Comparative Monitoring of Knowledge for Climate

Project SSA01 – Mid-term report

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Content

1 Introduction and outline of the project

This report is the contribution of project SSA01 Comparative Monitoring of Knowledge for Climate to the mid-term review of the Knowledge for Climate programme. We first provide a brief outline of the project. For each main component of the project we then discuss the relevance and place in the project, the main questions, approaches, methods, and data, and results in relation to outputs and activities.

1.1 Outline of the project

The relation between science and society is changing. The linear model in which science is given an autonomous position in relation to society is losing ground to a model in which collaborations and interactions between science and industry as well as between science and society are stimulated. This changing relation is partly reflected in and constituted by the rise of a variety of new agenda setting arrangements, funding instruments, and new ways of organizing research and the interaction with societal stakeholders. A major example are those research programmes promoting transdisciplinary research and knowledge co-production: large-scale multi-actor multi-measure research programmes (MAPs). These programmes aim to produce a systemic change in the relation between science and society by including societal actors in the programme, e.g. in the agenda-setting phase or in programme committees. Moreover, these programmes adhere to a mission-oriented perspective on science, i.e. they organize research in the context of large-scale scientific challenges (e.g. discovering the structures of materials at the nano scale) or societal challenges (e.g. finding a cure for cancer). Furthermore, these programmes are very large, and aim to develop a sustainable research infrastructure. Relatively little is known about the organisation, dynamics and effects of these new types of funding instruments.

These MAPs are an important and relatively new instrument in science policy. Several research policy instruments at the European level have 'MAP characteristics'. And specifically in the Netherlands, the instrument has been used extensively over the last two decade: the so-called BSiK and FES programmes. These represent huge investments in specific research areas, implementing a specific form of targeted funding. It is not an exaggeration to say that the BSiK and FES investments were the main innovation in research funding. Recently, this form of agenda setting and funding was abolished in favour of the so-called 'top sector' approach, but without any serious research about their functioning and impact. It is fair to say that the abolishment of the BSiK/FES instrument and the introduction of the 'top sector' model are good examples of fact-free politics. This project aims to fill this knowledge gap, in order to support future evidence-based science policy. This is one of the formal tasks of the Rathenau Institute, but also fits in the 'third mission' of Dutch universities.

We will study how new ways of agenda setting, funding and organizing research works on three levels: (1) by comparing the organization and functioning of a range of topically similar MAPs (figure 1a); (2) by delving deeper into one MAP and investigating how knowledge is (co-)produced on the micro project level (figure 1a); and (iii) by comparing the scholarly and societal output of MAPs with other modes of funding and agenda setting (figure 1b).

We focus on the relationship between the organisation, dynamics and effects of one particular type of MAP, namely that which addresses societal problems by producing basic and useful knowledge, and which put a strong effort in getting the knowledge to the relevant users. More in particular, the project will study MAPs within the domain of climate mitigation and adaptation research. One of the main cases of our study is the Knowledge for Climate programme (Kennis voor Klimaat; KvK). This project contributes to the KvK programme's mission "to create a sustainable knowledge infrastructure for managing climate change". Yet, its main goal is to investigate the functioning of MAPs in order to evaluate its value for science policy and for society.

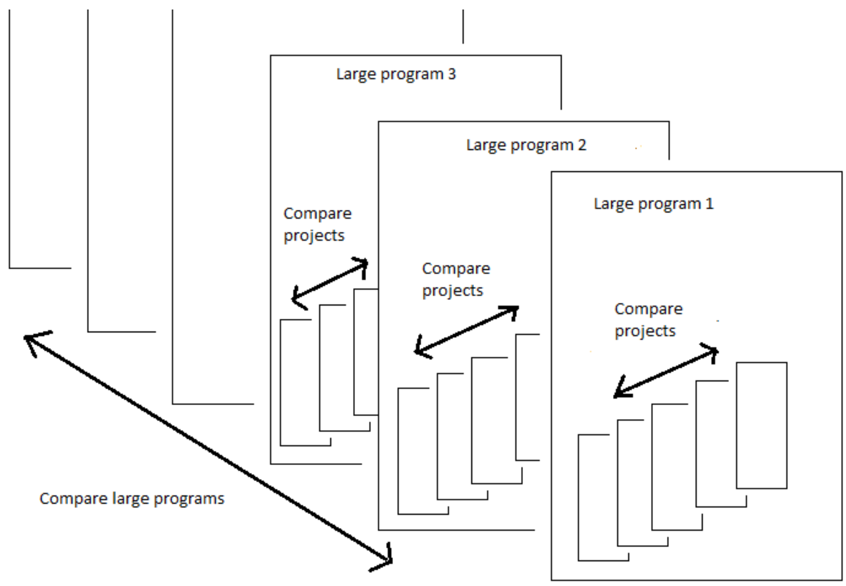

Figure 1a: Comparative approach – comparison of programmes and of projects.

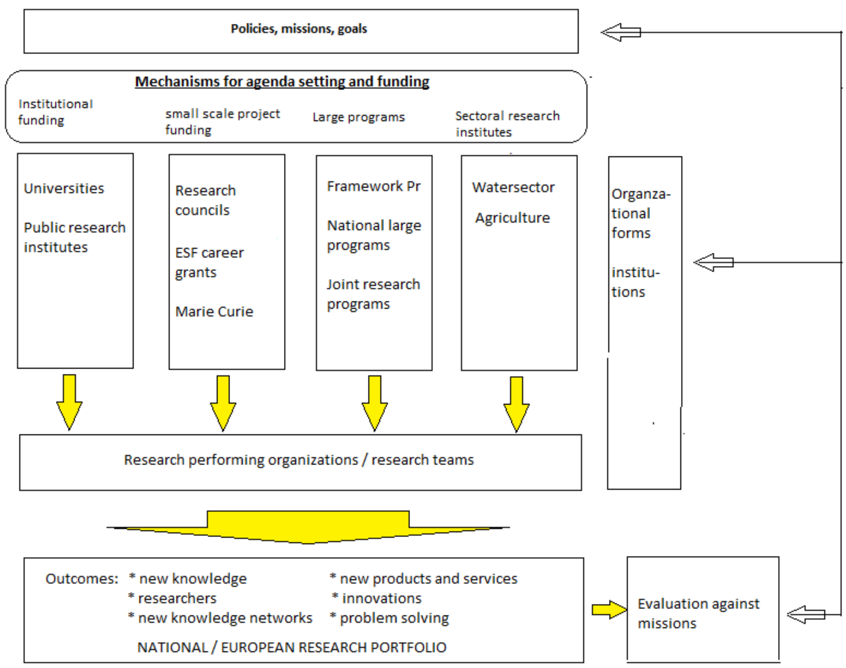

Figure 1b: Comparative approach - the effects of funding modes

1.2 Objectives

Our study aims to increase the understanding of the organisation, dynamics and effects of MAPs, using the transdisciplinary problem field of climate mitigation and adaptation research as a case. In this way, we aim to show how MAPs influence research practices (in particular the relations between knowledge producers and users), research output, research impact, and knowledge transfer activities. We will study these MAPs in different national contexts. The insights from our study will help improve the governance and organization of future MAPs in order to increase their overall performance.

The project has two main objectives:

1. to produce knowledge about the factors that influence the organization, dynamics and outcomes of large-scale multi-actor multi-measure research programmes.
2. to inform policy makers and research managers on how to improve and optimize the execution of large-scale multi-actor multi-measure research programmes with the ultimate goal to improve societal impact, next to scholarly quality.

The specific focus will be on climate mitigation and climate adaptation research.

1.3 Specific questions

The project addresses the following specific research questions that concern the dynamics and effects of MAPs within the transdisciplinary problem field of climate mitigation and climate adaptation research.

1. What MAPs and other programmes have been introduced to organize and facilitate knowledge co-production in the field of climate adaptation and mitigation?
2. How is knowledge co-production organized and coordinated in these programmes? What are the differences and similarities?
3. What is the effect of these programmes on the research context and practice of participating scientists?
4. To what extent do cognitive and organisational factors influence learning inside knowledge co-production projects?
5. How are these knowledge co-production projects demarcated and protected from incentive systems in science, policymaking, etc.?
6. What is the societal impact of the research done within MAPs in comparison with other forms of climate research?
7. How do MAPs affect research output and outcomes in the field of climate mitigation and adaptation research, in terms of productivity, impact and topical orientation?
8. Are skill-profiles of (PhD) researchers that have worked within MAPs different from others who worked under other conditions?

The answers to these questions will be used to answer the overarching question:

9. What lessons can we draw about the functioning, organization, and improvement of MAPs as science policy instruments? Specifically in the field of climate mitigation and adaptation and for transdisciplinary problem fields more generally.

The first three research questions relate to the first level: a comparative analysis of MAPs. MAPs differ in organizational and governance structure and they are applied in the context of different national science systems. We expect to find differences in MAP dynamics and effects that relate to these differences in governance structure and national science system context. The first set of questions will be studied in an international comparative perspective.

The fourth and fifth research questions focuses on the process of transdisciplinary knowledge development, in particular regarding the local conditions that influence the success of transdisciplinary research projects. This process will be examined in a comparative study of specific transdisciplinary projects, namely the regional hotspots within the Knowledge for Climate programme. This is the second level of the project.

The questions six, seven and eight focus on the third level, which is the comparison of the output and outcomes of MAPs compared to other forms of organizing climate research.

The last research question combines the results of the first eight research questions to draw overall conclusions and to formulate lessons and recommendations for the organisation of transdisciplinary knowledge production.

1.4 Structure of the project

Project SSA01 consists of three main research components, reflecting the three levels of comparison distinguished above..

1. **International comparative study of the organisation and dynamics of large multi-actor multi-measure research programmes**: We compare several large-scale mission-oriented programmes in the Netherlands with similar programmes in other countries. This comparative analysis aims at producing general knowledge on the functioning and dynamics of MAPs in transdisciplinary research fields. This component focuses on specific questions 1, 2 and 3. For a more detailed description see section 2.1.

2. **Microlevel study of organisation and dynamics of transdisciplinary hotspots**: We study the so-called hotspot projects in the KvK programme to find out how scholarly and societally relevant output is (co-)produced by scientists and stakeholders in local research projects. This comparative analysis aims at generating general knowledge on the local conditions that contribute to the success of transdisciplinary research projects. This component focuses on specific questions 4 and 5. For a more detailed description see section 2.2.

3. **Study of the effects of large multi-actor multi-measure programmes on outputs and outcomes**: We measure the effects of the programme and its hotspot projects on outputs and outcomes. We focus on three types of output, i.e. (1) scientific output, (2) societal output, and (3) human capital. This component focuses on specific questions 6, 7 and 8. For a more detailed description see section 2.3.

Fig. 2 presents a model in which the relations between the different components of the research project are conceptualized.

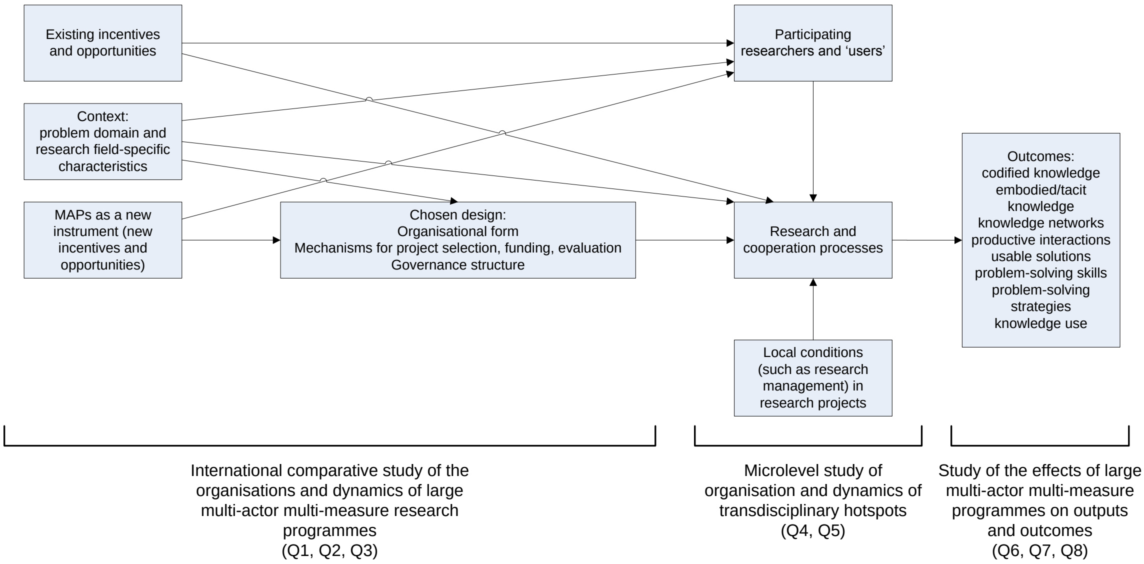

Figure 2. Research model with the relations between the main components

1.5 Team

The team consists of seven persons.

1. *Project leader: dr. Edwin Horlings, Rathenau Instituut.*
   Horlings is responsible for the administrative and organizational issues of the project, and for the daily management of the research.
2. *Supervisors: prof.dr. Peter van den Besselaar, Vrije Universiteit; prof.dr. Wim van Vierssen, KWR Watercycle Research Institute & Delft University of Technology*
   Van den Besselaar and Van Vierssen are responsible for the general direction of the project, for the scientific quality, and act as supervisor for the researchers.
3. *Researchers, all at the Rathenau Instituut.*
   Two post docs: dr. Wouter Boon and dr. Elizabeth Koier (starting on October 1st, 2012 or later, depending on the project planning)
   Two junior researchers / PhD students: drs. Tjerk Wardenaar and drs. Stefan de Jong.

2 Research components

This section provides a brief description of the design, methods, and results of the three main research components of project SSA01.

2.1 Organisation and dynamics of MAPs

Researcher: Tjerk Wardenaar

Brief description

Research programmes that organize and facilitate knowledge co-production in the field of climate adaptation and mitigation have become increasingly popular over the last decade. Knowledge for Climate and Climate changes Spatial Planning are well-known examples in the Netherlands, but similar programmes have been introduced in countries all over the world. This subproject compares the Dutch programmes with programmes in Germany, the United States, and (possibly) the United Kingdom. The comparative analysis focuses on the programmes' organizational and governance structures and their influence on the research context and practices of participants.

Main research question(s)

1. What programmes have been introduced to organize and facilitate knowledge co-production in the field of climate adaptation and mitigation?
2. How is knowledge co-production organized and coordinated in these programmes?
3. What is the effect of these programmes on the research context and practice of participating scientists?

Methods, data, approach

<u>Exploratory survey</u>

International inventory of climate programmes (research question 1)

Anecdotal evidence suggests that research programmes that organize and facilitate knowledge co-production have become increasingly popular. There is, however, no systematic overview of such programmes. This subproject began with taking stock of this type of research programme. In the first step we made an inventory of programmes in 16 OECD countries resulting in 26 relevant programmes in 14 countries. The (scientific) directors of the 26 programmes were subsequently approached with an exploratory survey. In addition to questions on the organization of climate science in their own country, the survey focused on the programmes' general characteristics (size, duration, activities) and on the collaboration between scientists and social actors (on programme, project, and process level). 18 programme directors filled out the survey for a response rate of 69%.

In-depth (semi-)structured interviews

International comparison of Knowledge for Climate, KLIMZUG, and NOAA RISA (research question 2 & 3)

The survey provides initial insights into the organizational structure of programmes that organize and facilitate knowledge co-production (e.g. on the level of non-academic stakeholder involvement). However, these insights do not do justice to the complex processes that are involved. Since little is known about these complex processes, the second step in our approach consists of in-depth case studies. We have selected cases from three countries based on differences in stakeholder involvement that were revealed by our explorative survey. Knowledge for Climate (the Netherlands) has high involvement; KLIMZUG (Germany) has moderate involvement; and NOAA RISA (United States) has low involvement. Apparently, these programmes have chosen a different approach to the organization of knowledge co-production, despite similar objectives.

The case studies are performed by means of interviews and site visits. Projects within a case are selected in consultation with programme management. At each project different types of participants are interviewed, including management, principal scientists, early career scientists, and stakeholders. Around 60 semi-structured interviews are conducted (with a minimum of 20 for each case). A different interview protocol has been used for different types of participants, but all focus on four central themes: (1) organization of the programme, (2) research context and practices, (3) motivations and incentives for participation, and (4) the context of the national science system.

Comparative analysis of the coordination approaches of two Dutch programmes (research question 2)

The programmes central in our study have to coordinate programme activities in order to produce both scientifically excellent and societally relevant output. To gain insight into the way that programmes approach this coordination task we have compared two Dutch programmes: Climate changes Spatial Planning and Next Generation Infrastructures. 37 semi-structured interviews were conducted. Interviewees were selected to adequately represent the diversity of each programme in terms of roles (i.e. board members, sub-programme leaders, scientists, stakeholders) and participating organisations. The interviews consist of three parts: (1) the organisations of the programmes in general with an emphasis on coordination aspects such as monitoring activities, funding, etc.; (2) the roles and activities of non-academic stakeholders; and (3) the coordination of scientist-stakeholder collaborations. In addition, we have made extensive use of the programmes' documentation (e.g. evaluations, annual reviews, project plans, websites).

Results

<u>International inventory of climate programmes (research question 1)</u>

The international inventory confirmed the popularity of knowledge co-production in climate science programmes: 14 out of 16 countries have introduced a 'special programme' to organize this type of knowledge production. The response of the (scientific) directors of the programmes provides a first impression of how knowledge co-production is organized and facilitated. With respect to the focus of programme activities three types of programmes can be distinguished: (1) policy inspired programmes (focus on knowledge production), (2) co-production programmes (balanced focus), and (3) knowledge transfer programmes (focus on knowledge transfer).

The three programme types differ with respect to the involvement of stakeholders in the research process. However, they also appear to share a surprising characteristic, i.e. stakeholders are in most cases involved in formulating research questions, in setting up the research design and performing research this involvement drops. Involvement is highest in the interpretation and communication of outcomes (see figure 3). This preliminary finding does require closer examination in the in-depth case studies.

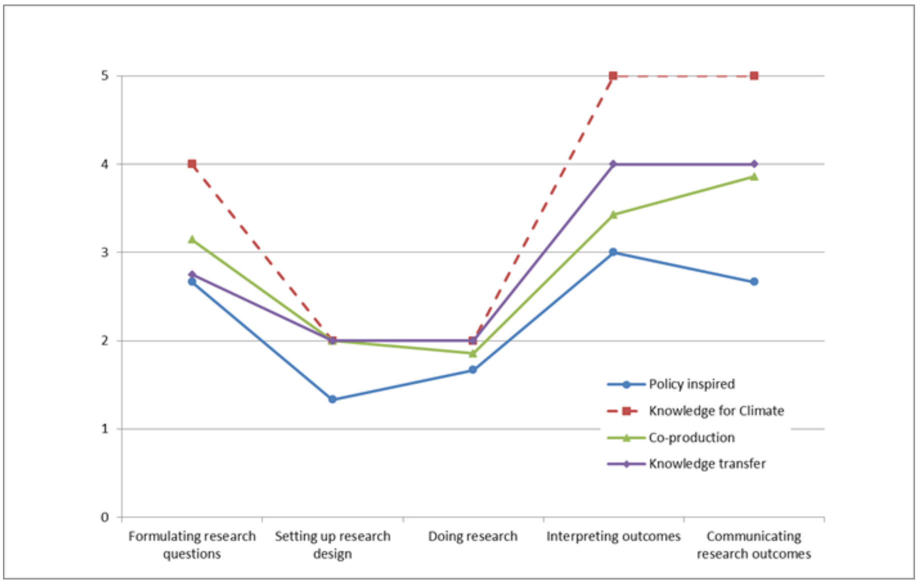

Figure 3: Involvement of stakeholders in research process per programme category (values: 1 = Never, 2 = Rarely, 3 = Frequently, 4 = Most of the time, 5 = Always)

International case studies (research questions 2, 3)

The interviews with participants of Knowledge for Climate (the Netherlands), KLIMZUG (Germany), and NOAA RISA (United States) provided rich information on the organisation of knowledge co-production in these programmes and on its effects on the research contexts and practices of participants. At present, interviews are still being coded and analysed, but our analysis already provides some preliminary results.

(1) The role of this type of programmes in the science system.

The objectives and goals of the programmes central in our study indicate that they aim for another way of organizing science-society interactions. They can be understood as a new model for ever closer connections between individual scientists and non-academic stakeholders. Programmes like Knowledge for Climate possibly have another role in the science system than "traditional" research programmes. In the interviews we have explored this role by asking interviewees about the added value of their programme. Thus, we could identify three (broad) functions, i.e. (1) providing a 'safe haven' for science-society interactions (e.g. by organizing hotspots in Knowledge for Climate), (2) providing alternative research careers (e.g. by giving researchers possibilities "to do more than just research"), and (3) training of early career scientists in non-academic skills (e.g. by connecting PhDs to knowledge users).

(2) The organization of interactions between scientists and non-academic stakeholders within the programmes.

Interactions between scientists and non-academic stakeholders are by definition central to knowledge co-production. The interviews show that there are large differences in the organization of such interactions, both between cases and within cases. The three programmes have a division of labour between scientists (sometimes mediators or coordinators) that are involved in science-society interactions and scientists that perform more traditional research tasks. In some cases such a division of labour is official, e.g. hotspot projects versus theme projects in the Dutch Knowledge for Climate. Often however, the division is unofficial and emergent. None of the three programmes was able (or willing) to force all their scientific participants into knowledge co-production processes.

(3) Differences in constraints for these programmes due to contextual factors.

The international comparative research design enables us to identify the influence of contextual factors on the dynamics of the three programmes. At present, we are still in the process of systematically comparing interview data on these contextual factors. However, an exploratory inventory provides a tentative idea of factors that matter, namely (1) the organization and reward system of the PhD system; (2) the level of climate literacy of non-academic stakeholders; and (3) the duration of the programme.

Coordination for Societal Relevance and Scientific Excellence (research question 2)

Coordination is a key aspect of the governance structure of a research programme. Programmes that organize and facilitate knowledge co-production between scientists and societal actors are often described as (formal) network organisations. Our analysis of the coordination approaches of Climate changes Spatial Planning and Next Generation Infrastructures, however, shows (1) that typical network values such as friendship, reputation, and altruism played only a minor role in the programmes' coordination approaches; and (2) that the two programmes applied a coordination approach that consisted of a different mix of hierarchical, market, and network coordination mechanism. Climate changes Spatial Planning applied hierarchical mechanism in the selection and monitoring of projects, while Next Generation Infrastructures relied more strongly on market coordination.

A comparison of the two programmes on cognitive (dominant scientific discipline), institutional (isomorphic pressure from stakeholders), and organizational (composition of consortia) characteristics reveals that differences in their coordination approaches are most likely caused by the organizational characteristics of the programmes. The large and diverse consortium of Climate changes Spatial Planning made agreements, contracts and control mechanisms much more necessary early on in its life cycle. The small and familiar consortium of Next Generation Infrastructures relied on gentleman's agreements, giving directors little control later on in the programme, forcing them to use small markets (open calls) to stir the programme.

Research agenda 2012-2014

Research contexts and practices (research question 3)

Programmes that facilitate and organize knowledge co-production aim to provide a 'safe haven' for science-society interactions (see also insights in "the programmes' role in the science system" above). In this way, working in this type of programme potentially influences the research context and practice to a large extent. Research questions, for example, are unlikely to be formulated out of curiosity or theory but will result from the needs of non-academic stakeholders.

Initial analysis of the interviews indicates, however, that participants' research practices will be influenced differently due to a (unofficial) division of labour. To gain a better understanding of knowledge co-production in these programmes we work on a categorisation of different types of collaboration processes ranging from limited stakeholder consultations to extensive knowledge co-production projects. By specifying the different types of collaboration processes, we will be better able to understand individual projects. This may also be useful for improving the design and governance of projects related to the specific needs of projects.

2.2 Organisation and dynamics of transdisciplinary hotspots

Researcher: Wouter Boon

Brief description

Dealing with grand societal challenges and similar wicked problems like climate change and climate adaptation calls for knowledge production. Because wicked problems involve a wide range of actors, interests and perspectives, the process of knowledge production can gain from including a wide range of knowledge producers and users. This range should include scientists from various organizations and disciplines as well as societal stakeholders from governmental agencies, companies and NGOs.

The inclusion of a wide range of organizations, disciplines and locations is called knowledge co-production. When dealing with wicked and contextualized problems, it can be beneficial to involve knowledge users in knowledge co-production processes. The involvement of a heterogeneous set of societal actors partly legitimizes science. Moreover, they can be instrumental in the research process and even contribute with their experiential knowledge and creative potential. In relation to that, research for climate adaptation involves switching between generalizable and context-specific knowledge. For example, while producing climate models it is important to validate them on a local level. At the same time, these models gain legitimization when local actors were able to contribute.

Much is known about the input and output of interactions between knowledge producers and knowledge users (cf. the work of Von Hippel and colleagues). However, hardly any research has been done into the governance of user-producer interactions. This is especially true for knowledge co-production processes in the context of transdisciplinary hotspots.

The hotspots within the Knowledge for Climate program consist of research projects conducted by teams of mixed composition (practitioners and scientists) with a focus on dealing with real-world problems (adaptation strategies). The Knowledge for Climate program provides an excellent opportunity to do a comparative multiple case study on favorable conditions for knowledge co-production, because the cases (hotspots) are sufficiently similar in their overall objectives and organization – being part of the same research program – as well as sufficiently different in their local organization to make for an interesting comparative analysis. Furthermore, the dynamics inside the hotspots will be compared to dynamics of transdisciplinary teams in other large-scale multi-actor programme.

Main research question(s)

From a societal point of view, increased understanding of knowledge co-production aims to contribute to understanding how large-scale research programmes, such as Knowledge for Climate, can organize local and contextualized projects. By this, lessons are learnt that extend beyond the level of individual projects (and even research programmes) and might lead to integrated solutions for knowledge co-production for the purpose of 'wicked' problems and grand challenges.

The focal research objective of this subproject is a microlevel study of organisation and dynamics of transdisciplinary hotspots to uncover conditions of success for knowledge co-production in local and contextualized climate adaptation projects. This research objective is divided into two research questions.

The first research question is the extent to which cognitive and organisational factors influence the level of learning inside these projects. We envisage the level of success of knowledge co-production as the extent to which learning occurred between the different actors involved in these projects. Ample research has been done on working in collaborative teams. However, there has been little focus on collaborations in projects in which representatives of different organizations and disciplines are taking part (Ibert, 2004; Provan et al, 2007). A pertinent question is how the knowledge that is produced inside the project translates to the 'home organizations' of the project members. To what extent do the degree of knowledge integration inside projects, the embedding of these projects in organizations and the governance of the projects, influence the degree of learning inside the projects and between projects and organizations?

The second research question focuses on the fact that knowledge co-production projects are often organized in separate, protective spaces. The rationale behind this protection is that by 'decoupling' the activities in the projects from the business-as-usual practices of organizations a space is created for flexible and innovative research (Aldrich, 1979). At the same, this leads to challenges in transferring the results of these projects to other contexts. The tension between innovativeness and transferability, and the questions how to organize protection and knowledge transfer, is central in this part.

These two research questions cover several potentially influential conditions that influence the performance in knowledge co-production projects. The level of analysis is the hotspots as well as the project teams inside the hotspots. While studying these hotspots, this subproject takes the programme in which these hotspots are situated for granted. In other words, programme organization, governance, etc. are regarded as exogenous, whereas the analysis on programme level (section 3.1) sees these elements as endogenous. Of course there is a grey area in the sense that it might be the case that hotspot practices – against all odds – have an influence on the programme level. All in all, the interactions between sections 2.1 and 2.2 are taking place where the programme and project levels touch each other.

Furthermore, the performance of these knowledge co-production projects is partially measured in the context of the two topics described above. For example, research question 1 on the embedding of projects uses learning as a dependent variable. However, for the project's performance we also link up with the SSA01-project parts that measure scientific, societal and embodied impacts (section 2.3).

Methods, data, approach

Both research questions use a mixed-method approach, combining qualitative and quantitative methods, including in-depth interviews and document analysis. The projects that were studied were part of the first tranche of projects of Knowledge for Climate, i.e. projects addressing urgent knowledge questions. We focused on the first tranche projects because they are nearly all finished at the moment of study, which means that the certain project output is realized or at least is envisaged. We initially selected three first tranche projects in the Rotterdam hotspot on urban heat, flood risks in unembanked areas and risk perception. The Rotterdam hotspot was chosen because it had the most wide range of projects in the first tranche and provided for a rich case. The selection of the project (one out of nine) was based on the degree of heterogeneity of actors involved. It should be noted that preliminary results are presented in this paper. Data collection and analysis in other projects and hotspots is under way. Part of this data collection is corroborated by work done by master thesis students of Tilburg University (organizational sciences) under supervision of dr. Maryse Chappin.

Results

Research question 1 on the influence of knowledge integration, team embedding and team governance on learning in teams and between teams and organizations is presented in the form of conference paper and presentations at the International conference on governance of adaptation (March 2012, Amsterdam) and the EU-SPRI conference (June 2012, Karlsruhe). This study contributed to observing under which circumstances and factors this variety is resulting into effective learning in research teams. Factors that were influential in the cases under study were the extent to which previous collaboration took place (and whether the project is part of a continuous learning process), the level of knowledge integration and the way this is managed in terms of leadership (distributed versus centralized) and task partitioning (integrative versus complementary collaboration; cf. Hara et al, 2003).

Research question 2 on knowledge co-production in protective spaces is presented in a conference paper and presentation at the International Conference on Sustainability Transitions 2012 (August 2012, Copenhagen). The knowledge co-production niches were studied in one knowledge co-production project, following three aspects of interest. First, protection took the form of support by a large-scale research program and was necessary to provide a safe haven for research on this – a least for the Dutch setting – novel research topic. A second reason why the protection was needed was because of the knowledge co-production character and related issues (evaluation schemes, etc.) discussed above. Second, the team participants paid much attention to connecting to the 'global' community around the research subject. In terms of framing local research in terms of global values and aggregating local practices to the global scale was prominently visible. Third, the governance of this project was rather heterogeneous in terms of leadership, coordination and task partitioning.

Research agenda 2012-2014

The data collected for research questions 1 and 2 need to be further analysed and reported, leading to several articles that centre on collaboration in projects in environmental sciences. To substantiate the findings we compare these projects in the context of Knowledge for Climate with projects in other large-scale multi-actor research programmes. These other programmes will have different ways of governing knowledge production, which makes claims about the influence of the factors that influence knowledge co-production performance more robust.

In the end we can draw conclusions about the factors that contribute to successful knowledge co-production in terms of learning but also in terms of scientific, societal and embodied output. For the latter three outputs, we make a link with sub-project 3 (see section 2.3 below).

2.3 Effects on outputs and outcomes

We discern three different types of output and outcomes of large-scale research programmes. First, scientific output forms the most obvious type and consists of, amongst others publications and reports. Second, societal output is important in these large-scale research programmes that seek both scientific excellence and societal relevance. Third, these programmes also have effects on human capital in the sense that they attract and nurture scientists with specific skills that are in line with the science-society interaction and integration. These three types of outputs and outcomes are described below.

2.3.1 Societal output and outcomes

Researcher: Stefan de Jong

Brief description

It is increasingly expected that science contributes to societal progress. Governments, as well as other policy makers, have introduced numerous policy instruments to improve collaboration between scientific research organizations and societal organizations such as governments, companies and NGOs. One of these instruments is funding large-scale co-production research programmes. An important rationale for organizing research in these programmes is creating a knowledge infrastructure for innovation by bringing together scientific and societal actors.

In this subproject we study how large-scale co-production research programmes organize their knowledge transfer and diffusion activities and how this results in societal impact. In the first phase we have done an explorative study on how knowledge flows between researchers and stakeholders are organized in two of these programmes and how this organization relates to societal impact of the projects in these programmes. We have collected and analysed data for two cases: Next Generation Infrastructures (NG Infra) and Climate changes Spatial Planning (KvR) programme. In the second phase, the exploratory study will be extended to include two cases: Climate changes Spatial Planning (KvR) and Knowledge for Climate Research (KvK). For both cases a considerable amount of data is already available, but additional data will have to be collected. Finally, we will collect similar data for other forms of climate research, at least small-scale researcher-driven projects. Comparing societal the impact of MAPs with other forms will teach us about the added value of the different forms of organizing research.

Research questions

Main research question

How do large-scale co-production research programmes organize internal knowledge transfer and diffusion, and how does this relate to their societal impact? Do these transfer and diffusion processes work better than those of other modes of research?

Sub research questions to be answered in each case

1. What are the characteristics of the formal programme network?
2. How is interaction between researchers and stakeholders in projects organized?
3. What is the societal impact of research projects?
4. Do the different programme types differ in societal impact?

Methods, data, approach

Network analysis (sub research question 1 and 2)

Literature on social networks states overall network configuration and network position of actors affects knowledge exchange patterns. Therefore, we started this subproject by visualizing and analysing the formal project networks of NG Infra and KvR. The visualization is based on the project databases of the two programmes. These databases provide information about the organizations and people that are involved in each project. Both research projects and dissemination projects are included. Using this information, projects that share two organizations are linked to visualize the formal knowledge exchange network for each programme.

Survey (sub research question 2 and 3)

Surveys have been send to project leaders in the case of NG Infra (n=110, response rate = 58%) and to all involved researchers and stakeholders in the case of KvR and KvK (n=1774, response rate = 24%). Questions covered topics such as agenda setting, collaboration, research output and dissemination activities. Five impact statements were also included. These statements reflect the societal aims of the programme as indicated by programme management in interviews. Based on these statements, impact scores have been calculated ranging from 0-1.

Statistical analysis (main research question)

Using non-parametric tests (Kendal's tau b and Mann-Whitley), relations between network characteristics and actor composition of projects on the one hand and project impact on the other hand have been studied.

Results

In the exploratory studies, results on project level concern those projects for which impact scores could be calculated based on survey results (NG Infra n=47, KvR n=24). In the exploratory phase, only the researcher survey results are included. Stakeholder survey results have not yet been included.

What are the characteristics of the formal programme network?

An exploratory analysis has been done for NG Infra and KvR. Figure 4 shows the networks of NG Infra and KvR. In the NG Infra programme, the network consists of 209 projects and 75 actors. The 209 projects are connected through 170 links. The density of the network is 0.008. On project level, there is only one project with a very central position in the network, the other projects mostly have low centrality scores. In the KvR programma, the network consists of 69 projects and 78 actors. The projects are connected through 672 links. The density of the network is 0.286. On project level there is a wide distribution of network centrality scores.

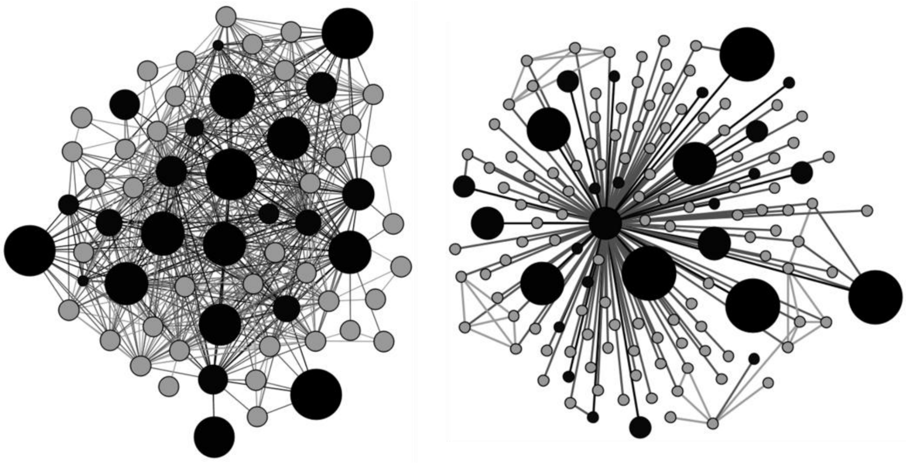

Figure 4: Project networks KvR (left) and NG Infra (right). Projects that share two or more organizations are linked. The color of the project indicateswhether an impact score could be calculated (black nodes) or not (grey nodes). The size of the black nodes represents the size of the impact score. Networks have been constructed in Gephi, using Force 2 Atlas layout with no overlap.

How is interaction between researchers and stakeholders in projects organized?

In NG Infra half of the projects involve only one organisation and half of the projects only involve one or two persons. 21.3% of the projects involve stakeholders. Private stakeholders are involved in 10.6% of the projects and public stakeholders in 10.6% of the projects. In KvR half of the projects involve five or more organizations and half of the projects 38 or more persons. 91.7% Of the projects involve stakeholders. Private stakeholders are involved in 25% of the projects and public stakeholders in 91.7% of the projects.

What is the societal impact of research projects?

Impact scores (ranging 0-1) for 47 NG Infra projects could be calculated, half of the projects score 0.2 or less. In the KvR case impact scores could be calculated for 24 projects, half score 0.71 or more.

How do large scale co-production research programmes organize internal knowledge transfer and diffusion and how does this relate to their societal impact?

In the case of NG Infra, impact seems to be related to the involvement of stakeholders and the number of involved organizations. In the case of KvR no relations between impact and the other variables have been found.

In contrast to literature, no effects of network position have been found. This could be an indication that project impact and project network position are not related. More likely, however, is the explanation that there is not enough variation within the two datasets to find statistically significant effects. In the NG Infra case most projects have similar network characteristics, while in the KvR there might be too few cases. These problems will be overcome in the next phase of the subproject, as explained below.

Research Agenda 2012-2014

The research agenda 2012-2014 focuses entirely on climate research by (i) extending the KvR case, (ii) including KvK, and (iii) including several other forms of funding/organizing climate research, such as council-funded projects. Adding KvK is particularly interesting to get more insight in the effect of deliberately organizing projects with the aim of having societal impact. Although data are available, additional data have to be collected. The NG Infra case will not be extended.

Network analysis (sub research question 1 and 2)

A network analysis on project level will be done for KvK. Data are already available.

Survey (sub research question 2 and 3)

An additional survey will be done among KvR and KvK researchers for two reasons. The first reason is to improve comparability between the cases. At the time of the previous survey, most KvR projects were already running for a few years, while most KvK projects were still in their start-up phase. At the moment, most KvK projects have been running as long as the KvR projects at the time of the previous survey. The second reason is to enable a longitudinal analysis per case. This will give more insight in longer term effects. The survey will be based on the previous survey, to secure comparability over time. The survey will be distributed in October 2012. A similar dataset will be collected for other forms of climate research.

This will result in the following data set:

	KvR	KvK	Other types of research
2009	Researchers	Researchers	Researchers
	Stakeholders	Stakeholders	Stakeholders
2012	Researchers	Researchers	Researchers
	Stakeholders	Stakeholders	Stakeholders

Statistical analysis (main research question)

Statistical analyses will be extended in a number of ways.

First, stakeholder surveys will incorporate the stakeholder perspective and reveal if researcher and stakeholder perceptions concerning impact differ. Second, longitudinal comparisons will be made. Third, impact will be related to other survey items, related to the research process. Is involvement of stakeholders in agenda setting, research and dissemination a predictor for impact? Are some motivations to involve stakeholders more likely to result in impact than others? Does it make a difference whether collaboration was easy or difficult? Are certain types of products more likely to result in impact than others? The data to answer these questions have been collected during the first survey. Additional data to answer these questions will be collected in the second survey.

Expected results:

This sub-project will show whether different modes of research differ in terms of their societal impact.

2.3.2 Scientific output and outcomes

Researchers: Elizabeth Koijer, Edwin Horlings

Large-scale mission-oriented research programmes change the behaviour of the scientists who participate. Large-scale programmes affect the decision making of scientists by imposing requirements on agenda setting (through joint programming) and collaboration (through conditions with respect to matched funding, stakeholder involvement, and interuniversity collaboration).

The central question of this project is if scientists active in large-scale research programmes such as KvR and KvK select different research topics, are more productive and have more impact than scientists who rely on other, more conventional sources of funding.

The literature proposes three possibilities:

1. In problem-oriented thematic programmes scientists would spend much less time on relevant scientific topics, making scientific output and impact is lower than elsewhere. Moreover, large programmes may involve more bureaucracy with negative effects on productivity. Finally, in research programmes competition may be lower and cooptation higher, which does not attract the best researchers to work, again with a negative effect on outcomes, productivity and impact.
2. There is also a positive interpretation. The thematic orientation of a programme does steer scientists towards other issues, but does not necessarily result in outputs of a lower level. Good researchers are often interested in relevant topics, which is why the performance level can be equally high.
3. Researchers apply for funding from thematic programmes but use the funds to do traditional research. They effectively relabel their questions. This implies that there would be no no difference with scientists who rely on other types of funding.

Specific questions

What are the research topics in climate science worldwide and in the Netherlands? What are the research topics studied by scientists working in KvR and KvK? Is their topical specialisation the same or different from worldwide climate science? Is the work of programme participants a continuation of pre-existing topics or do we see an emergence of new topics? Is this specialisation related to the thematic orientation of KvR and KvK?

Are scientists working in KvR and KvK more or less productive than climate scientists working outside the programmes? Does the work of scientists working in KvR and KvK have more or less impact than that of climate scientists working outside the programmes?

Have the programmes facilitated the emergence of new networks? Do we see a stronger focus on national collaboration? Is there an increase in co-publication with stakeholders?

Methods and data

The research will be based on three sources of information. First, the membership database of the two climate programmes provides detailed information on the identity and affiliations of participants as well as information on the projects. The second source is a dataset of all scientific publications in Thomson Reuters' Web of Science relating to climate change, adaptation and mitigation. The third source concerns documentation on the thematic orientation of the KvR and KvK programmes.

We will combine scientometric analysis and social network analysis to identify and analyse collaboration networks and patterns of topical specialisation. The questions on topical specialisation will be answered by creating a topical map of climate science worldwide and in the Netherlands. The development of topics will be mapped over time and related to the development of KVR and KVK.

Expected results:

This subproject will show whether different modes of organizing research differ in terms of selection of research topics, in terms of productivity, and in terms of impact.

2.3.3 Embodied knowledge or human capital output and outcomes

Researchers: Tjerk Wardenaar, Wouter Boon

In this part we narrow the focus on the effect of participating in co-production programmes on the characteristics, skills and careers of scientists. After all, embodied knowledge is an important, but often neglected, output of research programmes. In the three international programmes of our study (section 3.1), for example large numbers of PhDs participate and obtain their degrees. While their dissertations are listed (and evaluated) as output, the embodied knowledge, training and obtained non-academic skills are not. In this way, a potentially large impact of these programmes remains hidden. To gain insight into this hidden output of the programmes we will study the characteristics and skills of participating PhDs of the three programmes.

Firstly, the *characterization* of individual scientists who contribute to climate adaptation projects. The question is which characteristics of these scientists determine their role in the Knowledge for Climate program. There is general consensus that solving grand challenges requires a different mode of science production – knowledge co-production – that revolves around collaboration among scientists and societal stakeholders. There is extensive literature on the costs and benefits of multi-institutional and multi-disciplinary collaboration in science. Knowledge co-production adds a dimension by combining actors who respond to different incentive systems, speak a different language, formulate their goals on different levels (e.g. individual reputation, collective objectives), and work on different time scales (e.g. Choi et al 2004). Does involving science in societal problems require different scientists (to bridge academic core and hotspot practice as well as to work with stakeholders in hotspots) or can the same scientists in different roles?

Network analysis is used to describe the network of scientists and demarcate the positions of these scientists. These network positions are explained focusing on several characteristics of these scientists, such as age, gender, career and life cycle, and past experience. These characteristics were measured through bibliometric analysis (e.g. focusing on publications and citations), analysis of scientists' CVs, and document analysis.

This part is work-in-progress. We have drawn a sample from the participants of the Knowledge for Climate programme (Kennis voor Klimaat; KvK) in the Netherlands. Using the membership database, which was made available by the programme office of the Knowledge for Climate programme and which links individuals to organisations, projects, and programmes, a two-mode network was constructed (Figure 1). This network shows how individual participants take part in regular projects and hotspots projects and how projects are linked through participants. From the network we can identify three types of academic researchers: (1) researchers working in regular research projects with other academics, (2) researchers working in hotspot projects with people from government, industry and NGOs, and (3) researchers that link regular projects with hotspot projects, some of whom have double affiliations. The properties of each type of researcher need to be examined to discover differences in lifecycle stage, cognitive specialisation, institutional identity, geographical location, and past performance.

This part needs further data collection, data analysis as stated above. An additional comparison with a network of scientists in another large-scale research program in another sector (healthcare and pharmaceutical sciences) is explored at the moment. Reporting will be in the form of a scientific article.

Building on the first part, a second step is the focus on PhD students. In the three international programmes of our study (section 2.1) large numbers of PhDs participate and obtain their degrees. While their dissertations are listed (and evaluated) as output, their embodied knowledge, training and obtained non-academic skills are not. PhDs from these programmes, however, might benefit largely from these skills. PhDs from these programmes may have an advantage for academic and non-academic employers. Anecdotal evidence suggests that stakeholders (potential employers) value the embodied knowledge of these programmes highly.

This part of the research is still in the development phase. At present, we try to identify the key characteristics and skills. On the one hand, we use the insights of the *characterization* of individual scientists described above. On the other hand, we make use of previous studies in the fields of knowledge utilization, knowledge co-production, and (social) psychology. Knowledge utilization and co-production studies emphasize communication, translation, and mediation skills. Psychological studies stress the current importance of employability (i.e. developing yourself to be able to work in different environments). These insights will result in a set of key competences.

To assess the effect of participating in these programmes on the skills of PhDs we will compare the competence profiles (based on these key competences) of different groups of PhDs. These compete profiles are planned to be obtained by means of survey research. We will survey PhDs from different programmes and peer groups of PhDs in more traditional research projects. A comparative analysis of the different samples will show how participating effects these profiles. In this way, we gain insight into the embodied output that is produced due to the training of PhDs in programmes that facilitate and organise knowledge co-production.

The conclusions of this part of the project give insight into (an underexposed) output of knowledge coproduction programmes: highly skilled people. However, the relevance of these conclusions are beyond knowledge coproduction programmes. The number of PhD holders worldwide has been growing for decades, but the academic labour market is unable to provide enough jobs. A large number of graduates will therefore continue their career outside academia, i.e. in jobs that do not require a PhD degree or academic skills. This study gives insight into the possibilities and benefits of an alternative PhD training trajectory.

3 Knowledge transfer

The results of our research will be published in scientific journals. The primary community is that of science policy studies. We aim to publish in journals such as Research Policy, Science & Public Policy, Research Evaluation, and Scientometrics. The resulting output will be part of the PhD theses of Tjerk Wardenaar and Stefan de Jong.

The mission of the KvK programme calls for an active involvement of stakeholders. This is why, in addition to the research activities, we also organise activities aimed at a wider non-academic audience. The lessons drawn from the various components in our project will be presented to policy makers in various locations. One example is an interactive workshop at the Day for Young Civil Servants in 2011, where trainees were shown how to effectively engage scientists to support public policy.

In order to contribute to the KvK goal of developing a sustainable climate research infrastructure, the implications of the project will be discussed with the KvK governing bodies.

3.1 Wouter Boon and Edwin Horlings (eds.), Gezamenlijk onderzoek voor de grote maatschappelijke vraagstukken

In this edited volume, we bring together knowledge about knowledge co-production around different problem areas. The volume provides an overview of ‘good practices’ of knowledge co-production for grand societal challenges in different sectors. The first goal is to show how to organize collaborative science-society knowledge production. Can knowledge co-production contribute to dealing with grand societal challenges and if so, how? Under which conditions? Which evaluation criteria can be used? Which level of operation works best: local, regional, national, international? This points towards success factors as well as potential barriers and tensions that are related to knowledge co-creation projects.

Tackling complex problems is beyond individual actors. They need to collaborate and must be activated and empowered. Various arrangements have emerged, each specific to their environment. Chapters 2 thru 6 present existing arrangements of knowledge co-production on climate change, health, social problems, water management, and sustainable agriculture. Chapter 7 provides a guide to setting up and carrying out knowledge co-creation projects. Chapter 8 gives an expert view on the challenge of appraising co-created knowledge. In the final chapter we pool the results and draw conclusions. The main objective of this chapter is, however, to encourage a debate about the potential of knowledge co-production for tackling the grand challenges.

1. Wouter Boon and Edwin Horlings, Introduction
2. Tjerk Wardenaar, Samenwerken in klimaatprogramma's – balanceren tussen wetenschappelijk project en consultancy [Collaborating in climate programmes – Balancing between science and consultancy]
3. Wouter Boon, Universitair medisch centra als innovatiehubs [University medical centres as hubs of innovation]
4. Yvonne Zonderop, Uitdagingen voor de co-creatie in de sociale sector [Challenges for knowledge co-production in the social sector]
5. Marlous Blankensteijn, Gelegitimeerde kennis? [Legitimised knowledge?]
6. Johan Bouma en Peter Smeets, Functionele transdisciplinariteit als basis voor bijdragen vanuit de landbouw aan duurzame ontwikkeling]Functional transdisciplinarity as a basis for the contribution of agriculture to sustainable development]
7. Femke Merkx, 'Kenniscocreatie: hoe doe je dat?' ['Knowledge co-production: how do you do it?']
8. Leonie van Drooge en Stefan de Jong, Waardering van gezamenlijke kennisproductie [Appraising collaborative knowledge production]
9. Conclusions and discussion

The publication is aimed at policymakers and politicians in the Netherlands who have an interest in science and innovation policy and/or in grand societal challenges. In order for this report to have an impact, the presentation of the report (planned for December 2012) will coincide with a series of Internet blogs, supported by Twitter, highlighting topics and chapters from the report, as well as a symposium on knowledge co-production.

3.2 Debating function on demand-oriented innovation and research policy

The results of our work are also relevant for tackling other societal problems and for other areas where scientists interact with social stakeholders. We regularly communicate findings and insights on knowledge co-production and user-producer interactions, for example by taking part in discussion meetings. The topics of these meetings include interactive research programming, social innovation, and the positioning of non-academic research institutes. The findings that were presented were well-received and include:

- Demand articulation during agenda-setting and execution of research requires a continuous learning process. It is not enough to arrange demand articulation as a one-off exercise.
- Being involved in user-producer interactions demands that knowledge producers and users maintain a certain level of knowledge and resources.
- Knowledge co-creation often happens during the agenda-setting and valorization phase but there is less interaction and user involvement during the knowledge production itself.

The plan is to continue this debating function and in this way to communicate, discuss, and validate the findings of our research into Knowledge for Climate. One way of doing this, is by taking part in a debate series organized by Knowledge for Climate.

4 Preliminary results

The exploratory phase of the project has been completed. Our main findings with respect to the main questions of the project are the following. Given the stage of the project, these conclusions may change. However, they give an idea about the flavour of the conclusions one may expect from this project.

4.1 Main findings

The first main finding is that there is a wide variety of multi-actor multi-measure programmes (MAPs) that involve stakeholders, stakeholder interaction takes different forms, and knowledge co-production is a rare phenomenon. We have yet to find out if knowledge co-production works well and works better than conventional scientific research.

- There are large differences in the organization of interactions between scientists and stakeholders within and between programmes. There is a division of labour between scientists who are involved in science-society interactions and scientists who perform more traditional research tasks.
- We have a first impression of the contextual factors that influence the dynamics of programmes, namely: (1) the organization and reward system of the PhD system; (2) the level of climate literacy of non-academic stakeholders; and (3) the duration of the programme.

- MAPs appear to have three (broad) functions: (1) they provide a ‘safe haven’ for science-society interactions, (2) they support alternative research careers, and (3) they train early-career scientists in non-academic skills.

The second main finding relates to an analysis of knowledge co-production in protective spaces in one KvK hotspot project. Preliminary results show that:

- Protection – in the form of support by a large-scale research programme –was necessary to provide a safe haven for a new topic of research and because of the knowledge co-production nature of the project.
- Team participants paid much attention to framing local research in terms of global values and aggregating local practices to the global scale.
- Project governance was heterogeneous in terms of leadership, coordination and task partitioning.

The third main finding is that effective learning in research teams is influenced by the extent to which previous collaboration took place (whether the project is part of a continuous learning process), by the level of knowledge integration, and by the way this is managed in terms of leadership (distributed versus centralized) and task partitioning (integrative versus complementary collaboration).

The fourth main finding is that (formal) network configurations at project level do not seem to make a difference. We will have to make an in-depth analysis of case studies to find out which factors do matter. These factors can then be reintroduced into network analysis to derive more general conclusions.

4.2 Expected scholarly contributions of the project

This project will contribute to our understanding of (i) the dynamics of science systems, (ii) the organization of research, (iii) science-policy interfaces, and (iv) the role of scholarly knowledge and expertise in society and policy.

1. Within the science of science and science policy, a main issue is the relation between forms of agenda setting, funding, evaluating and organizing research at the one hand, and the quality, productivity, topical orientation and societal impact of research on the other. By comparing the output of different modes of organizing research, we may empiri-

cally test whether the changes in the science systems are beneficial or mainly detrimental – as is often argued.[1]

2. More specifically, when completed, the project will improve our understanding why some researcher-stakeholder network configurations support the societal impact of research and other configurations do not.
3. One of the models for improving knowledge use is ‘co-production’, leading to transdisciplinary knowledge. The project will contribute to our understanding of how the various modes of organizing co-production relate to impact. Co-production and transdisciplinary research require larger and more heterogeneous teams. This project will contribute to our understanding of the conditions for successful team science. Until now the focus has been on the size and composition of monodisciplinary scientific teams[2] and on cross-disciplinary collaborative science projects.[3] Our project will generate insights that can guide the science of team science into new directions.
4. By studying the interactions between researchers and stakeholders on project level, we will clarify the role of knowledge co-production. Is coproduction as a model the way to go, or do we need to find other models for organizing the science-stakeholder interface?[4]
5. Finally, by studying the societal impact of climate research MAPs, the project will contribute to the understanding of the role of scholarly knowledge and of research-based expertise in society and politics. What is the role of knowledge in practice, and what are the conditions for uptake?[5] What determines the absoptive capacity of social stakeholders and policy makers?

These expected results are highly relevant for science policy, which is all too often fact-free, as new forms of governing and organising research (and the research-policy interface) are generally introduced without a any understanding of how science and the science-society interface works.

[1] Some references: Whitley, Glaser, the changing governance of the sciences, Springer 2007; Whitley et al, Reconfiguring knowledge production OUP 2010; Radder (ed) The commodification of research Pittsburgh University Press 2010)
[2] Verbree, M. (2011). Dynamics of academic leadership in research groups. Den Haag, Rathenau Instituut.
[3] Falk-Krzesinski, H. J., N. Contractor, et al. (2011). "Mapping a research agenda for the science of team science." Research Evaluation 20(2): 145-158.
[4] Pielke, R. A. (2007). The Honest Broker: Making Sense of Science in Policy and Politics. Cambridge, Cambridge University Press. Gibbons, M., C. Limoges, et al. (1994). The new production of knowledge. The dynamics of science and research in contemporary societies. London/Thousand Oaks/New Delhi, SAGE Publications.
[5] Schon, the reflective practitioner; Collins & Evans, Rethinking expertise; Pielke, the honest broker. Driesses, Leroy, Van Vierssen, from climate change to social change.

5 Discussion

Science is expected to (and can) contribute to grand societal challenges. There are different modalities ranging from small-scale to very large-scale (e.g. temporary research programmes, permanent institutes, local working groups). What works best? Is knowledge co-production a solution? And is it better to set up large-scale mission oriented research programmes or to focus on small-scale local-problem oriented, like the KvK hotspots?

This question cannot yet be answered, as the research on the outcomes and impact of research organized as MAPs has only just started. Also, the comparison with the output and impact of other forms of organizing climate research still has to be done. These are crucial parts of the project.

Finally, if MAPs work well in climate change, mitigation and adaptation research, should there also be similar programs for other complex problems, such as declining social cohesion, aging, and problems of poverty and inequality. In other words, are modalities of organizing research dependent on the field and social domain involved? This is a crucial question that of course will require more research. Nevertheless, we will try to reflect on this in our analysis: where do we see processes that seem specific for the sector, and where do we see processes that also may occur elsewhere.

6 Appendix: Output (2010 – 2012)

Scientific publications:

Given the phase of the research, we do not have publications yet. However, results have been communicated in other forms (mainly conferences) and several papers are in preparation and will be submitted in 2012.

Publications for general public:

Boon, W., Vraagsturing in innovatiebeleid: daal van die top af, Rathenau Weblog, 30 september 2011, http://rathenaunl.wordpress.com/2011/09/30/vraagsturing-in-innovatiebeleid-daal-van-die-top-af

Wardenaar, T. & Boon, W., Grote onderzoeksprogramma's moeten de 'juiste mensen' stimuleren (www.rathenaunl.wordpress.com, 2012)

Policy reports and factsheets:

Merkx, F., Roks, D., Wardenaar. T., Impact van Klimaatkennis: Maatschappelijke impactanalyse van Klimaat voor Ruimte en Kennis voor Klimaat (Rathenau Instituut, 2011)

Wardenaar, T., Climate Science Programmes and Stakeholder Involvement (KvK Factsheet, 2012)

Wardenaar, T., Case Study KLIMZUG (KvK Factsheet, to be sumitted 2012)

Wardenaar, T., Case Study NOAA RISA (KvK Factsheet, to be sumitted 2012)

Conference presentations and conference papers:

Boon, W., Horlings, E., Van den Besselaar, P. Governance of team science (International conference on governance of adaptation, Amsterdam 2012)

Boon, W., Horlings, E., Van den Besselaar, P. Governance of team science (EU-SPRI conference, Karlsruhe 2012).

Boon, W., Horlings, E. Governance of learning processes in transdisciplinary climate research projects – knowledge co-production in protective spaces (International Conference on Sustainability Transitions, Copenhagen 2012)

Boon, W., Horlings, E. Governance of learning processes in transdisciplinary climate research projects (4S/EASST conference, Copenhagen 2012).

Boon, W., Horlings, E., Van den Besselaar, P. Governance of learning processes in transdisciplinary research teams. Conference paper International conference on governance of adaptation, Amsterdam 2012.

Boon, W., Horlings, E. Governance of learning processes in transdisciplinary climate research projects – knowledge co-production in protective spaces . Conference paper, International Conference on Sustainability Transitions, Copenhagen 2012.

Boon, W. Academic hospitals as innovation hubs (in: Report on knowledge co-production, Rathenau Instituut 2012)

Hessels, L., Boon, W., Wardenaar, T. Varieties of coordination: A systematic comparison of 37 network programs (International workshop Understanding Research Coordination, Amsterdam 2012)

Merkx, F., Roks, D., Wardenaar. T., Organization of Scientific Research on Climate Proofing the Netherlands (EASST, Trento 2010)

Wardenaar, T. The influence of stakeholder involvement on research practices in climate science (4S/EASST, Copenhagen 2012)

Wardenaar, T. Boon, W., Horlings, E. National differences in organizing stakeholder involvement in climate science programmes (Climate Adaptation Futures: Panel Evaluation Success in Climate Adaptation Support, Tucson 2012)

Wardenaar, T., de Jong, S.P.L., Organizing Science Society Collaborations: Coordination for Social Relevance and Scientific Excellence (Atlanta Conference, Atlanta 2011)

Wardenaar, T., Horlings, E., Organizing Stakeholder Involvement in Climate Science: An inventory of programmes, activities, and obstacles (4S, Cleveland 2011)

Wen, B., and Horlings, E., Understanding the formation and evolution of collaborative networks using a multi-actor climate program as example. Paper for the Social Networks and Multiagent Systems @AISB/IACAP World Congress 2012, Birmingham

<u>Organized scientific panels:</u>

Wardenaar, T. & Horlings, E. (chair), Organizing stakeholder involvement in climate science (4S 2012, Cleveland)

Valorisation, communication & workshops:

Boon, W.P.C. Demand steering and demand articulation: knowledge co-production in large research programmes (AWT Symposium Quadruple Helix and innovation policy, Den Haag 2012)

Boon, W., Invited speaker at brainstorm session on interactive research programming (ZonMw, Utrecht 2012)

Boon, W., Invited speaker at workshop on 'Collaborations in the Health Sciences' (Centre for Society & Genomics Workshop, Utrecht 2011)

Boon, W., Invited speaker at workshop on demand articulation and demand steering Royal Netherlands Meteorological Institute (KNMI, De Bilt 2012)

Heringa, P., de Jong, S.P.L., Wardenaar, T., Workshop succesvol samenwerken met wetenschappers (Jonge Ambtenaren Dag, Eindhoven 2011)

Wardenaar, T., Productive interactions as indicator for societal relevant climate science (Climate Prediction Applications Science Workshop, Miami 2012)

Scholarly (journal) publications in preparation (to be submitted in 2012):

Boon, W., Horlings, E., Van den Besselaar, P. Governance of learning processes in transdisciplinary research teams (related to section 2.2, research question 4). To be submitted to an environment and policy journal.

Boon, W., Horlings, E. Governance of learning processes in transdisciplinary climate research projects – knowledge co-production in protective spaces (related to section 2.2, research question 5). To be submitted to a science, technology and innovation journal.

Boon, W. Academic hospitals as innovation hubs. To be submitted in a technology transfer journal.

Boon, W., Chappin, M. Cognitive factors influencing transdisciplinary team performance (related to section 2.2, research question 4). To be submitted to a environment and policy journal.

Wardenaar, T., de Jong, S.P.L., Hessels, L.K., Coordination for Social Relevance and Scientific Excellence: A Comparative Analysis of two Dutch Network Programmes (related to section 2.1, research question 1). To be submitted to a science, technology and innovation journal.

Wardenaar, T., Horlings, E., van den Besselaar, P.A.A., Stakeholder Involvement in Science-Society Collaboration Programmes in Climate Science (related to section 2.1, research question 1). To be submitted to a science, technology and innovation journal.