspective.
- 12 Although we treat the concept of accompanying research in this dossier as a “political” term, our use here of the formulation “demanded by society” is intended to make it possible to include demands that cannot be primarily attributed to the political system.
- 13 See also the similar debate about the concept of “complementary sciences”: no discipline likes to see itself downgraded to the status of a complement or assistant to another. This term can only make sense in relation to a specific task or in a very specific context, for example when chemists help archaeologists with their dating expertise.
- 14 See, for example, H. Paschen and T. Petermann, *Technikfolgen-Abschätzung: Ein strategisches Rahmenkonzept für die Analyse und Bewertung von Techniken*, in: T. Petermann (ed.): *Technikfolgen-Abschätzung als Technikforschung und Politikberatung*: Campus, 1992, 19-42 www.itas.fzk.de/deu/Itaslit/pape92a.pdf.
- 15 This means that this attribution may be made by politicians, but it may also be made by societal bodies such as NGOs or industrial associations. The crucial element is that this attribution does not come from within the scientific system.
- 16 Against this background, it is noteworthy that demands for accompanying research often arise in connection with debates around values.
- 17 In the Austrian genome research project GEN-AU, for example, it was stated explicitly that this kind of project connection was desired.

MASTHEAD:

Owner: Austrian Academy of Sciences; legal person under public law (BGBl 569/1921; BGBl I 130/2003); Dr. Ignaz Seipel-Platz 2, A-1010 Vienna

Editor: Institute of Technology Assessment (ITA); Strohgasse 45/5, A-1030 Vienna;
www.oeaw.ac.at/ita

Mode of publication: The NanoTrust Dossiers are published irregularly and contain the research results of the Institute of Technology Assessment in the framework of its research project NanoTrust. The Dossiers are made available to the public exclusively via the Internet portal "epub.oeaw" :
epub.oeaw.ac.at/ita/nanotrust-dossiers

NanoTrust-Dossier No. 011en, December 2010: epub.oeaw.ac.at/ita/nanotrust-dossiers/dossier011en.pdf

ISSN: 1998-7293



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