

Regaining an intermediary position in the Dutch research funding landscape

A resource dependence theory interpretation of research funding organizations' interactions with nanotechnology

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DRAFT

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This paper argues that the intermediary position of research funding organizations (RFOs), is not merely a given position for example because the law provides a basis and a ministry provides a budget for a research funding organization. Others have modeled this position by using principal agent theory. Resource dependence theory, as outlined by Pfeffer & Salancik (1978, 2003) is proposed here as a more suitable conceptual frame. This is demonstrated by the actions related to nanotechnology of RFOs, researchers and ministries in the Netherlands. Ministries and researchers initially bypassed the RFOs when developing a nanotechnology research program, but within a few years, the RFOs re-involved themselves in agenda setting processes for nanotechnology.

1 Introduction

In the course of the past two decades, the new research field of nanotechnology was created, developed and supported by researchers, foresight organizations, and ministries.

Most descriptions or definitions of nanotechnology refer to phenomena that occur at the nanoscale, which is one thousand's of a micrometer, or 10^{-9} meter. Documents differ about the range of nanometers that is involved, but in most cases this is 1 to 100 nanometer. At

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this scale, matter behaves differently or shows different characteristics compared to more macro scale. Because much is still unknown about this behavior and these characteristics, it is an interesting field for investigation. At the same time, most documents also point out that this offers opportunities for technology² development and promising applications. It is often stressed that nanotechnology is a highly interdisciplinary field of research which combines disciplines such as material science, chemistry, and physics.

Nanotechnology has become institutionalized in research organization. Recently a number of research institutes started to carry the phrase 'nano' in their respective names. The first journals for nanotechnology appeared as of 1990, although most came into existence around or after 2000. Many introductory textbooks have been published and historical highlights of the field have been identified.

These few lines have not even scratched the surface of the development of nanotechnology. For some historical and cultural introductions into to the field and interesting aspects, see for example (Baird et al., 2004).

In an increasing number of countries ministries and research funding organizations (RFOs) have initiated funding programs, especially after President Clinton announced the National Nanotechnology Initiative in the United States in 2000. Later, also the European Union invested billions in nanotechnology research through its Seventh Framework Program. This paper will discuss the nanotechnology funding actions and interactions of RFOs, researchers and ministries in the Netherlands.

Research funding organizations will be conceptualized as intermediary organizations between government and research. Braun(1993), Gaston(1996), and Van der Meulen(2003) have used principal agent theory to characterize RFOs' intermediary position. This paper proposes resource dependence theory not only to characterize the exchange relations between ministries, RFOs and researchers, but also to analyze the background of information asymmetries between the various actors, and to analyze changes in these relations and the effects thereof to RFOs.

The Dutch case study will show that ministries and researchers can bypass the RFOs in different ways, with potentially damaging effects to the RFOs' intermediary position between government and research and hence to the the RFOs' ability to fund research. Secondly, it will show that the RFOs later tried to involve themselves in the process that initially kept them at bay.

The case study is based upon policy documents, annual reports, an evaluation report and other documents and web pages. In addition eight semi structured in depth interviews with policy makers and researchers provided additional material. Unfortunately, at the time of writing, not all interviewees have cleared their interview data. Interview data that is used in this paper has been cleared, but because this is still a draft and published through PRIME web pages, the interviewees are made anonymous.

² Many authors distinguish between nano science and nanotechnology. For reasons of simplicity, I will only

2 Resource dependence theory applied to research funding organizations

Research dependence theory, as elaborated by Pfeffer & Salancik (1978), stresses the notion that organizations are intricately and inescapably bound to their environment which contains the resources that an organization needs in order to survive. Pfeffer & Salancik focus on the interplay between organizations and their environments. As they formulate it "The central thesis ... is that to understand the behaviour of an organization you must understand the context of that behaviour—that is, the ecology of the organization" (p. 1) The authors pose that an organization's survival depends on the management of demands of those interest groups on whose resources and support the organization depends. The ability to acquire and maintain resources is the key to survival (p. 2), hence the subtitle of Pfeffer & Salancik's book: *A Resource Dependence Theory*

A multi level model with an intermediary position for RFOs

Interestingly, Pfeffer & Salancik (1978) do not define or describe what a resource is. They do adopt a broad notion of resource, considering for example that when they discuss discretion over resources, they point to knowledge as a resource that is controlled on the basis of possession (p. 48). This indicates that with 'resource' Pfeffer & Salancik do not only refer to raw materials, money, personnel, buildings and the like, but also to less tangible or countable items. This is an advantage for studying RFOs in comparison to principal agent theory which focusses on contract relations, that is relations where monetary means are exchanged for services or products.

RFOs depend on two major categories of resources and associated interest groups: knowledge and quality stamps provided by researchers and money which is usually provided by Ministries.

Usually Ministries provide the budget or substantial parts of the budget of RFOs. This is trivial in the sense that this thesis focuses on publicly funded RFOs. The general interest of Ministries in RFOs is that they – the Ministries - want to support national research activities and RFOs provide help. This help mainly consists of a distribution mechanism, but may also involve advice and other services such as knowledge transfer and communication of research results to the general public.

The other resource category is that of knowledge as provided by researchers. The staff of a RFO usually consists of former researchers, RFOs' boards consist of researchers and RFOs involve researchers in many of their activities, in particular also in the funding of research. Researchers provide among others ideas for funding by sending in project proposals, help selecting funding proposals, and help evaluating finished research projects and programs. One particular resource, provided by researchers is approval of other researchers' project proposal. This approval is usually provided through peer review procedures and can be seen as a particular resource, viz. as a stamp of approval of scientific quality.

From a resource dependence theory perspective this two folded dependency situation is interesting. It means that in order to serve the interest of the budget providing Ministries, which is to provide resources to researchers, RFOs need the assistance of those who receive resources from the RFOs. In other words, researchers

are dependent on RFOs for resources, but RFOs are dependent on researchers too. Regarding the relation with budget providing Ministries, RFOs, that is *public* RFOs, hardly have alternative sources that can provide budget to the same extend as Ministries. In short, RFOs are dependent on two sources to which their relation is such that it allows for little room for maneuver because alternative sources are virtually non existent when it comes to their task of research funding.

This particular resource dependence situation of RFOs between two major interest groups, shows an *intermediary* position between researchers and government and suggests a *multi level model* to depict and analyze the changes in their environment and their actions. Principal agent theory allows for a similar conceptualization, but one has to expand the notion of a contract to such an extend that other concepts from principal agent theory, such as shirking or moral hazard loose their sharpness.

Enactment capacity of RFOs

Pfeffer & Salancik (1978) focus not only on the way the organization acts towards its environment, but also on how it perceives its environment. In order to understand how an organization's environment affects it, Pfeffer & Salancik (1978,, p. 63) distinguish between three notions³ of environment. The first consists of basically all that exists, that is all 'interconnected individuals and organizations' that are directly or indirectly related to the organization. The second notion refers to those individuals and organizations that interact directly with the organization. As Pfeffer & Salancik point out, it is through this subset that an organization *can* experience its environment. I will refer to this notion as *experienceable environment*⁴. 'Can' was italicized above, because it is not this environment as it is that influences an organization's action, but it is this environment as observed, registered and interpreted by the organization that influences its actions. Here, Pfeffer & Salancik (1978,, p. 72) follow Weick (1969,, p. 64) when they speak of an *enacted* environment. Organizations, like individuals, recreate or reconstruct events from their environment. In other words, they respond to self made representations of their environments and events therein. Thus the enactment depends not only on the organization's environment but also on the organization's information system, that is the organization's internal structure which selects which parts of the environment are seen and which structures the enacted vision.

Through workshops, symposia and other means, RFOs stay in touch with external actors such as policy makers from ministries or representatives from NGOs, industry and other RFOs. Next to targeted activities for policy making, RFOs also collect information about their environment through regular contacts with ministries, other RFOs in neighboring countries, international governance bodies such as the OECD, the European Commission, or the Nordic Council.

The main focus of RFOs' data collection activities is however on the subject of their funding activities, viz. on the research layer. More often then not, if not systematically, researchers are consulted when new policy is developed through various procedures. This may be through interviews, questionnaires, workshops and symposia. Often, portfolio analysis is part of the procedures as well.

³ Pfeffer & Salancik speak of 'level', but in order to prevent confusion I use the word 'notion'.

⁴ Pfeffer & Salancik do not provide an adjective.

3 Bypassing and repositioning

The Dutch research funding situation around the end of the twentieth century is characterized as a semi classical. It is classic in that there were (and still are) two major RFOs. The *Nederlandse organisatie voor Wetenschappelijk Onderzoek* (NWO - Netherlands Organisation for Scientific Research) was established in 1988 and funds research as performed at the universities and public research institutes. NWO is an independent organization which receives most of its funding from the Ministry of Education, Culture and Science. Scientific quality is its main objective, but it also received the assignment to orient itself towards societal issues and to fund applied research in addition to fundamental research - two less classical elements (Kersten, 1996,, p. 338). NWO became the hierarchical umbrella for a number of already existing RFOs and research institutes. One of these was the foundation *Fundamenteel Onderzoek der Materie* (FOM , Foundation for Fundamental Research on Matter) which was established in 1946 and operated a few well known research institutes for basic research. Another other was the *Stichting Technische Wetenschappen*⁵ (STW, Technology Foundation) which was established in 1981 and had been funded by the Ministry for Economic Affairs. STW promoted applied research and technology transfer to Dutch companies, and had been using matching funding criteria and both scientific and societal review of project proposals from its start (Beemt & Le Pair, 1991; Pair, 2001). This situation remained when STW became part of NWO and constituted another less classical element within NWO. Besides, STW and FOM, another NWO division that plays a role in the following story, is NWO's division for *Chemische Wetenschappen* (CW - Chemical Sciences). Because NWO's divisions and institutes remained relatively independent , this paper may refer to them as RFOs, or as divisions.

Next to NWO, another research funding organization existed. It was called Senter in 2000, but later merged with energy research institute NOVEM into SenterNovem. It is a typical technology funding agency, funded and steered by the Ministry of Economic Affairs.

Before 2000, two Dutch foresight organizations and a non-funding research council had observed the rise of nanotechnology as a new field and had published about that (Chehab & Enzing, 1998; OCV, 1996; Wolde, 1998). STW had renamed a small program into a micro and nanotechnology program, but apart from that no funding priorities had been set until 2000 when CW made the first move.

RFOs plan the lead (2000 - 2001)

In 2000, NWO's Area Board *Chemische Wetenschappen* (CW - Chemical Sciences division) selected four areas within chemistry, viz. sustainable chemistry and technology, chemistry and life sciences, molecular nanosciences, and new research methods.

Besides the portfolio analysis, there were contacts between NWO Board and the CW Board to exchange and coordinate wishes and plans in both directions. And thirdly, CW invited representatives of CW's sixteen study groups for scientific input

⁵ Currently, the Dutch name is *Technologiestichting STW*.

from the chemistry field in the developing of policy plans. These study groups consists of researchers in different topics within chemistry. They each organize an annual meeting to keep researchers from the Netherlands up to date and in contact with each other.

Demarcating a new field and declaring it a priority is one step, actually making money available for it is another. CW's resource dependence situation, in principle provided CW the discretionary power to fund and organize its own funding programs. Around 2002, CW spent about € 29 M (NWO-CW, 2004). However, apparently, CW in practice did not have the resources available. NWO, industry and government had promised financial contributions for a new program (NWO, 2001a, p. 40) and CW indeed funded a program Nanosciences⁶ from 2001 or 2002 until 2006. It was a relatively small program with a total budget of about half a million Euros.

CW's new priority apparently caused a response within other NWO divisions, because in May 2001, NWO included nanotechnology into its third multi annual plan. It covered the period 2002 to 2005 and identified nine 'Themes' which cut across the divisions and which were elected as strategic priority areas (NWO, 2001b). The following themes were identified: Cultural Heritage, Ethical and Social Aspects of Research and Innovation, Shifts in Governance, Cognition and Behaviour, Fundamentals of Life Processes, System Earth, Digitalisation and Information Technology, Nano-Sciences, and Emerging Technologies.

NWO used a bottom up strategy to fill in the Themes with funding programs. That is, NWO left it to its divisions to develop coordinated programs. By the end of 2001, the divisions had consulted with their researchers and developed twenty programs which gave content to eight Themes: Nano-Sciences was not covered.

NWO did not present ideas of how to organize the Themes, but announced that for each theme a suitable organizational shape would be developed before the end of 2002 (NWO, 2001b, p. 8, 38). For the Nano-Sciences NWO's central Board offered € 1,3 M if the NWO divisions would develop a plan (Zachariasse, 2003, p. 10). € 1,3 M can hardly be considered to reflect a priority, considering the size of NWO's total spending of more then € 400 M in 2002 (NWO, 2003, p. 119) Even when compared to the other eight themes, nanotechnology was at the bottom of the list. NWO reserved € 0,7 M over a period of five years for nanotechnology, whereas the average was about € 17,5 M per theme (NWO, 2003 (?), p. 7). A committee was set up, but it failed to produce a plan⁷.

Government and scientists take the lead (2000 - 2003)

One source of income of the Dutch state and the Dutch economy consists of sales of gas reserves that were found in the province of Drente in the north east of the Netherlands. The government invests returns of these gas fields in Dutch infrastructure to support economic developments. As of 1993, a part of that budget is being invested in support of the Dutch research infrastructure. During the first round in 1994, about Mfl 250 was spent on research without a formal review procedure. The second round which followed four years later, had a more formalized procedure, but a general critique on that process was that it was too much top down organized. Ministries were allowed to propose projects and were free to organize this as they saw fit. This resulted in a rather opaque situation and many parties involved had the

⁶ My translation

⁷ Interview with A, January 2008.

impression that grants were largely dependent on good contacts between parties and ministries (Ernste et al., 2005, p. 17).

The latest investments through this fund were arranged through the *Besluit subsidies investeringen kennisinfrastructuur* (Decision subsidies on investments in knowledge infrastructure⁸) better known as BSIK, which was published in December 2002. This third round Government wanted to have a more transparent selection process in which applicants would know application criteria in advance and could receive feedback on why proposals were not granted (Hoogervorst, 2002).

The third round would distribute about € 800 M to consortia of research groups/institutes and companies over the period 2003 to 2010. The subsidies were provided on the basis that the consortia would fund half of the proposal themselves, which meant that this round would cover investments of about € 1600 M, or about € 200 M per year. To provide some contrast to this amount, NWO's spending in 2002 reached the level of around € 400 M (NWO, 2003, p. 119).

The BSIK decision was published at the end of 2002. Preparations had started by the end of 1999 and much work had already been done by ministries and researchers towards the end of 2002. Ernste et al.(2005) provide a detailed account of the process. In short themes for the program were developed and evaluated until the start of 2001. In May 2001 a call for expressions of interests went out in May 2001 and closed in September. From September 2001 until the end of 2002 a Government decision on the themes was prepared and finally taken. This was the BSIK decision mentioned above. In December 2002 the call for applications was launched and in February 2003 almost seventy proposals were submitted. A number of institutes spent about half a year to assess the proposals and by the end of November the Government decided to grant thirty four proposals. (Ernste et al., 2005, p. 16)

Two issues about BSIK are worth exploring because they relate to RFOs. The first is the selection of the nanotechnology theme. The ministerial steering group that prepared the third BSIK round commissioned the consultancy firm KPMG in April 2000 to develop a list of themes. KPMG interviewed hundred twenty actors in ministries, advisory councils, research organizations, consortia that received grants from the second investment round and non-governmental organizations. In 1999, the Ministry of Education, Culture and Science had approached the Association of Universities in the Netherlands, Koninklijke Nederlandse Academie der Wetenschappen (KNAW - Royal Netherlands Academy of Arts and Sciences) and NWO to stimulate them to prepare for the third BSIK round and together provide ideas and themes. The KPMG interviews and sent in suggestions⁹ amounted to about two hundred ideas which KPMG grouped into seven themes: systems innovation, computing and communication technologies, integrated system for multi functional and high quality use of space, knowledge transfer within small and medium sized enterprises, sustainability (in the economy, technology, ecology and culture), and breakthroughs in health, food, genetic and bio technologies. Actors felt that KPMG's selection and discussion was too broad and not surprising. The steering group continued with the seven themes but felt that the themes needed better arguments to legitimize spending the budget on them and in the second half of 2000 commissioned

⁸ My translation

⁹ The suggestions did not only come from the three research organizations, nor is it clear whether the three indeed had sent in suggestions and themes.

separate thematic reports from different experts. The steering group also added another theme to the list, which is how nanotechnology became included in this BSIK round. (Ernste et al., 2005, p. 25, 33).

It is striking that the steering committee asks a consultancy agency rather than a RFO to develop a list of themes. NWO and its divisions had developed instruments to identify new plans and trends in the Dutch research landscape. Moreover, they were in the process of developing new priorities during the very same years that the steering committee set out to identify funding themes.

Another interesting issue about the BSIK process concerns the organization of the review process. Different institutes assessed different aspects of the proposals. The Netherlands Bureau for Economic Policy Analysis, the Netherlands Institute for Spatial Research, the Social and Cultural Planning Office of the Netherlands, the Netherlands Environmental Assessment Agency, and the Rathenau Institute for technology assessment together evaluated three societal aspects, viz. legitimacy of the investment, societal return on investment, and financial and environmental risks. (Ernste et al., 2005, p. 40; Hoogervorst, 2002,, p. 22)

The KNAW evaluated the proposals on scientific quality through an international peer review committee for each of the final BSIK themes. Although KNAW is a highly authoritative academic council which, it, as far as I know, had had no prior substantial experience with evaluating research proposals. NWO and its subdivisions had spent almost fifteen years developing review processes in program funding settings. This raises the question why the steering group did not delegate the provision of scientific quality stamps to NWO or one of its divisions? One might go one step further and ask why not delegate the entire funding program to NWO?

P. Tindemans, who directed the Science Policy department within the Ministry of OCW during the nineteen nineties, raised the point already on the occasion of the second BSIK round. But the Ministry of Economic Affairs and other ministries were dead set against delegation to the RFOs because they wanted to remain in control of spending the money¹⁰, so they bypassed the RFOs. And during the third round they did it again.

While the ministries bypassed the RFOs in the BSIK procedures and preparations, researchers also knew how to contact ministries directly. The Ministry of Economic Affairs had actively tried to develop a consortium for nanotechnology during the years that a list of themes for BSIK was being developed (Ernste et al., 2005, p. 33). The Ministry of EZ had asked a group of researchers who earlier had applied for funding for nanotechnology at the Ministry to develop the thematic report for the nanotechnology team¹¹. This report turned out as a proposal, called 'Masterplan Nanotechnologie'. It included plans for the DIMES institute at Delft University of Technology, MESA+ at the University of Twente, and BioMade at the University of Groningen. It was ready by the beginning of 2001 but by then, Eindhoven University of Technology had complained about the proposal at the Ministry and rumors existed about other complaints from the Radboud University Nijmegen and Wageningen

¹⁰ Interview with B, January 2008.

¹¹ Interview with B, January 2008.

University. The Ministry saw problems arising and asked P. Tindemans and STW director L.J. Halvers to develop a solution¹².

Tindemans and Halvers made a tour along the universities to get them organized in one proposal. These included the universities of the 'Masterplan Nanotechnologie' and the other three universities. Based on his knowledge of the Dutch universities, Tindemans knew that other universities and institutes with physics and chemistry departments were not interested. Tindemans saw this was confirmed by STW and by the fact that the other universities later did not complain¹³.

Tindemans and Halvers wrote an initial memo and organized talks and workshops to develop the outlines for a new proposal, dated July 11th, 2001. Later the participating universities and groups developed it further into a final proposal called NanoNed¹⁴.

Recruiting Tindemans, a former high ranking policy maker for research, and Halvers, director of a RFO, makes sense from a resource dependence perspective. Because these two were well aware of the national research situation their recruitment enlarged the BSIK enactment capacities to the extent necessary to overview possibly all potential research institutes and groups interested in a nanotechnology proposal.

By the end of 2003, the Minister of Economic Affairs announced the government's decision to support thirty three proposals with a total of € 678 M. Within the microsystems technology and nanotechnology theme, three proposals received a total of € 130 M. NanoNed received € 95 M which made it by far the biggest proposal. The second biggest proposal received € 52 M, whereas the average budget was about € 20 M¹⁵. The NanoNed program started in January 2005 and will end in 2009.

All successful consortia of the third BSIK round were free to organize their respective programs' management as they saw fit. SenterNovem and NWO would distribute the funds and monitor the programs, but apart from that they were free. This is another occasion where BSIK could have used NWO's expertise in program management.

The NanoNed program decided to delegate the program's administration to STW, rather than to develop its own. Self management included¹⁶ further development of the projects. The NanoNed proposal included outlines for individual projects. These were later filled in by the flagship captains who then had some flexibility to adjust the projects depending on new insights, publications, results of other projects and the like. Because there were maybe two years between the writing of the NanoNed proposal and the actual start of the program, such flexibility was welcome. The flagship captains still had to remain within the flagship and cluster borders.

¹² Interview with B, January 2008.

¹³ Interview with B, January 2008.

¹⁴ Interview with B, January 2008.

¹⁵ This figures do not include the three proposals mentioned above that received funding a few months later.

¹⁶ Other aspects of self management can not yet be discussed because interview data has not yet been accorded by the interviewees.

The self management shows that the funding program operates as a small RFO in itself. At least, it performs tasks that RFOs also perform when they run funding programs : review of project proposals, financial administration, monitoring and progress control. One major difference is that within NanoNed, there are no calls for proposals because projects were already outlined within the application at BSIK.

This section showed that the Government and researchers took a different route than the RFOs. This route involved two tracks. One track concerns the attempts of a number of scientists to find funding for research and nanotechnology research and facilities by turning to the Ministries directly. This is easily understandable from a resource dependence perspective. Universities nor RFOs have enough budget to cover the needs. In addition, expensive facilities or equipment require particular forms of funding and/or cooperation between institutes that usually are not provided for through regular procedures. Researchers may go searching for funding anywhere. Their institutes, RFOs, European Framework Programs, private funds, local government and industry are potential sources. Why not approach the ministries?

The second track is a general bypassing of research councils in the three BSIK rounds, which becomes most visible in the third round where BSIK developed an elaborate review process. In this track, three instances of bypassing can be identified, one of which is the not involving the RFOs in the scientific quality review and which is most questionable from a resource perspective. The fact that BSIK did not use the services provided by the RFOs is difficult to understand. Unless foreign RFOs are taken into account, no other organization is more suitable for the job. To this testifies the fact that BSIK had to develop its own review procedures and asked KNAW to evaluate proposals on scientific quality. KNAW definitely qualifies as an organization of high scientific standards. However, KNAW never before evaluated research proposals in a funding program context.

One might argue that NWO and its divisions never dealt with budgets the size of the third BSIK. This is true, but the same holds for KNAW. Probably, in the Netherlands very few organizations related to public research have dealt with similar amounts for programmatic funding, with the exception of ministries. Another argument might be that NWO does not include explicit societal quality stamps into its procedures. This is true although NWO and its divisions do involve societal actors in their policy and program development. Possibly NWO can learn to adopt explicit societal quality stamps into its review procedures, just as it has learned to develop societal relevant research programs. Another solution would be to make use of NWOs resources for scientific quality stamp only, i.e. to replace KNAW with NWO in the BSIK procedures.

Even the argument that the ministries wanted to remain in control of spending the money can not be a decisive argument. If the provision of quality stamps, either scientific or societal is delegated to other organizations, then part of the control is already out of the ministries' hands. Secondly, Switzerland shows how the national scientific RFO, the Schweizerischer Nationalfonds zur Förderung der Wissenschaftlichen Forschung, provides scientific quality evaluation whereas government or, depending on the exact funding instrument, parliament remain in control of the final decision.

The bypassing of the research councils and the size of the BSIK investments constituted a major and noted change in NWO's environment. The following section deals with the RFOs' responses to these changes and will outline a few consequences to NWO's resource dependence situation.

RFO's adapt to the new situation (2000 - 2006)

At the latest when the BSIK decision was published in November 2002, but probably earlier, it became clear to the Dutch RFOs that the BSIK program was about to invest in nanotechnology. The RFOs then had to consider their position. In May 2001, NWO's new multi annual plan had prioritized nanotechnology, but no concrete program was developed and no budget determined. Would it still make sense to develop something in parallel? NWO's Chemical Sciences division did not follow up on the small program that it had launched in 2000. The budget available for BSIK was enormous compared to CW's annual budget of around 2002, so probably CW's Board decided not to invest in nanotechnology.

In view of the RFOs' structural resource dependence situation, the BSIK program poses a serious threat to the RFOs' ability to fund research. Compared to the situation before the third BSIK round¹⁷, a change of balance is created: if next to the RFOs, a large fund for research is available to researchers, then researchers may not turn to the RFOs anymore or not in the first instance. This means that researchers may not hand in their research ideas at the RFOs, that researchers are less willing to voluntarily invest time and energy in the RFOs review procedures, Boards, program committees, and policy making activities. Diminishing support from researchers means a deterioration of the RFOs' ability to know what is going on, i.e. to enact their environment. Moreover, if researchers withdraw from the review process, the RFOs are left without means to assess scientific quality¹⁸. BSIK of course does not leave the Dutch RFOs without means, but it does change the balance of resource availability.

In addition to the change of balance, there are indirect effects, resulting from the conditions of BSIK funding. One effect has to do with the fact that BSIK requires matching budget from the funded groups and their institutes. This may result in less available budget to other groups within the institutes. Consequently, these other groups turn to the RFOs with different requests. This is of course not damaging to the RFOs, but it does result in a change in the funding portfolios.

Another consequence derives from the application oriented character of BSIK. Groups that have received funding from BSIK or other application oriented programs turn to RFOs with applications for fundamental research. Other researchers may then complain because they wonder why such groups still not have enough, whereas the applications may address interesting fundamental questions. This then poses a resource dependence dilemma to the RFOs: which researchers does it want to keep or discourage from applying and for providing quality assessments?

Summarizing, the existence of large programs such as BSIK next to the RFOs, causes a potentially damaging change in the RFOs' resource dependence situation,

¹⁷ In principle the same holds for the first and the second round, but in these rounds the BSIK budget was substantially smaller.

¹⁸ None of the interviewees mentioned this, nor did I find other sources that show that such concerns are articulated. However, one small sign that may indicate such concerns can be found in the summary of Zachariasse(2003). Zachariasse notes that if the NanoNed proposal would be granted, then that would offer a good opportunity to physicists to find external funding which does not go through FOM and NWO ('buiten NWO en FOM om', p. 5)

both in terms of effectiveness of funding activities and in terms of their ability to enact their environment. Next to that, the societal quality criterion of BSIK and other programs, has effects on the quality of research and the RFOs portfolio.

Whereas NWO's division for Chemical Sciences decided not to invest in nanotechnology, FOM responded more active. By the end of 2002 or the beginning of 2003, a debate developed within FOM on how FOM should best position or reposition itself scientifically in view of nano developments (Zachariasse, 2003, p. 6).

In February 2003, FOM published a short note *Ontwikkelingen rond nanowetenschappen en nanotechnologie* {Developments of nano sciences and nanotechnology¹⁹ - \Zachariasse, 2003, Fx 13058}. It contained a summary of national and international developments in research policy and an inventory of nano research within FOM.

Zachariasse backtracked nano science research within FOM's research programs and activities, and based on that estimated that in 2002, FOM had spend about € 6,5 M on nano projects, which is about ten percent of FOM's spending in that year. Eighteen out of FOM's sixty three programs were partly or completely within nanotechnology and Zachariasse also took inventory of 44 work group leaders²⁰ participating in NanoNed. (Zachariasse, 2003, p. 10, 15 - 20)

FOM published a new strategic plan in October 2004 for the period 2004 to 2010. To develop this strategic plan FOM²¹ organized a conference in March to discuss draft plans with researchers and other actors from within and outside FOM. These include Board members, directors of FOM's institutes, committee chairs of FOM's various researchers committees, and a few laureated researchers. From outside FOM, representatives from amongst others companies, TNO, sciences departments of Dutch universities, KNAW, NWO's Board and division boards, the Ministry of Education, Culture and Science (FOM/GBN, 2004, p. 7)

A remarkable move of the new strategy was the introduction of 'Nano physics / technology' as a new priority field. This new field was filled by moving some running programs for other priority fields to the new field (FOM/GBN, 2004, p. 16 - 17). Two other already existing subfields were merged into one. Moreover, FOM's Board announced a split between first and second rank priority fields to accommodate cutbacks. The first rank priority fields included the new Nano physics / technology field. The two merged fields were put in the second category (p. 5, 16). What the exact consequences of this ranking were remains unexplained in the strategy plan. Because of a drop in income and because the Board wanted to invest in a few new plans, it saw itself forced to cut back on the total budget of the priority fields in the course of the years from € 22,7 M in 2004 to € 8,7 M in 2010 (p. 29)²². So FOM's Board not only identified a new priority field, it also wanted to save it from cutbacks.

¹⁹ My translation

²⁰ FOM organizes researchers in so called work groups. In 2002 there were more than 200 work groups (FOM, 2003,, p. 105 - 107).

²¹ Officially, the strategic plan was a combined plan of FOM and the NWO division for Physics. For reasons of simplicity I will mention only FOM in this text.

²² It was expected that FOM's total budget would drop from € 77,7 M in 2004 to € 67,4 M in 2010. (p. 27)

FOM saw an excellent opportunity for a multi or interdisciplinary approach in cooperation with the NWO divisions Earth and Life Sciences, Chemical Sciences and STW. FOM wanted to develop the NWO Theme Nanosciences and indicated that it wanted to invest € 3 M per year. (FOM/GBN, 2004, p. 39 - 40)

So, contrary to CW a few years earlier, FOM did think that it still could make a worthwhile addition to research support next to the NanoNed program. FOM, of course had a bigger budget than CW, although € 3 M per year is still far less than the € 20 M to € 22 M per year that is available per year through the NanoImpuls and NanoNed projects²³. Moreover, part of the € 3 M had already been reserved for the running programs that were moved to the nano physics / technology field. Probably, FOM did not invest new money nor invested rerouted money, as it did for other plans presented in the strategy plan.

FOM went ahead with its plan to develop the NWO Theme Nanosciences and together with STW, it established the Blank committee, named after the committee's chair Prof. D. Blank. The committee commenced its work in January 2005, and its aim was to devise a national research program for nanoscience. It observed that in spite of NWO's 2001 strategic plan no structural funding program was launched. The NanoNed program was launched, but as the committee pointed out, it was only as a five year program rather than a long term structural program. (Blank, 2006, p. 2)

The committee prepared for its task by consulting other researchers. The committee identified about fifty researchers, based on the members' own knowledge and based on suggestions made by their contacts. This way the committee extended its the horizon of its experienceable environment and hence could aggregate the views of a large number of people. The enacted vision of nano research in the Netherlands thus reached NWO.

The committee's report was published in January 2006. It proposed three themes that together constituted a national program on nanoscience and nanotechnology, viz. 'Nanomedicine', 'Beyond Moore', and 'Functional nanoparticles and nano-patterned surfaces'. These themes were selected in view of the strengths of a large number of Dutch research groups in combination with the "expected social and economic impact" (Blank, 2006, p. 3) of these themes.

In May that same year, NWO published its new strategic plan, *Wetenschap gewaardeerd* (Science appreciated²⁴), for 2007 - 2010. This plan supported the Blank Committee's proposal without further ado. FOM, STW and Chemical Sciences announced that they wanted to develop a national initiative together with two other NWO Gebieden, viz. Earth and Life Sciences and Medical Sciences (NWO, 2006, p. 54, 61 and 63).

Although CW decided not to further invest in nanotechnology after 2006 and FOM prioritized mostly through relabeling and protecting nanotechnology from cutbacks, the NWO divisions kept nanotechnology on their and NWO's central agenda. In

²³ Here, I am counting the government investments, not the investments plus matching funds. One might also compare, not with the overall budget, but only the NanoNed and NanoImpuls investments in program funding. Then about one arrives at about € 15 M per year. This, however would not be completely 'fair' because the FOM projects may use the NanoLab NL facilities for the cheap tariffs, which means that the NanoNed program pays for part of the FOM funded projects.

²⁴ My translation

terms of financial resources, NWO and its divisions could not make a big impression with targeted funding next to BSIK investments in nanotechnology. However, through the Blank committee, NWO pointed at a flaw in BSIK's approach when it came to developing a structural nano research agenda. Through NWO's new strategic plans, the RFOs offered this agenda for funding to the Ministry of Education, Culture and Science. This way, NWO continued a claim on the new field. In stead of providing financial resourced, it offered knowledge which carried the scientific stamp of approval of the Blank committee and the fifty researchers that had provided feedback to the committee. As the following section will show, NWO's divisions teamed up with NanoNed into the *Nederlands Nano Initiatief* (NNI - Netherlands Nano Initiative)

A new national program and a new research funding organization?

On November 16th, 2006 the Dutch Government released a white paper on nanotechnologies. *Kabinetsovisie Nanotechnologieën. Van Klein naar Groots* ("Government vision on nanotechnologies. From small to big"²⁵). The white paper discussed many aspects of nanotechnology, such as economic potential and societal applications, risks and regulatory issues, ethical and judicial questions, research agenda, coordination, and societal support and communication.

The Government did not promise to invest in nano research, but left that decision to the next Government. At the time of publication, the Netherlands had an outgoing Government while awaiting elections, later in November. The white paper identified five research themes for a national research agenda. These were the three identified by the Blank committee, the theme Water purification and Energy supply which resulted from a Rathenau report, and the theme Food and health as proposed by the NanoNed consortium. The government found FOM, STW and NanoNed's initiative to develop a National Nano Initiative interesting and announced that it wanted to ask them to take education, infrastructure and risk research into account. (Staatssecretaris van Economische Zaken et al., 2006,, p. 6, 21 - 26)

NanoNed, FOM, and STW interpreted the government's positive comments on their efforts as an invitation to further develop a national research agenda. In March 2007, the three published a preparatory note which sketched the outlines of a draft program based on the five themes identified by the government, plus an additional theme Risks and toxicology of nanotechnology. The NNI consortium aimed for a program that requires investments of around € 100 M per year for a ten year period. (Zachariasse et al., 2007, p. 3 - 4)

The note was discussed throughout the remainder of the year in a number of workshops, one for each theme. Compared to the Blank committee, the NNI consortium broadened the range of actors that it tried to involve in the workshops, in order to make it a nationally coordinated program. More researchers were approached and representatives from companies. Fourteen persons were asked to identify at least twenty five persons in their field or theme to invite for the workshops. During the workshops, attendees were asked to identify persons who, based on their qualities, should be included in a subfield. This resulted in around 170 researchers mentioning 250 persons.

²⁵ My translation. The word 'groots' means both big and something of stature.

The workshops provided input for a draft national research agenda. In the course of 2008, Prof. Dave Blank has been writing this draft agenda, which is where the story ends for the time being.

4 Conclusion

The Dutch case history showed that the Dutch Ministries did not delegate spending the research funds from natural gas benefits to NWO, nor to SenterNovem. In stead, a direct interaction between researchers and Ministries was set up to prepare the funding process and a separate advisory body was set up. Also the scientific evaluation of program proposals, and management and administration of the granted program proposals was not delegated to the RFOs, but to KNAW and the granted consortia respectively. In short, the RFOs were bypassed to a large extent when it comes to the funding process. In case of the NanoNed program, one NWO division, viz. STW, became involved in NanoNed's program administration.

The RFOs were also bypassed in terms of policy making or strategy development. The sheer financial volume of the BSIK plans dwarfed the embryonic plans of NWO and its divisions. The Chemical Sciences division more or less stopped its plans and FOM relabeled existing programs but did not invest additional money nor developed additional plans. STW was not developing any plans at that time. Still, the divisions later initiated an attempt to develop a national plan (Blank committee) which ended up in NWO's latest strategy report. Meanwhile, the NanoNed Board started developing plans for follow up funding and these two developments grew into the NNI initiative. The Government's white paper further encouraged the Dutch NNI to develop a national research agenda.

It is interesting to notice that repeatedly the group of researchers involved in developing nano research agendas is widened through government's and RFOs' actions. Researchers initially proposed plans involving small consortia which later were made to include wider ranges of groups to eventually nation wide coordination. It was the Ministry of Economic Affairs which enforced and organized this widening in the preparations for the third BSIK round. Then the RFOs induced widening of actors by establishing the Blank committee. The Dutch NNI included an even wider range of researchers, in part because Government added research themes to the research agenda.

Widening the range of researchers and other actors involved, means that a wider enactment of the research landscape is taken into account and hence coordination of wider, up to nation wide, nano research can result. Currently, NNI is performing this task of nation wide coordination, which usually is performed by RFOs. The NNI consortium is also looking for substantial funding, which it hopes to receive from government rather than from NWO. So, the consortium is doing two jobs that are usually left to an RFO.

If NNI is as successful in raising funds as it hopes to be, it will then perform a third task usually left to an RFO, which is of course research funding. Moreover, its internal organization and funding procedures will be more similar to a normal RFO

than those of NanoNed. In particular, individual research projects will not be outlined in the program application, but there will be calls for proposals.

At present, NNI hopes to draw funds from the next BSIK round, which is expected and maybe already under construction. It is also expected that the fourth round will have an even bigger budget to spend which may allow NNI's financial wishes to be fulfilled. Let us suppose that NNI indeed is successful and that a de facto research council is born and in place for ten years.

Not only a de facto RFO has then been created, but also a new problem of follow up funding. If the fund that feeds BSIK will keep growing, then it may not be a problem in terms of availability. Still, the NNI will have to await whether the Dutch government is willing to fund follow up because the fund's aim is to support the Dutch economy through one time investments in infrastructure. Possibly, other reasons may prevent BSIK from further investments. For example, another promising new field may have emerged, or nanotechnology may have lost its goodwill somehow.

Another scenario may be that the NNI will have positioned itself as a regular RFO and be acknowledged as such. In that case, it could try to claim access to the regular NWO budget. If successful, that would mean that structural funding would be available to the new field. It would also mean that it would become a regular division under NWO's umbrella, rather than next to NWO. It would be another step in the institutionalization of nanotechnology as a regular discipline.

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