BOUNDARY ORGANIZATIONS IN A CHANGING CONTEXT:

A study of Dutch national knowledge institutions

Pauline de Kroon   **19 June 2018**   **MSc. Thesis report**

WAGENINGEN
UNIVERSITY & RESEARCH

BOUNDARY ORGANIZATIONS IN A CHANGING CONTEXT:

A study of Dutch national knowledge institutions

A thesis submitted in partial fulfillment of the requirements of
Wageningen University & Research Master's Programme Forest and Nature Conservation

By Pauline de Kroon
890814 481050

Commissioned by the Netherlands Environmental Assessment Agency (PBL):
Eva Kunseler

Front image: Knowledge co-production (Stroud, 2016)

Esther Turnhout
Chairgroup Policy and Society
Wageningen University and Research
The Hague, 19 June 2018

WAGENINGEN
UNIVERSITY & RESEARCH

Summary

The work of boundary organizations is under constant influence of developments in society and science. Increasing initiatives from citizens to structure the public domain, changes in the way that knowledge is communicated, decentralization of the government and wicked problems are influencing societal research questions, and influence the way in which boundary organizations conduct research regarding these societal questions. To work on the societal research questions, there is a need to not only use traditional, modernistic methods, but to also use more reflexive methods. Because of this, the Netherlands Environmental Assessment Agency, in Dutch known as Planbureau voor de Leefomgeving, (PBL), is caught between the modernist - and the reflexive logic. This has proven fertile ground for challenges with regard to the role and position of the PBL within 'reflexive' projects. The PBL expressed its wish to explore whether other Dutch boundary organizations are also caught between logics and experience the same kind of challenges. The scope of this research therefore lays on Dutch boundary organizations in the context of the changing arena in which they navigate. The aim is to contribute to the understanding on how Dutch boundary organizations respond to the changing demands of knowledge production of science for policy. The main research question that was formulated to obtain this objective is as follows: *'How do Dutch boundary organizations respond to the changing demands for knowledge production?'.* A qualitative research approach with an interpretative study design was used. Via non-random expert sampling the network of National knowledge institutions (RKIs) was chosen, after which the main selection of units of analysis took place via snowball sampling. Through semi-structured interviews, participant observation, and a phenomological approach, in-depth insight was gained regarding 1) the RKIs role perception of science for policy, 2) how the modernist and reflexive logic are represented within the RKIs and 3) the conditions that influence the performance of the RKIs. Based on the data it can be concluded that the RKIs are caught between logics. This is shown by the presence of considerations for all four roles of science for policy, and the presence of a modernist as well as reflexive view, and the manifestation of both these logics at once. In most RKIs the modernist logic is dominant. In dealing with this 'in-betweenness' the RKIs with a dominant modernist view encapsulate the reflexive elements within the modernist logic. This is shown by the modernistic quality principles that are guiding the RKIs in the performance of the role of science for policy. From a modernistic perspective there is acknowledgement for the need to use reflexive elements, but these tend to be implemented in a modernistic way and evaluated from a modernistic point of view. The presence of enabling conditions for innovation and inter- and transdisciplinary approaches can influence the performance of these RKIs, but this will not change their modernist perspective. Two RKIs differ from this, for in their reflection upon the research context, the problem structure, the subjects and their key tasks, they show considerations for both modernist and reflexive logic. Furthermore, in dealing with being caught between logics they use a different alignment strategy. They make loose connections between the attributes that constitute both logics, and in this they value components of both logics as important for the formulation of societal robust advice. In these last two RKIs most of the conditions for innovation and inter- and transdisciplinary approaches are met. This enables these RKIs to use elements of both the modernist and the reflexive logic. However, what ultimately enables the RKIs to use the loose connections strategy is the absence of a dominant modernist logic, and the presence of a reflexive view on science for policy.

Samenvatting

In de uitvoer van taken op het vlak van wetenschap en beleid worden grensorganisaties continu beïnvloedt door veranderingen die zich in het speelveld voordoen. Deze veranderingen kenmerken zich door toenemende burgerinitiatieven, veranderingen in de wijze waarop kennis een rol speelt, de decentralisatie van de overheid, maar ook door een toename in complexe problemen. Dit veranderende speelveld is van invloed op het soort kennisvragen dat gesteld wordt, en op de wijze waarin grensorganisaties invulling geven aan onderzoek naar deze kennisvragen. Naast modernistische onderzoeksmethoden is het voor deze kennisvragen nodig ook gebruik te maken van reflexieve onderzoeksmethodes. Het Planbureau voor de Leefomgeving (PBL) bevindt zich door deze veranderende vraag van kennisproductie voor beleid tussen de modernistische en reflexieve logica in. Hierdoor zijn er uitdagingen ontstaan op het gebied van de rol en de positie van het PBL binnen projecten met een meer reflexieve aanpak. Het PBL wil graag weten of andere grensorganisaties zich ook tussen de modernistische en reflexieve logica in bevinden en of en welke uitdagingen zij daarbij ervaren. Dit onderzoek richt zich daarom op Nederlandse grensorganisaties in de context van een veranderend speelveld, met als doel een bijdrage te leveren aan de kennis over hoe Nederlandse grensorganisaties, in de wijze waarop kennis voor beleid gevormd wordt, inspelen op veranderingen in het speelveld. De daar bijhorende hoofdvraag luidt als volgt: *Hoe gaan Nederlandse rijkskennisinstellingen om met de veranderende vraag naar kennisproductie?* Deze hoofdvraag is beantwoordt middels een (kwalitatieve) interpretatieve studie. Via een niet-willekeurige expert steekproef is het Rijkskennisinstellingen-netwerk (RKIs) als case geselecteerd, waarop vervolgens middels de sneeuwbal-methode respondenten geselecteerd zijn. Via semigestructureerde interviews, observaties en een interpretatieve aanpak voor data analyse, is inzicht verkregen in: 1) de rolopvatting van de RKIs in de functie van wetenschap voor beleid, 2) hoe de modernistische en reflexieve logica binnen de RKIs naar voren komen, en 3) welke condities van invloed zijn op de wijze waarop de RKIs kunnen werken. Op basis van deze inzichten kan geconcludeerd worden dat de RKIs zich bij de uitvoering van hun werk tussen de modernistische en reflexieve logica in bevinden. Dit wordt duidelijk doordat de RKIs overwegingen voor alle vier de rollen van wetenschap voor beleid laten zien, en doordat binnen de RKIs zowel een modernistische – als een reflexieve zienswijze naar voren komen. De modernistische logica domineert binnen de meeste RKIs over de reflexieve. De wijze waarop de RKIs tussen de twee logica's navigeren is door inkapseling van de reflexieve elementen in een modernistische zienswijze. Dit is af te leiden aan de modernistische kwaliteitsprincipes die leidend zijn binnen het werk dat de RKIs uitvoeren. Vanuit een sterk modernistisch perspectief wordt de noodzaak van inpassing van reflexieve elementen erkent. Echter, de reflexieve elementen worden vanuit een modernistische wijze geïmplementeerd en geëvalueerd. De aanwezigheid van stimulerende condities voor innovatie en inter- en transdisciplinair werken kunnen het werk van de RKIs beïnvloeden, maar dit zal nog niet zorgen voor een verandering in de modernistische zienswijze. Er zijn twee RKIs die zich op dit gebied onderscheiden. In de reflectie die bij hen plaatsvindt op de onderzoekcontext, de probleemstructuur, onderwerpen en de kerntaken, laten zij overwegingen zien voor zowel de modernistische als reflexieve logica. Bij deze RKIs wordt volgens een andere strategie tussen de twee logica's genavigeerd. Bij hen worden er losse connecties gemaakt tussen de waardes die bij de twee verschillende logica's horen, en worden de attributen van beide logica's als belangrijk en waardevol gezien voor het tot stand brengen van maatschappelijk relevante, robuuste, kennis. Bij deze laatste twee RKIs wordt aan de condities voor innovatie en inter- en transdisciplinair werken voldaan. Hierdoor kunnen deze RKIs gebruik maken van elementen uit zowel de modernistische als de reflexieve logica. Echter, de afwezigheid van een dominante modernistische logica, en de aanwezigheid van een reflexieve zienswijze op wetenschap voor beleid, is uiteindelijk de belangrijkste factor die het voor deze twee RKIs mogelijk maakt om te navigeren middels de strategie van losse connecties.

Acknowledgement

Contents

List of figures

List of tables

List of abbreviations

MRQ	Main research question
RQ	Research question

RKI-network	**Network of national knowledge institutions**
CBP	Netherlands bureau for economic policy analysis
CBS	Statistics Netherlands
KiM	Netherlands institute for transport policy analysis
KNMI	Royal Netherlands meteorological institute
NFI	Netherlands forensic institute
NVWA	Netherlands food and consumer product safety authority
PBL	Netherlands environmental assessment agency
RIVM	Dutch national institute for public health and environment
RKI('s)	National knowledge institution(s)
RKD	Netherlands institute for art history
RWS	National agency for infrastructure and watermanagement
RCE	Cultural heritage agency
SCP	The Netherlands institute for social research
WODC	Research and documentation center

1. Problem statement

The Netherlands Environmental Assessment Agency, in Dutch known as Planbureau voor de Leefomgeving, (PBL) is a government funded expert agency which operates as a boundary organization on the science policy interface. Boundary organizations are organizations that serve as a bridge between science and policy. They are institutionalized bodies that perform research, give policy advice and evaluation within a specific context, all in a scientifically grounded way (Lentsch & Weingart, 2011; Petersen, Cath, Hage, Kunseler, & van der Sluijs, 2011). The PBL works in the context of spatial planning, nature and environment (PBL, 2017). In the production of policy assessments, evaluations and new policy advice, the PBL is constantly balancing between scientific validity and providing useful knowledge for policy (Huitema & Turnhout, 2009).

The work of the PBL is under constant influence of developments in society and science (Kunseler & Verwoerd, in development). An example of this influence is the decentralised Dutch nature policy, which made the twelve Dutch provinces responsible for both the development and the implementation of the nature policy. Together with the National government the provinces are now responsible to achieve the international nature goals, to complete the Dutch Nature Network, to increase societal engagement and to promote the relation between nature and the economy. In order to see whether these ambitions can be realised by 2027, the PBL has been commissioned to conduct this evaluation. Because the nature policy is increasingly characterized by multi-stakeholder involvement, and also by multi-level governance, the PBL had to design a new evaluation method with a reflexive character. The evaluation method focusses on participation of all these stakeholders, and takes place during the policy process in order to combine learning and the accountability purposes of evaluation. Together with the other stakeholders, the PBL is developing a new way of knowledge production, using learning by doing (Verwoerd, Regeer, & de Wildt-Liesveld, 2017). Other changes in society that are influencing the way in which PBL produces knowledge are 1). More initiatives from the citizens, for example local citizens or societal foundations, to structure and give form to the public domain. This influences societal research questions as well as the way in which the PBL conducts research regarding these societal questions. 2). The way in which knowledge is communicated has changed over the years. Through the digitalisation and social media there is more factual or non-factual knowledge to be had. For example, conclusions regarding certain information can be shared by anyone, without factual back up, and can reach the other side of the world in an eye-blink. For the PBL this means that there are new opportunities to share knowledge, but at the same time they face the challenge of presenting this in an attractive and easy to share form (Bressers & Poldermans, 2018).

A recent inventory at the PBL has shown that the developments in society and the need for new ways of knowledge production is affecting the way in which the PBL can work. There is a need to not only use traditional scientific methods (objective, valid, disciplinary), but to also use more reflexive methods (interactive, action oriented, participative) (Kunseler & Verwoerd, in development). In this, the PBL is caught between logics, with on the one hand the more traditional ways of knowledge production, where the role of stakeholders is relatively small as for example units of analysis, and on the other hand a more reflexive and interactive way of knowledge production in which stakeholders are included in the process of the formulation of the problem and the research questions, and in which the knowledge and input of the stakeholders is included in the research process itself (Kunseler, 2017). Being caught between these two logics has proven to be fertile ground for challenges with regard to the role and position of the PBL within 'reflexive' projects. For example, how is the PBL to guard objectivity and independence, while at the same time valuing reflexive

quality principles such as addressing perspective plurality and uncertainties? Figure 1:1 shows a visualization of the above-mentioned problems.

The PBL suspects that other boundary organizations are also caught between these logics, and experience challenges when it comes to balancing between scientific validity and producing useful knowledge for policy. Therefore, the PBL has expressed the wish to find out how other boundary organizations navigate in the changing arena of the science/policy interface. The objective of this thesis therefore is *to contribute to the understanding on how Dutch boundary organizations respond to the changing demands of knowledge production of science for policy*.
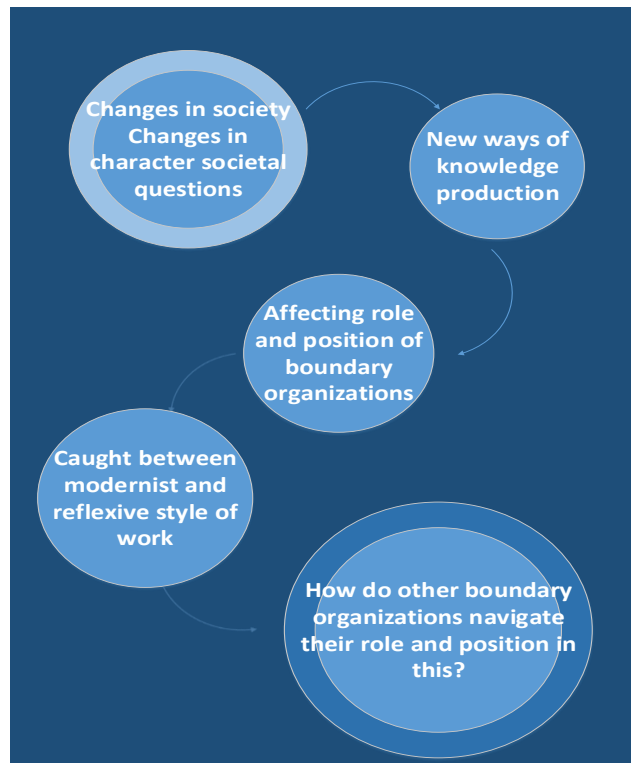
Figure 1:1 Visualisation of the problem statement

This document presents the thesis report that was made to achieve aforementioned objective.

- Chapter 2 starts with the context in which this thesis finds its starting point and provides the reader with relevant background information.
- The theoretical framework that has been used to interpret and analyse data is explained in Chapter 3.
- Following this, in Chapter 4 the research questions and the operationalization of the concepts can be found.
- Chapter 5 will explain the methodology that was used to conduct this thesis.
- In Chapter 6 research results will be shared.
- In Chapter 7 the research questions will be answered, and a conclusion to the main research question will be given.
- In Chapter 8 the findings of the research will be discussed, as well as the limitations of the research.
- Finally, in Chapter 9 some recommendations for further research can be found, as well as practical recommendations for boundary organizations.

2. Context of the problem

The role of science in society is changing, just as society is. In the past century, scientific progress has made the development of industrial innovations and a welfare state possible. Although this progress is largely positive and benefits society, the negative consequences are also becoming more apparent. A negative consequence is for example the CO2 emission that is a result of the use of fossil fuels in industry and for transport. Society is confronted with the need to change the use of fossil fuels; new and more environmental friendly alternatives have to be found. This automatically requires involvement of scientific experts. However, because of the wicked nature of the problem, scientific experts are no longer the only party that have a role to play in this. There are many stakeholders involved, such as private companies, the government, but also citizen groups. According to Rittel and Webber (1973) wicked problems are unstructured societal problems that occur at different system levels. Different societal actors are involved, and there is no right or wrong approach to resolve the problem. This is because every stakeholder brings in their own knowledge, views and objectives. This can result in competing facts and values for each stakeholder. Based on this, a shared problem definition is very hard to formulate. The absence of consensus makes dealing with wicked problems time consuming and hard to succeed. Moreover, there are a lot of uncertain factors and the realization has dawned that science does have limitations and is not 'all knowing'. Partly in response to this realization, citizens have become more outspoken and have developed issues of trust, not only with regard to science, but also to the government (Funtowicz & Ravetz, 2008; R.J. In't Veld, 2010). These changes in society are influenced by science, while at the same time society is influencing science. Another classic example of a wicked problem that society and science are facing is climate change. Climate change affects life on earth in all kinds of ways that we are only just starting to discover. This topic involves a high level of uncertainty, unpredictability and ambiguity, and is a classic example of a wicked problem. These elements often form the basis for trust issues, because the more uncertainty , the less quality science and policy makers can deliver (Funtowicz & Ravetz, 1994). This, and the constantly shifting character of issues, presents a problem for the way science produces knowledge and for the effective governing of society.

2.1. Science for society

All these developments are showing its effect on the role of science for policy. After all, working on societal issues is quite an endeavour. Where the role of scientist used to be to conduct research, resulting in clear, straightforward answers that could be used for the development of science or society (mode-0), or to provide instrumental advice to policy makers (mode-1), this technocratic style of working no longer suffices due to the wicked nature of the problems society has to deal with (Regeer & Bunders, 2007). Society has entered the post-normal (science) era in which 1) knowledge production is issue driven and 2) science, policy and society have become interrelated (Funtowicz & Ravetz, 1994; Kønig, Børsen, & Emmeche, 2017), and 3) scientist and policy makers are forced to rethink the way in which society produces knowledge (Felt, Igelsböck, Schikowitz, & Völker, 2013). In order to address wicked problems, and to reduce the gap between science and society, other non-scientific stakeholders are included in the production process of knowledge. This inclusion of other stakeholders for the creation of knowledge is also known as mode-2 science. In mode-2 science knowledge is produced in a transdisciplinary way, meaning that multiple stakeholder perspectives on societal issues are integrated, enabling a process in which collaborative innovation of knowledge and active learning can take place (Basta & Kunseler, in development).

A transdisciplinary approach to science

In a transdisciplinary approach, disciplinary boundaries are overstepped with the aim to reduce the wickedness of problems. All stakeholders: - academics, citizens, bureaucrats, etc.-, that are concerned with the problem are involved in the process. Both scientific (expert) knowledge, bureaucratic knowledge, and other stakeholder knowledge (lay, professionals) are an ingredient to work on wicked problems (Edelenbos, van Buuren, & van Schie, 2010). Key aspects of transdisciplinarity are mutual learning, co-production of knowledge and collaborative framing (Bunders et al., 2010; Klein et al., 2012). There are different ideas about whether and how to integrate scientific expertise with the perspectives and knowledge of stakeholders and each transdisciplinary project differs in terms of the type of issue at stake, the objective, and the stakeholders involved (Turnhout, Stuiver, Klostermann, Harms, & Leeuwis, 2013). In answer to this the amount of guidelines for this approach and knowledge about this approach, is gradually increasing. For example, Gabrielle Bammer (2015) and colleagues have produced a toolkit for transdisciplinarity to enable transdisciplinary practitioners to learn from each other. The eight toolkits can be used to identify concepts and methods that are relevant in transdisciplinary research, as well as insights and tools on aspects of collaboration, synthesis of knowledge from all stakeholders, systemically thinking and making change happen (Bammer, 2013; Bammer, McDonald, & Deane, 2013; Bennett, Gadlin, & Levine-Finley, 2010; Bergmann et al., 2012; Young et al., 2014). Another example is the publication of the Rathenau Institute, in which they have researched the use of co-creation, in which context this can be applied, and which methods and techniques can be used to enable co-creation (Merkx, 2012). Other scholars such as Rowe and Frewer (2005) contributed to developing the field of transdisciplinary research by performing a literature review of participation methods that could be identified through articles from the United Kingdom and the United States, resulting in an overview of methods and where to find the articles. Recently, there have also been scholars who have tried to identify common ground in all the existing transdisciplinary articles and aimed at the formation of a conceptual framework (Brandt et al., 2013; Jahn et al., 2012).

The ideal transdisciplinary research process

Jahn et al. (2012) have formulated a conceptual model for the ideal transdisciplinary research process. In this, they have identified different stages, as can be seen in Figure 2:1.
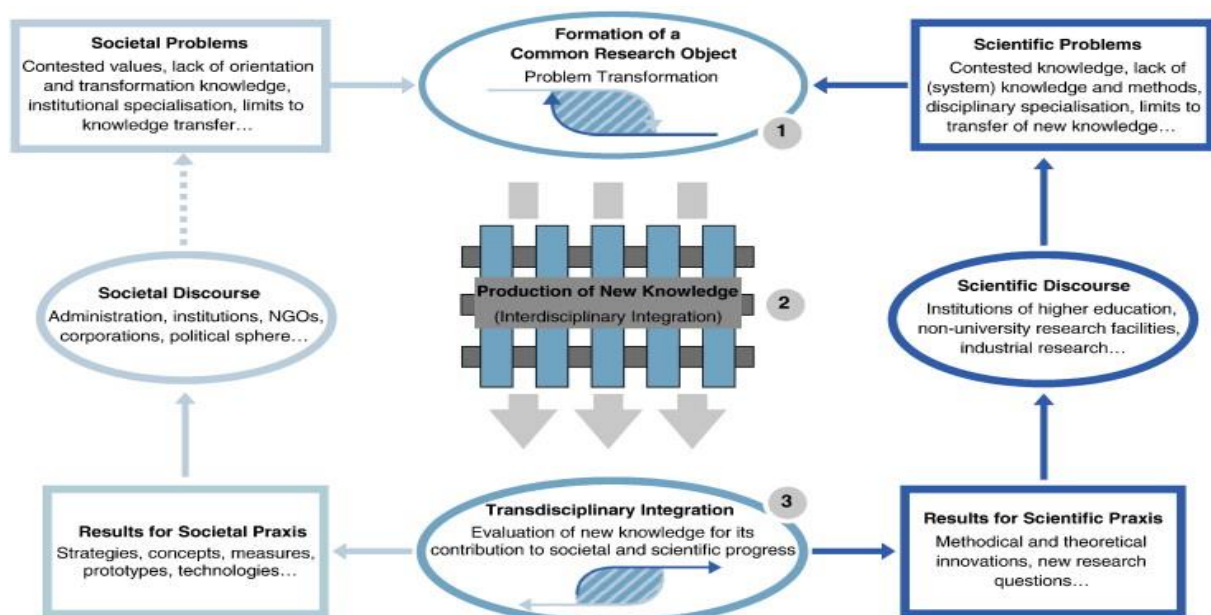
Figure 2:1. Model of ideal transdisciplinary research process (Jahn, Bergmann, & Keil, 2012)

Although each transdisciplinary project varies, this model effectively captures the essence of transdisciplinary research. In the middle of the model the three stages of transdisciplinary research are shown. To the left and right, the societal or scientific action that takes place in each stage can be seen. In _stage one_ all actors come together to work on a problem definition and to formulate a joint research object and plan. In this phase the plurality of visions, values, background, interest and goals becomes very clear. The degree to which the actors succeed in identifying and formulating a joint problem and goal determines the success for the whole project. In the _second stage_, the framework that was built in stage one, and the (disciplinary) knowledge of the actors, plays an important role in social learning and the co-creation of knowledge. Each actor integrates and shares research findings on a regular basis, thus building a platform for the production of new knowledge. In the _third and last stage_, initial results are formulated and assessed in terms of usefulness with regard to the research objective that the project set out with. Next to this, the validity of the results is checked, after which the results can be integrated in solutions, methodologies, innovations, or any other matter that contributes to decreasing the wickedness of the problem. Based on this, the transdisciplinary process can begin anew (Bunders et al., 2010). A more detailed explanation of each stage can be found in the work of Jahn et al. (2012). It is important to realize that transdisciplinary research is an iterative process, in which the kind of problem that is investigated, the complexness of this problem and the (un)certainty decide how much time is spent on each stage (Hirsch et al., 2008). Transdisciplinarity is '_. . . simultaneously an attitude and a form of action_' (Thomspon, 2004, p. 521).

2.2. Consequences for boundary organizations

The inclusion of multiple stakeholder perspective and stakeholder knowledge in the process of transdisciplinary knowledge production is affecting the position of boundary organizations. They are no longer the only party influencing the knowledge production process and they have to innovate methods that are used for research. For this, they need to interact with non-scientists, which is affecting their role in terms of transparency, objectivity, credibility and independency, as shown in the purple in Figure 2:2 (Bijker, Bal, & Hendriks, 2009; Hilgartner, 2000; Jasanoff, 2005). Responses to this are shown in the green in Figure 2:2. It shows a variety in ideas about what the role of boundary organizations is in handling complex problems, about how this should be organized and institutionalized, who should do this and how boundary organizations should perform the new role (Maasen, Lengwiler, & Guggenheim, 2006).

Figure 2:2. Consequences for boundary organizations

Regeer and Bunders (2007) and Kunseler (2017) wrote about the need for new ways of knowledge production in boundary organizations and challenges that can occur while doing so (see Figure 2:2). For example, challenges occur in how to finance interactive project programs, but also in the time scheme of a project, because interactive stakeholder approaches need more time to set up. Furthermore, keeping up the normal, traditional work, while at the same time spending time on innovation of methods and techniques requires a specific mind-set, in which not only the traditional quality principle of science are valued (objective, valid, disciplinary), but also the more reflexive quality principles are given a place (interactive, action oriented, participative) (Regeer & Bunders, 2007). They also wrote about the way the PBL navigates the changing arena of knowledge production. This changing arena shows itself in the diversity of (new) stakeholders that have to be taken into account. For example, decentralisation of the Dutch government has had the effect that the PBL now also works with stakeholders such as local governments, provincial governments and municipalities.

Based on their research, it can be assumed that other Dutch boundary organizations experience the same kind of challenges, and that they are in different stages of realizing this shift and the way it is affecting their position. Some boundary organizations might already have embarked on a route to innovation by looking for other ways of input from societal actors (Regeer & Bunders, 2007). The scope of this research therefore lies on Dutch boundary in the context of the changing arena in which they navigate, aiming to contribute to the understanding of how Dutch boundary organizations respond to the changing demands of knowledge production of science for policy. The main research question that has been formulated to obtain this objective is as follows:

'How do Dutch boundary organizations respond to the changing demands for knowledge production?'

3. Theoretical framework

The objective of this thesis was to contribute to the understanding of how Dutch boundary organizations respond to the changing demands of knowledge production of science for policy. To be able to achieve this objective, it was necessary to find out what the role perception of the boundary organizations is and how they see the role of science for policy. Furthermore, to achieve this objective it was necessary to distinguish these roles between a more traditional view on the role of science for policy, and a new, reflexive view on the role of science for policy. Last but not least, to be able to see whether the changes in this role perception can be linked to the changing demands for knowledge production, it was necessary to find out which conditions are influencing the role choice. The elements in the theoretical framework have given guidance in formulating the research questions and the interview questions, as well as given guidance in structuring and analysing the results of the research.

- Paragraph 3.1 will introduce the different roles of science that have been identified in literature, which have helped in identifying the way boundary organizations position themselves in the policy arena.
- Paragraph 3.2 introduces two co-existing logics. In the context of this thesis these logics were used to categorize the roles and style of work that the boundary organizations are using.
- In Paragraph 3.3 three alignment strategies for working between these two co-existing are introduced. These alignment strategies were used to see how the Dutch boundary organizations respond to the changing demands for knowledge production.
- Following this, in Paragraph 3.4 a number of conditions that influence the way in which the boundary organizations can perform their roles are discussed.
- Finally, in Chapter 3.5 the conceptual model that was proposed, based on these theoretical concepts, is shown.

3.1. Roles of science

To study the relation of the role perception that boundary organizations have of the role of science for policy, Pielkes framework for the roles of science played in policy was selected. The framework shows the ideal roles of how scientist position themselves in relation to policy and politics (2007). The roles that were used in this thesis are the Issue advocate, the Science arbiter and the Broker or policy alternatives. In addition to this, Turnhout et al. (2013) formulated a new role based on Wadsworth (1998), the Participatory expert. Studying the way boundary organizations view their role in science has proven helpful in seeing whether changes in role have occurred/are occurring. Table 3:1 shows the four roles that were used and the characteristics of each role.

Table 3:1. *The four roles of science played in policy, (Pielke, 2007) and (Turnhout et al., 2013), based on (Wadsworth, 1993)*

Role	Issue advocate	Science arbiter	Broker of policy alternatives	Participatory expert
Role description	Issue Advocates ally themselves with a particular interest and actively engage in policymaking, using their scientific authority to guide policy in a preferred direction. Boundary work discourses emphasise the importance for policymakers to conform to specific science-based standards and the importance for scientists to take responsibility in certain issues and speak their minds to policymakers.	Science Arbiters steer clear of the explicit considerations of policy and politics but recognise the fact that policymakers may raise questions that require expert judgement on issues of fact. They hold themselves responsible for eliminating those options that fly in the face of scientific evidence.	Brokers engage in the policy process, and, in interaction with policy, they communicate existing knowledge, relate this to policy questions or knowledge demands, and explore possible alternatives and their implications. Their goal is not to eliminate options, but to expand the scope of choices available to policymakers depending on their value judgements.	Participatory expert very intensively work together with knowledge users and stakeholders. They navigate the boundaries between the creation and the use of knowledge. In practice, the boundaries between these two are blurred, and social learning occurs because the experts become part of the process.

From the point of view of boundary organizations, these four roles are not static, but can be enacted depending on the context and the science-policy question that is at hand (Huitema & Turnhout, 2009).

3.2. Modernist and reflexive logic

In this thesis two perspectives on science were used to structure the data that was gathered: modernist logic and reflexive logic. These perspectives on science are based on recent work of Kunseler (2017). According to Kunseler these perspectives are *'. . . co-existing logics, which guide scientific advisers in their conceptions of the purpose of their job, the quality principles they intend to adhere to and the roles they intend to perform'* (Kunseler, 2017, p. 18). As can be seen in Table 3:2 these logics find their foundation in the understanding of the scientific advisors of what science is, and what role science can play in the governance of life in society.

Table 3:2. Foundations of modernist logic and reflexive logic (Kunseler, 2017, p. 19)

	Ontological foundations	Epistemological foundations	Sociological foundations	Political foundations
Modernist logic	Reality as singular, one-sided, universal	(Logical) positivism; emphasis on reality as objectively knowable (empiricism, reductionism, scientism)	Modernisation; social progress and technological optimism; science and technology solve societal and environmental problems	State-centred society; hierarchical policy processes; technocratic and bureaucratic relations between expertise and policy
Reflexive logic	Reality as pluralistic, perspectival, constructed	Social constructivism; emphasis on reality as constructed (pluralism, relativism)	Reflexive modernisation; awareness of social complexity of environmental problems; science responds to societal needs to generate applicable, integrated and robust knowledge	Network society/mode-2 society; open, flexible multi-level and multi-actor governance networks; deliberative relations between expertise and policy

3.2.1. Modernist logic

Modernist logic finds it origins in the 18th century, in a time where the state and church still enjoyed absolute power. With the idea that society should not be governed based on prejudice and religious traditions, modernists promoted the use of scientific reason to assist in the development and governing of society (Lentsch & Weingart, 2011; Stockmann, 2016). From there on society and science continued to develop. With the assistance of science, Western industrialization was made possible. In the first period of industrialisation environmental risks, pollution and related health problems were limited to the poor, working class. However, as the industrialisation continued, societal risks such as release of dioxins (a group of chemical compounds) and nuclear energy also emerged. As society perceived little impact from these risks, and had not yet linked the emergence of these risks to science, science still experienced a lot of authority. Scientist continued to develop new technologies, and although the awareness of (negative) consequences of these technologies was growing, the uncertainty remained 'in a black box' and undealt with (Beck, 1992). As a part of modernity social institutions developed (for example: political systems, market systems, health programs), creating numerous opportunities for human beings to develop and marking the welfare state (Giddens, 1990). As a result of all these processes, a whole variety of norms, beliefs and attitudes have formed about the role of science in society. For example, the government has appointed several organizations that have the legal right to provide government organizations with policy advice and evaluations (Hoppe & Halffman, 2004). According to Kunseler (2017) there are three attributes of modernist logic: speaking truth to power, bridging the gap, and norm of objectivity. In Table 3:3 these attributes are shown.

Table 3:3. Attributes of modernist logic of scientific advice to governments (Kunseler, 2017, p. 25)

	Purpose of scientific advice	Role of experts at the science – policy interface	Quality principle for scientific advice
Modernist logic	Speaking truth to power Experts employ technical methods to produce empirically confirmed and logically consistent statements to inform evidence-based decision making	Bridging the gap Experts mediate domains of science and policy and work to keep them apart	Norm of objectivity Experts seek to properly represent nature in a rigorous, independent and detached manner by the use of credibility-enhancing strategies and appeal to scientific rhetoric

When looking at the four roles of science played in policy (Pielke, 2007; Turnhout et al., 2013; Wadsworth, 1993), Issue advocate and Science arbiter are in resemblance with the attributes of modernist logic and have therefore been categorized under modernist logic. For example, Issue advocates ally themselves with a particular interest and actively engage in policymaking to guide policy in a preferred direction. They emphasise the importance for policymakers to conform to specific science-based standards. This resembles with the modernist attribute of speaking truth to power, as well as with the norm of objectivity. Science arbiters recognise the fact that policymakers may raise questions that require expert judgement, but they steer clear of the explicit considerations of policy and politics. They feel responsible to eliminate policy options that fly in the face of scientific evidence. This shows resemblance with the modernist attributes speaking truth to power, as well as bridging the gap and norm of objectivity (Pielke, 2007). The empirical findings of this study were used to find out whether this categorization is actually reflected in practical reality. Figure 3:1 shows the relation between these concepts. The arrows show that the attributes of the modernist logic influence the way in which the roles are performed. These roles are part of the modernist logic, which can be seen as the way the role of science in policy is performed.

Figure 3:1. Relational framework of the role of science in policy from a modernist logic point of view

3.2.2. Reflexive logic

As society encountered problems that became more and more complex, it became apparent that modernity has a dark side. Institutional decisions that were aimed at gaining more economic opportunities were showing their side-effects. These effects are still felt today, and they transgress territorial boundaries, are ignorant of class, unprecedented in both visibility and scale, and they are affecting the total human population (Fischer, 2000). Beck (1992) refers to this as 'risk society', where *'. . . the dark sides of progress increasingly (have) come to dominate social and political debate'* (Fischer, 2000, p. 49). Where in modernist times science was not associated with the risks that were uncovered, in risk society many problems that are now experienced are ascribed to the use of science and technologies. A call for transparency in science has unlocked uncertainty from 'the black box'. Because of this and the large scale of the problem, there is more ambiguity as to how problems are experienced and defined, more uncertainty and more complexity (Rittel & Webber, 1973). Society has become reflexive, where *'. . . social practices are constantly examined and reformed in the light of incoming information about those very practices, thus constitutively altering their character'* (Beck, 1992, p. 38). The technocratic style of science no longer suffices, since the social problems have become so complex (Beck, 1992). To understand the complexity of the problems society is dealing with, and to find ways to address these, experts are expected to use reflexive logic, in which they *'. . . acknowledge the plurality of problem perspectives* (from all involved societal actors) *and draw on various knowledge forms to understand the complexity involved and become responsive to societal needs''* (Kunseler, 2017, p. 22). Kunseler (2017) has identified three attributed of reflexive logic: Socially robust knowledge, knowledge brokerage, and attitude of humility. In Table 3:4 these attributes are shown.

Table 3:4. Attributes of reflexive logic of scientific advice to governments (Kunseler, 2017, p. 25)

	Purpose of scientific advice	**Role of experts at the science – policy interface**	**Quality principle for scientific advice**
Reflexive logic	Socially robust knowledge Experts employ interactive and deliberative methods to integrate knowledge's and perspectives to inform societal problem-solving and actions	Knowledge brokerage Experts bring different perspectives and rationales in line and organise productive interactions between them	Attitude of humility Experts seek to address perspective plurality and uncertainties, and engage in deliberation and collective learning by acting as reflective practitioners who enact reflective practice

When looking at the four roles of science played in policy (Pielke, 2007; Turnhout et al., 2013; Wadsworth, 1993), Broker of policy alternatives and Participatory expert are in resemblance with attributes of reflexive logic and have therefore been categorized under reflexive logic. For example, brokers engage in the policy process, and in interaction with policy communicate existing knowledge that relates to policy questions or knowledge demands. They explore policy alternatives and expand the scope of choices available to policymakers. This resembles with the reflexive attribute of socially robust knowledge, as well as knowledge brokerage. Participatory experts work together with knowledge users, and navigate the boundaries between creation and use of knowledge. The experts become part of the process, and because of this social learning occurs. This is in resemblance with the reflexive attributes socially robust knowledge, knowledge brokerage as well as attitude of humility (Pielke, 2007; Turnhout et al., 2013; Wadsworth, 1993). The empirical findings of this study were used to find out whether this categorization is actually reflected in practical reality. Figure 3:2 shows the relation between these concepts. The arrows show that the attributes of the reflexive

logic influence the way in which the roles are performed. These roles are part of the reflexive logic, which can be seen as the way the role of science in policy is performed.
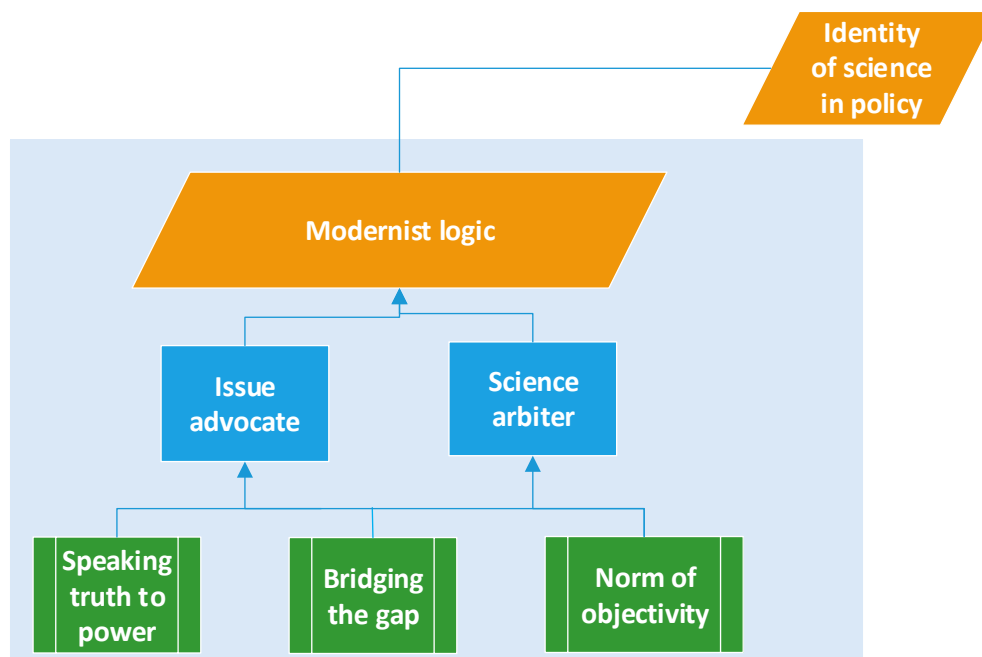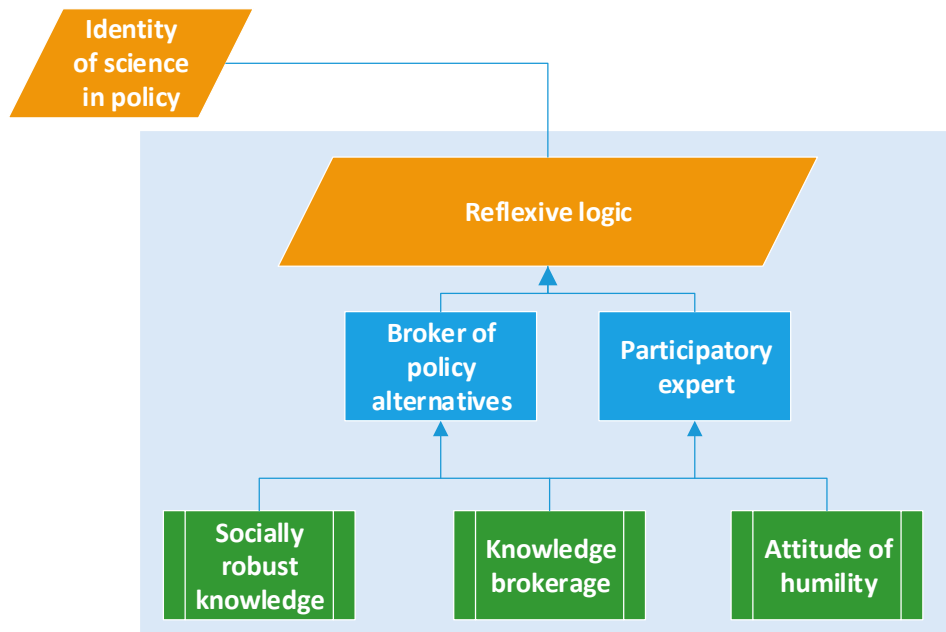

Figure 3:2. Relational framework of the role of science in policy from a reflexive logic point of view

3.2.3. Implications for boundary organizations

The modernistic logic is still present in today's society (Giddens, 1990), and elements of this logic will always influence the role and place of boundary organizations in the science-policy arena. However, at the same time, elements of reflexive logics are also emerging. *'Science becomes more and more necessary, but at the same time, less and less sufficient for the socially binding definition of truth'* (Beck, 1992, p. 155). As a result, the way in which science produces knowledge is under question: Having to maintain objectivity, while integrating multiple actor perspectives, as well as gain trust while at the same time risking this trust by giving transparency (Felt et al., 2013). Knowing this, the question can be raised how these two logics are reflected within Dutch boundary organizations. Boundary organizations aim at producing scientifically sound and policy relevant advice within a specific context (Lentsch & Weingart, 2011). However, under the two logics, there are different interpretations as to what scientific quality and policy relevant advice actually entails. In the science-policy interface, where the boundary organizations fulfil their function, scientific advisors therefore are caught in-between logics (Kunseler, 2017).

3.3. Alignment strategies

Kunseler (2017) identified three strategies in which environmental experts at the PBL cope with these two co-existing logics. The first, ***encapsulation***, is shown in

Figure 3:3 and has also been described by other scholars, such as Reinecke (2015), Turnhout, Dewulf, and Hulme (2016). It shows how scientists respond to a call for more reflexive logic, and more stakeholder involvement, and how this response becomes encapsulated in the structures of modernist logic. *'Experts inadvertently impose their scientific framings and techno-managerial ways of working on the process, hereby 'closing down' the process, which precludes reflection upon the needs, requirements and conditions of the other participants'* Kunseler (2017, p. 26).
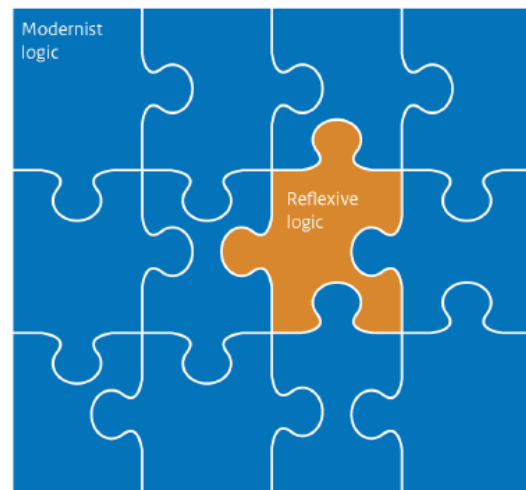
Figure 3:3. Encapsulation in participatory knowledge production (Kunseler, 2017, p. 27)

The second strategy is called the ***decoupling strategy***. As can be seen in the top right of Figure 3:4, the modernist and reflexive logic are not connected. In practice, PBL practitioners perform a mix and match of ambitions, methods and means, depending on the issue at hand, the needs and the preferences of the stakeholders involved. A careful separation of project intentions in terms of instrumental and technological knowledge (modernist) and co-created knowledge (reflexive) can thereby be achieved, thus decoupling these two logics (Kunseler, 2017). This makes it possible to evaluate the results of the project under both concepts.
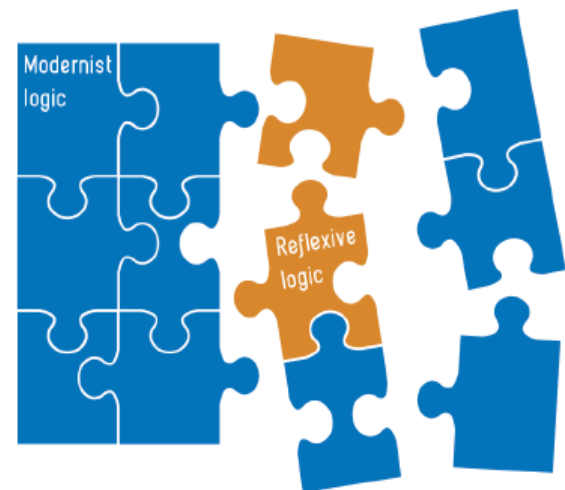
Figure 3:4. Decoupling and loose connections in participatory knowledge production (Kunseler, 2017, p. 152)

The third strategy, ***loose connections***, can be seen in the bottom right of Figure 3:4. In practice, PBL practitioners are able to connect *'. . . different quality assurance standards (e.g. causal inference and triangulation), assessment approaches (e.g. systems analysis and governance analysis), and roles of expertise (e.g. analyst and facilitator)'* (Kunseler, 2017, p. 150) to the core values of the production of policy-relevant, independent and scientifically objective advice, thereby achieving coherence to the organizational practice and alignment between the two logics.

3.4. Conditions for reflexive logic

The degree to which scientists in boundary organizations can work in a reflexive way does not only depend on the complexity of the research problem or the way practitioners see the role of science, but also on other conditions. Broerse and Bunders (2000) identified four conditions that can enable reflexive project approaches.

–   On the individual level, actors should be able to acquire relevant competences
–   On project level methodological principles should be leading
–   On institutional level the actor should be supported by their institutions
–   On a societal level the project should be aligned to the societal, broader context

The framework shown in Figure 3:5 shows the interaction between these four conditions. In successful reflexive and interactive projects, strategies and methodologies are aimed at these four levels and the interaction between these levels. These conditions can be identified as the enabling or constraining conditions for interactive approaches. A project can still fail if the people in the project do not have the right competences to work on the project. And if the project is not allligned to the broader context, nobody will understand the use and thereby the projects chance of success is diminished. At the same time, enabling factors can occur in for example the institutional setting. When participating actors are supported by their organizations, and their collegues at the organisation are open to learning what their particpating collegue has learned, progress can be made and the new knowledge is integrated (Regeer & Bunders, 2007). The interaction between these different conditions is shown by the arrows.
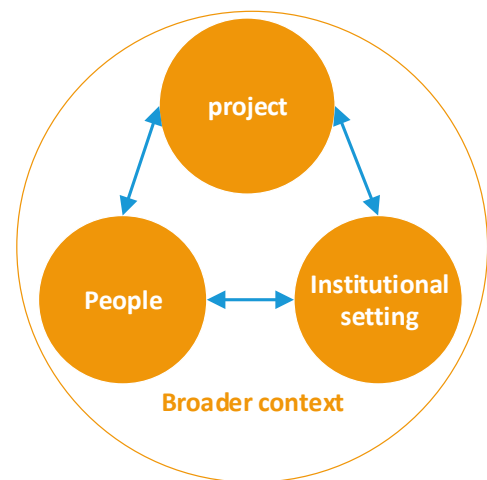
Figure 3:5. Framework for mode-2 methodology. Adapted from Broerse and Bunders (2000)

The challenge of interactive ways of knowledge production lies within the alignment of these four conditions (Regeer & Bunders, 2007). Although these conditions do not influence the perspective that the practitioners have of the role of science for policy, the conditions do influence the extent to which reflexive initiatives can be taken. Therefore, it is the expectation that these conditions for reflexive logic influence the alignment strategy that organization, particularly those that are caught between the modernist and reflexive logic, can use.

3.5. Conceptual model

Based on the concepts that have been introduced in the previous chapter the following conceptual model has been constructed. Figure 3:6 shows a visual representation of all the theoretical concepts of this thesis, including how they relate to each other. The model show that the way the boundary organizations view the role of science for policy depends upon the alignment of the conditions. When there is no alignment of these conditions, the alignment strategies are used to work in a modernist way, in which the attributes of modernist logic are the most dominant. This guides the role the boundary organizations take in the process of science for policy. When there is alignment of conditions, the boundary organizations are able to work in a reflexive way, where the attributes of modernist logic are the most dominant. This again, guides the role the boundary organizations can take in the process of science for policy.
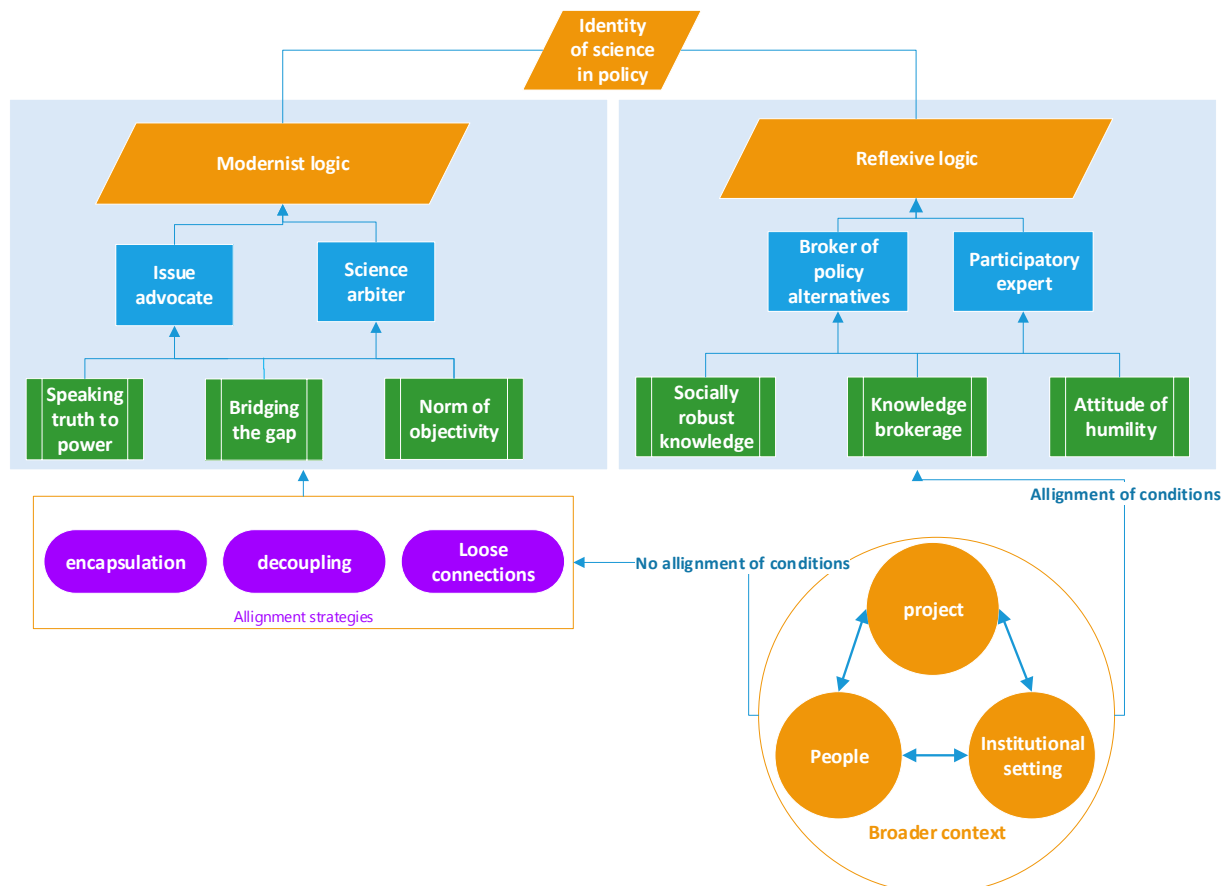
Figure 3:6. Conceptual model of all the important research concepts

4. Research questions

Based on the problem statement, the objective, the main research question (MRQ) and the theoretical framework, the following research questions (RQ) have been formulated:

MRQ: How do Dutch national knowledge institutions respond to the changing demand for knowledge production?
- **RQ 1:** How do national knowledge institutions perceive the role of science for policy?
- **RQ 2**: How are the modernist and reflexive logic represented within national knowledge institutions?
- **RQ 3:** Which conditions can be identified that influence the performance of national knowledge institutions?

4.1. Operationalization of research question 1

The most important concepts that were used to structure the data that was used to answer research question 1 was the framework of roles of science for policy (Pielke, 2007; Turnhout et al., 2013; Wadsworth, 1993). Table 4:1 shows the operationalization of the framework of roles of science for policy.

Table 4:1. Overview of boundary work discourse within the four roles played by science in policy (Huitema & Turnhout, 2009)

Role	Issue advocate	Science arbiter	Broker of policy alternatives	Participatory expert
Boundary work discourse	- Indicate that policy should conform to specific science-based standards. - Stress that scientists should take responsibility in certain issues and speak their minds to policymakers.	- Emphasise the importance of staying away from pure policy and the different responsibilities of science and policy. - Recognise the need for interactions between science and policy. - Do not problematize these interactions as a threat to the objectivity of science.	- Emphasise the importance of interaction between science and policy based on mutual processes of exploration of demand for and supply of scientific knowledge. - Recognise the responsibilities of science in this matter. - Acknowledge the inevitability of value-laden choices and uncertainties in these interactions. Offer scientific assessments from multiple value-perspectives.	- Perspectives of stakeholders are explicitly included in the knowledge production of knowledge. - Emphasize the need to involve other stakeholders for the sake of addressing and developing co-created solutions for social problems. - Work within the blurred boundaries between the production and use of knowledge.

This operationalization was used to identify how the national knowledge institutions perceive their scientific role for policy.

4.2. Operationalization of research question 2

The most important concepts for answering research question 2 were the attributes of the modernist and reflexive logic as formulated by (Kunseler, 2017). These attributes did not have to be operationalized any further, and were used as introduced in Paragraph 3.2.1 and 3.2.2. The description of these attributes was used to see which logics are represented within the national knowledge institutions, and to see how these represented logics interact with the role perception that was identified in research question 1.

4.3. Operationalization of research question 3

The most important concepts to provide an answer to research question 3 were the conditions formulated by (Broerse & Bunders, 2000). Table 4:2[a,b,c,d] shows how these conditions have been operationalized in order to structure and analyze the results. During the data analysis is was necessary to operationalize these conditions further. Attachment I shows the additional operationalization.

Table 4:2[a,b,c,d]. Enabling/constraining conditions for interactive approaches, adapted from (Bammer, 2013; Belcher, Rasmussen, Kemshaw, & Zornes, 2016; Brandt et al., 2013; Goven, Langer, Baker, Ataria, & Leckie, 2015) (Hollaender, 2003; Regeer & Bunders, 2007; Regeer, Hoes, van Amstel-van Saane, Caron-Flinterman, & Bunders, 2009; Winder, 2003) (Verwoerd, de Wildt – Liesveld & Regeer, in development)

a.

Enabling factors for interactive approaches		
Individual level	*Participants* - Committed to the shared objective - Timely involvement - Clarity of involvement (moment and intensity) - Acting as individuals, not as representatives	- Open, listening, curious, empathetic - Skills for joined learning, pro-active - Reflexivity - Feel empowered to take authority - Aware of their own beliefs

b.

Enabling factors for interactive approaches		
Institutional level	*Organizational embedding* - Support from the home bases of parties for co-operation - Possibility for changes in the process - Extended timeline	*Stimuli* - Financing - Adequate assessment criteria

c.

Enabling factors for interactive approaches	
Broader context (system level)	- Network is adaptive (neither too strong nor too weak) and provides learning opportunities - Co- evaluation of scientific knowledge production and societal processes concerning complex problems

d.

Enabling factors for interactive approaches			
Project level	*Project leader / core team* - Drives the project - Responsible for representation - Social, communication and management skills - Believes in the project - Able to handle obstacles and implicit assumptions	*Process management* - Mutual trust - Secure atmosphere - Attention to whom to involve and when - Equal role for all participants - Iterative phasing, open process	*Project framework* - Common research quality framework - Joined question and goals) - Integration of coherent and reproducible methods - Clarity of focus on which phase of research process and the type of knowledge

- Preferably an interdisciplinary team - Creates alignment between different (epistemological) cultures - Bases interventions on interactions - Can mediate different positions - Is transparent	architecture - Well-oiled communication and documentation - Separation of opinions, ideas and facts - Integration of perspectives, creating common language	that is produced (iterative) - Integration of scientific knowledge and societal knowledge - Generates impact on multiple levels - Takes into account dynamics and context - Clarity on assessment, measurement and evaluation strategies

This operationalization, as well as the operationalization shown in Attachment I, was used to identify whether the respondents experience enabling or constraining conditions in navigating between the modernist and reflexive logic.

4.4. Operationalization of the main research question

In the theoretical framework of this thesis the concepts modernist logic and reflexive logic were introduced. The modernist logic equals technocratic science, and the reflexive logic equals post-modern science. As already mentioned in the theoretical framework, research of Kunseler (2017) shows that there are three strategies that can be used to navigate when organizations are caught between these two logics: _encapsulation, decoupling_ and _loose connections_. The combined answers of research question 1, 2 and 3 (so, the role perception, the represented logics, and the conditions that influence the performance) were used to analyse which of these alignment strategies the national knowledge institutions use in their response to the changing demand for knowledge production. In this way, the main research question could be answered.

These three alignment strategies find their difference in the values that dominate the way practitioners give form to scientific advice, their role perception, and the quality principles that are guiding this process. Furthermore, these strategies differ in the way connections are being made between the different values. In this thesis, the strategies were operationalized and interpreted in the following way;

- In the _encapsulation strategy_ there is no change in the way the modernistic values are used. The reflexive logic and the values that are part of this logic are not fully recognized, but are encapsulated in the modernistic logic.
- In the _decoupling strategy_ there is more recognition for the reflexive logic, however the use of the reflexive logics is seen as something optional.

So, in the encapsulating strategy, as well as within the decoupling strategy, the modernistic logic and the values that are part of this logic are dominant in the way the practitioners give form to scientific advice, their role perception, and in the quality principles that are guiding them in this.

- In the _loose connections strategy_ the reflexive logic and the values that are part of this logic are recognized as valuable components for the formulation of societal robust advice. Therefore, whenever necessary, the reflexive values are integrated with the values that are part of the modernist logic.

5. Methodology

The following chapter will explain more about the methodology that was used to conduct this research. Paragraph 5.1 will introduce the research character and how the selection of the organizations and the units of analysis was done. In paragraph 5.2 the data collection methods will be explained, followed by paragraph 5.3, which will describe the way in which the data was analyzed.

5.1. Character

The research was used to gain understanding in how Dutch boundary organizations respond to the changing demands of knowledge production of science for policy. To do this, a qualitative research approach, with an interpretative study design was used. The choice for a interpretative study was made because it allowed an in-depth study of the variation that occurred within the topic of interest, and the use of theory to structure the findings (Hart, 2005). This approach gave the possibility to gain in-depth insight in the ideas, background, motives, argumentations and assumptions and other elements that are of influence on how the practitioners experience changing demands for knowledge productions (Kaufman, 2003; Silverman, 2013; van Lieshout, Aarts, & van Woerkum, 2006).

Selection of the organizations

In the Netherlands there are over 59 organizations that perform research in the service of the Dutch public (Koens, Meza, Faasse, & de Jonge, 2016). However, only those that are officially tasked to serve the Dutch government in analysing and proposing new policy options (based on scientific research), evaluation of existing policies or consequences of policy are of interest. Using non-random expert sampling (Kumar & Phrommathed, 2005), in which the experts are experienced practitioners at the PBL, the Network of boundary organizations was selected. In this network, thirteen organizations have joined with the purpose to form 'a window to society'. The activities of the network participants are characterized by policy related and practice oriented research, and by safeguarding the public interest. Through this they have a unique function on the boundaries of science, society and policy, producing scientific knowledge and expertise for the use in policy. The organizations that are part of the network have expertise on societal topics such as safety, health, economy, education, environment, law, (international) mobility, water and culture (KNMI[a], 2017). From now on, these organizations will be referred to as national knowledge institution (RKI).

Data was collected from nineteen respondents in total, representing ten organizations.

Table 5:1 gives a description of the ten represented organizations. For the sake of privacy, the individual respondents have been anonymized. Three RKIs are not represented due to non-response. These are the WODC, NVWA and RKD.

Table 5:1. Description of the RKIs that are represented in this thesis (KiM, 2017; KNMI[a], 2017; KNMI[b], 2017; Koens et al., 2016; NFI, 2011; PBL, 2017; RCE, 2017; RIVM, 2017) and (Baarda, Bakker, Julsing, & Fischer, 2014; CBS, 2017; RWS, 2017; SCP, 2017)

Name	Abbreviation	Purpose
Netherlands environmental assessment agency	PBL	- Conducts strategic policy analysis in the field of environment, nature and spatial planning - Provides solicited and unsolicited advice to the government, concerning policy relevant aspects of research results - Investigates and documents current environmental, ecological and spatial quality - Evaluates current policy and future trends that could be of influence on these topics
Dutch national institute for public health and environment	RIVM	- Promotes public health and consumer safety - Helps to protect the quality of the environment - Conducts scientific research in the areas of infectious diseases, vaccinations, population screening, life style, nutrition, pharmaceuticals, environment, sustainability and safety
Netherlands institute for transport policy analysis	KiM	- Provides knowledge input that can be used for the preparation of mobility policy, in the areas of public transport, civil aviation, transport by waterways, sustainability and safety - Analyses developments in order to explain them, draws up scenarios, analyses the effects of existing policies and predicts the effects of upcoming policies, using exploratory studies
Royal Netherlands meteorological institute	KNMI	- Monitors weather, climate, air quality and seismic activity - Forecasts weather - Gathers information about the atmosphere and the subsurface and translating this information into risks for the public - Offers advice, strategies for risk reduction of immediate and future dangers
Netherlands forensic institute	NFI	- Contributes to the criminal justice chain by providing forensic services through forensic analyses, investigation and prosecution of suspects and exoneration of innocent parties
National agency for infrastructure and watermanagement	RWS	- Designs, constructs, manages and conducts maintenance activities of the main infrastructure facilities in the Netherlands, such as the main road network, main waterway network and water systems
The Netherlands institute for social research	SCP	- Conducts research in the fields of health, welfare, social security, the labor market and education and in the interfaces of these fields
Netherlands bureau for economic policy analysis	CBP	- Conducts scientific research on the crossroad of economic sciences and public policy, with the aim to contribute to economic decision-making processes of politicians and policy makers - Analyses effects of current and future government policies
Statistics Netherlands	CBS	- Publishes national and European statistical information based on the needs of Dutch society, covering topics that touch the lives of all citizens (economic growth, consumer prices, crime, leisure, food, etc.)
Cultural heritage agency	RCE	- Manages, preserves and develops valuable heritage of our country - Provides advice, knowledge and information to policy makers, academics and practitioners concerning this national heritage

The approach of the RKI-network was done in two ways. The secretary of the RKI-network, Daan Vogelezang, was contacted to gain his approval over the inventory, and to get to know who the contact persons of each RKI were. While waiting for the list of contact persons, the researcher attended the first innovation meeting of the RKI-network in Nov. 2017. During this meeting the researcher spoke with representatives of almost every RKI. During these conversations, the thesis was introduced, as well as the potential role of the RKI-network in the data-collection. The aim of these conversations was to familiarize the participants with the researcher and the data-collection idea, in preparation of the contact with the official contact persons.

The selection of respondents within the RKI-network took place using snowball sampling (Kumar & Phrommathed, 2005). Once the list of contact persons was obtained, a letter was send to these contact persons. Based on the description of the research objective and research questions that was given in the letter, they were asked to point the researcher to potential respondents within their institution. In the letter it was explained that the researcher aimed to speak with a manager or chief with a vision on integrative and innovate ways of knowledge production, and with a senior employee with both theoretical and practical work-experience within the institution.

At some RKIs it was not possible to speak with two respondents. This was because the contact persons only referred to one potential respondent, after which these single respondents could not think of another potential respondent. In one case, the potential respondent that was suggested did not have time to participate.

5.2. Data-collection

The data collection was based on primary data, gathered through semi-structured interviews and participant observation.

Via semi-structured interviews the respondents of the RKIs were given the chance to reflect on the RKIs position in the changing arena of the production of scientific knowledge for policy. This resulted in audio-recordings, which were transferred into transcripts. These transcripts formed the basis for the data-analysis. The use of semi-structured interviews was chosen because according to Bernard (2017) semi-structured interviews provide the chance to demonstrate full control over what a researcher wants to know, while at the same time giving the researcher and the respondent the possibility to follow new leads. The semi-structured interviews were prepared based on the topics of interest that have been introduced in Paragraph 4.1 and Paragraph 4.2. In Attachment II the interview guide that was used within each interview can be found.

Participant observation is a form of observation in which researchers participate in the process of a community, in this case two RKI-meetings that took place (one in Nov. 2017, one in Apr. 2018). The researcher's presence at these meetings gave the members of the RKI-network a chance to get to know the researcher, and to ask questions regarding the progress of the thesis. Attending meetings, the researcher got the chance to learn more about the way the RKIs interact with each other while discussing topics regarding the thesis. It also provided an opportunity to form and further build a basis of trust (Bernard, 2017). This proved useful during the interviews. During attendance to the meetings, the researcher observed whether the topics of discussion could be categorized under the subjects 1) Innovation, 2) Implications and 3) Conditions. These are the three topics that were used to give structure to the interview guide (see Attachment II) and can be led back to the operationalization that is demonstrated in Paragraph 4.1 and 4.3.

5.3. Data-analysis

To structure and analyze the data, the theoretical framework of this thesis was used, combined with an interpretative phenomological approach (IPA). This is a qualitative research approach and has proven very useful to analyze the data in such a way that it fitted the objective of this thesis. *'IPA is a qualitative research approach committed to the examination of how people make sense of their major life experiences'* and *'IPA shares the views that human beings are sense-making creatures, and therefore the accounts which participants provide will reflect their attempts to make sense of their experience'* (Smith & Flowers, 2009, pp. 1, 4).

To order the data the researcher made use of the software ATLAS.ti. This is a program that can help researchers in systematically analysing phenomena in unstructured data (such as text and multimedia). It provided the researcher tools to locate, categorize, code and annotate findings to primary data material, and to weigh and evaluate their importance (Silver & Lewins, 2014). The analysis process took place in four phases that Baarda et al. (2014) have identified as necessary for qualitative data analysis.

Phase 1: exploration

This phase started as soon as the first audio-record was transcribed. A summary was made of each transcript, and send to the specific respondent(s) for validation. If a respondent had feedback or additions to make, this was added to the transcript, without removing anything from the original transcript. After the respondents gave validation for the summary, the original transcripts were uploaded in ATLAS.ti, after which a process of coding was started. The coding process took place in three rounds:

– Round 1: focused on identifying the different roles of science for policy in the segments
– Round 2: focused on identifying the attributes of modernist and reflexive logic in the segments
– Round 3: focused on identifying patterns in all the elements that were a result of round 1 and 2.
– Round 4: focused on identifying conditions that influence the performance of the RKIs.

This coding strategy was based on the operationalization of the three research questions (see paragraph 4.1 and 4.3). In round 1 the operationalization of Koens (2012) was added to the original operationalization that was proposed (see Attachment I). Whenever the transcripts showed segments that seemed to be relevant for answering the research questions, but the segments could not be coded with codes from round 1, 2 or 3, additional codes were made. In total, 124 codes were designed for round 1, 2 and 3, of which 122 were attached to segments in the transcripts. Attachment III shows a list of the codes that were used.

Phase 2 and 3: specification and reduction

Phase 2 and 3 have been combined. These phases were aimed at identifying structure in the codes and started once all the transcripts were coded. Going back and forth to each research question, the researcher loosely checked which codes and attached segments had the most potential for answering the research questions. After this, the researcher tried to identify patterns that would enable the construction of an overview of all elements that would be useful to answer the research questions. The sketches of this process can be found in Attachment IV.

The integration phase took place step by step, starting with writing the results, without analyzing them. During the writing it became possible to cluster the elements that resulted from phase 3 under the three research questions. When the results were written down, the analysis of the results started. This was done using the concepts and the operationalization of the concepts, as written down in Chapter 3 and 4. Five steps were taken:

The *first step* was to check whether the concepts of the theoretical framework could be identified within the written results. After this, it was checked whether the results contained the right elements to answer the research questions. This step could be taken intuitively, because the researcher was very familiar with the data, for she performed the interviews herself, as well as the transcribing, summarizing and coding of the data.

The *second step* was to identify notable results, to elaborate on them, and to look for connections between these results and the concepts of the theoretical framework.

The *third step* was to compare the results to the consulted literature of the proposal, and to new literature. In this, the researcher looked for commonalities, differences and/or (possible) explanations for the results. The results of this step were used for the discussion.

For the *fourth step,* the researcher took a time-out from the computer. It consisted of a time of contemplation about the data and the underlying connections that were already identified, as well as considerations of connections that were not identified yet. These thoughts were written down on post-it's, which forced the researcher to stick to the most important findings.

In the *fifth step* the researcher consulted with an expert on this topic, Dr. E. Kunseler (commissioner of this thesis), to check whether aforementioned steps and thought processes were correct. After this, a combination was made of the results and the elements of the analysis, and the research questions could be answered.

6. Results

The objective of this thesis is to contribute to the understanding on how Dutch national knowledge institutions respond to the changing demands of knowledge production of science for policy. In this Chapter the results of the data-collection will be presented. To analyse the results the theoretical framework and conceptual model, as proposed in Chapter 3, was used. The results find structure through the use of the research questions of this thesis (Chapter 4).

RQ 1: How do national knowledge institutions perceive the role of science for policy?

In this Chapter the data was used to identify how the national knowledge institutions perceive their scientific role for policy. The framework of roles of science, as operationalized in Paragraph 4.1, was used to structure and analyse the data.

6.1. Function of science for policy

All of the national knowledge institutions (RKIs) perform solicited and unsolicited (applied) research for the benefit of policy and/or society. From the governmental departments they receive various questions concerning the evaluation of policy, the state of various socially relevant topics, policy assessments and calculations regarding policy decisions and election programs. The RKIs all work to provide the government with information that can be used for evidence-based policy, as well as to inform society.

R.7 – 'Based on our expertise we map out different scenarios for the minister, so that he/she can make an informed decision'.

Besides answering questions from, and informing the governmental departments, the RKIs conduct research into socially relevant topics.

R.1 – 'A very important aspect of our work is to have societal awareness. We want to have a central position in society, therefore we have to know what's going on in society, and to be aware of societal wants and needs'.

In addition, there are three RKIs with extra tasks. There is an institution that has the task to provide the judiciary with evidence that can be used in court, and there are two institutions that have the task to implement policy in practice.

6.2. The influence of key tasks on role perception

The diversity in tasks, and the way in which these tasks are connected to structured or unstructured problems, is strongly influenced by the key tasks of the RKI. For example, the reason of existence for the CBS is *'. . . to publish reliable and coherent statistical information which responds to the needs of Dutch society'* (CBS, 2018). A respondent of CBS gave the following task description: '*It is the task of our organization to provide trustworthy statistical information. We provide numerical reports regarding relevant societal topics, on the basis of which policy decisions can be made'.* In this, the CBS does not give any recommendations to policy, they just provide the statistics. The same goes for the SCP, which has the key task to evaluate the effect of policies regarding health, welfare, social security, the labour market and education on society. For the CPB the same applies, primarily they conduct research concerning the effects of policies or developments on the crossroads of economic

sciences and public policy. One of the CPB-respondents mentioned *'. . . an increase of questions from policy regarding the way certain policy goals can be achieved'*. Within the CPB this leads to discussions because it is the internal opinion that outlining policy paths is not part of analysing policy effects. The key tasks of these organizations lead them to a role perception that matches the best with Pielke's Science arbiter, in which all the three modernistic attributes come to fore: Speaking truth to power, Bridging the gap and the Norm of objectivity. However, in bringing their role perception into practice these RKIs also use other roles.

6.3. Role fixedness

While attempting to classify the RKIs on the basis of their role perception, it became clear that they cannot be classified into a single role. Depending on the task at hand, the RKIs switch between the different roles, or make use of several roles at once. The context in which a research takes place, and the research phase are of influence on the roles that are performed. When looking at the Netherlands Forensic Institute (NFI) we see an illustration of the fact that the roles are context-dependent. The NFI has three key tasks, and the roles the NFI performs can be directly led back to these key tasks. In the key task that concerns forensic case investigations, the main goal is truth-finding in the service of the judiciary. The role of Science arbiter fits with this key task, because in this the NFI recognizes the fact that for this truth-finding the judiciary require expert judgement, and they eliminate options that fly in the face of scientific evidence. Enabling the exchange of knowledge and expertise with chain partners in the forensic and criminal investigation sector is one of the other key tasks of the NFI, as well as Research and Development (R&D). In these two key tasks the NFI increasingly performs the role of Participatory expert, for in the R&D the forensic practice that is gained in field experience is integrated in their daily practices, and leads them towards new developments, and for the exchange of knowledge and expertise training courses and other forms of interdisciplinary interactions are organized with chain partners (NFI, 2018a, 2018b, 2018c). The key tasks are not performed statically, but continually take place at the same time. Table 6:1 demonstrates that within the interviews, considerations for different roles emerged within the same organizations.

Table 6:1. Considerations for the different roles in the organizations (R. is respondent. Number)*

Role	Considerations
Issue advocate	*R.2[a] – 'I think that as a planning office we should take an agenda-setting role whenever we notice that the government is setting the wrong priorities. However, this is challenging, because taking this agenda-setting role means that we are influencing the government, and that is risky.'*
	R.3[b] – 'We never change conclusions, not even if there is political pressure. What we can do is make changes in factual inaccuracies, and listen to arguments. This means that the wording may be slightly modified. Regardless of the consequences the message stays the same and we stick to the official conclusion.'
	R.10 – 'Despite the relevance of our knowledge for policy, the budgets that are assigned to us are decreasing. In order to change this it is my opinion that we need to start addressing the politicians of The Hague through a joint lobbying effort, in which knowledge institutions can address the importance and relevance of their knowledge'.
	R.11[c] – 'If we see opportunities arise in our field of expertise we initiate joint efforts for further development of these opportunities. This is a complex system of checks and balances, however, it is our opinion that we are responsible for making use of the potential of what's already there, and what you see it can be in the future'.
Science arbiter	*R.1 – 'Our institution has the role to provide information that can be used for evidence-based policy. Policy has an increasing need for factual information.'*

	R.3[b] – 'Our organization wants to be involved in the policy projects from the start of the project. Although we all have different tasks, we believe that involvement and interaction from the start of the project on will increase the efficiency of the project, because tasks of all the stakeholders can be better timed'.
	R.4 – 'It is not our job to make decisions, that's the task of policy. Based on our research we inform policy, and we show them the consequences of different policy options. In the future, we want to work toward providing perspectives for action, on the basis of which policy can make decisions.'
	R.6[b] – 'The research of our organizations is always linked to policy. At all times, our key task is to evaluate the consequences of certain policies for society. Sometimes the governmental departments request specific policy evaluations, in order to use this for evidence-based policy making'.
	R.7 – 'Based on our expertise we map out different scenarios, with different options and consequences for policy. However, it is up to the minister to decide which option is chosen, and what we will do with our technical strength and the knowhow to apply knowledge in practice.
	R.8[b] – 'Our role is to advice the government and society. Reliability, availability and comprehensibility are therefore a very important part of the job.'
Broker of policy alternatives	R.1 – 'We try to have interaction with society, and adapt our research to that. Sometimes we have to compromise between what we can deliver and what society needs/wants from us. The needs of a journalist differ from a politician, a policymaker or a random citizen. We don't have the capacity to do everything.'
	R.4 – 'We are part of the ministry, and therefore we can have close interaction with policy. We call this 'Knowledge at the table'. About 40% of our work consists of answering short questions that are asked by policy, like: '' what about this and this topic, what data do you have/ do we need, what are the best research options for this problem, etc.''. Our job is to provide policy with answers for these kind of questions.'
	R.5[b] – 'We have to look at things, and think about things from the perspective of our customers and the citizens. We don't just look from our own point of view, but we really try to put ourselves in the shoes of our customers, and for whom the customer wants the job done. And in the end, this leads back to the citizens of the Netherlands.'
	R.6[b] – 'It is our key task to see what citizens experience from the policy decisions that have been made. It is our aim to inform citizens about the policy consequences, so that they can use this knowledge for themselves. The communication regarding this takes place in different forms.'
	R.7 – 'Reliability is a very important value. What we have noticed, is that there are differences between the advice that our advisors are giving, and that this causes friction for our clients. Because we want to be reliable for our clients we have to internally upgrade the way we organize the advice-procedures, so that we can guarantee the quality of our advice. However, the differences in advice originate from the personal coloring that every advisor unconsciously adds to the advice, therefore we cannot completely avoid value-laden choices'.
Participatory expert	R.2[a] – 'Within a certain project we quickly realized that the arena had become very complex, and that the traditional way we normally used for evaluations would not work. That is why we opted for a more iterative and participatory way of working, in which all important parties were actively involved.'
	R.4 – 'Regarding this topic we organized various creative sessions. In these sessions, multiple stakeholders were involved. The stakeholders know exactly how certain things work in practice, and which objectives they're trying to obtain. We try to include all of this in our analysis.'
	R.5[a] – 'Without the other parties, we cannot achieve this kind of innovation. Therefore, we often try to create co-creative processes, in which we sit and interact with all the stakeholders. Sometimes the job can be done in a one-dimensional way, and other times you need all of the parties together.'
	R.8[b] – 'We will have to involve citizens in the articulation of the knowledge questions, and in the actual data-collection to answer the knowledge questions. The research questions will have to be in line with their questions and value system. It's no longer a possibility to simply 'send''.

	R.10 – 'In this kind of joined projects, we often have the responsibility to assure the scientific quality. Other parties develop the instruments, or ensure that the collected data can be converted into information.'
	R.11[b] – 'Depending on their field of expertise, our experts work together with a network of national and international universities. With this network knowledge and experience is exchanged, innovation is being achieved, and articles are published.'

The considerations in Table 6:1 illustrate that the different roles can be performed simultaneously or can be alternated. For example, the quotes from R.8[a, b] show considerations for both the role of Science arbiter, as for the role of Participatory expert.

RQ 2: How are the modernist and reflexive logic represented within national knowledge institutions?

In this Chapter the data was used to identify how modernist and reflexive logic are represented within the national knowledge institutions. The attributes of modernist and reflexive logic, as operationalized in Paragraph 4.2, were used to structure and analyse the data.

6.4. Quality principles

When looking at the quality principles that guide the RKIs in their work, there are some core values that come forward within each institutions. These are; independency, reliability and social relevance.

Independence

There are three ways in which independence is discussed within the RKIs: independence in the way conclusions are drawn (judgement), independence in the position of the institution, and independence with regard to the image of the institution. The first form of independence is safeguarded through the use of scientific methods and techniques. In addition, the RKIs try to be as transparent as possible regarding the research choices that have been made, and how those have led to conclusions. Furthermore, all RKIs work with a fixed research agenda that is established and published annually. This fixed research agenda shows independence in the position of the institution, because it makes the research topics clear in advance. Several respondents spoke about independence with regard to the image of the institution. They indicated that the degree to which a research organization is considered independent by the public is reflected in the reliability attributed to those research results.

R.4 – 'As a researcher, it is not your place to put yourself in the position of policymakers. However, you have to be able to understand their position, and their role, in order to be able to interact with them. You always have to pay attention to the role fixedness of the researchers. For that reason, the management always takes part in the interaction process, and the researchers receive training concerning role fixedness, independency and how interaction can be of influence on this. It happens very often that when a concept of a research report is send to policy it comes back full of remarks. It is our duty to analyze in which context these remarks can be placed, and to ensure and guard the independency of the research results.'

R.11[c] – 'Being independent, both administrative as content-wise, is very important in our work. In addition, it is essential that the outcomes of our research are consistent. We safeguard this independent position and the validity of the research by using several scientific methods and strategies. Because of this, the government can use our research.'

Trustworthiness

Part of the core value trustworthiness is that there is continuity in the services that the knowledge institutions provide, as well as the reproducibility of the research results. The continuity in services is assured through the use of a fixed research agenda, which is set in consultation with policy. The reproducibility is made possible through several procedures for reliable research, such as; review procedures by independent parties, reading committees, supervisory committees and the use of review platforms. The supervisory committees consist of leading professors from the field, and whenever considered necessary, societal stakeholders. The contribution of this last group can be seen as a reality check, in which they review whether the conclusions are just (according to them),

and recognizable. Furthermore, quality assurance systems are set in place by means of review systems that check the scientific validity of the research. For example, on a regular basis internal intervision moments are organized at the institution of R.7. This is done in order to achieve more uniformity in advising procedures. Undisputable research results are also a part of the core value reliability. Society should be able to trust that the research results are correct and undisputable.

R.1 – 'We want to deliver high quality work, that's what's required of us. Our work forms the basis of important policy decisions that take place both regional, national, as well as international. The reliability of our work therefore is of utmost importance'.

In the treatment of the election programs, the need to produce undisputable research results is one of the reasons for the CPB to not include measurements of which there is not enough information on the basis of which reliable calculations can be made. Including the measurements of which there is insufficient knowledge would lead to a distorted picture of the policy effect.

CPB 2 – 'We had the fear that we would treat things in an asymmetrical way, because we could ascribe more effects to the topics of which we had a lot of knowledge and information, as compared to the effects we could ascribe to the topics we did not have knowledge or insufficient information about.
This asymmetrical treatment would lead to a distorted picture of the election programs'.

Societal relevance

The work of the RKIs directly or indirectly serves the general public interest. The cost-benefit analyzes, the research into infectious diseases, policy assessments, or the research results that are used in the support of judgements, all have in common that they contribute to a livable society. This is because the work of the RKIs contributes to the quality of the government's policy decisions, or contributes to the quality of material that is used by the judiciary for judicial rulings. From the interviews it emerged that social relevance is a very important core value in their work, which gives direction to the research decisions that are being made.

R.5[b] – 'We have to look at things, and think about things from the perspective of our customers and the citizens. So we don't just look from our own point of view, but we really try to put ourselves in the shoes of our customers, and for whom the customer wants the job done. And in the end, it leads back to the citizens of the Netherlands.'

The RKIs try to stay up to date about what is going on in society by 'keeping an eye out', by ensuring (digital) accessibility and initiating interaction with society. Several RKIs mentioned the importance of social appreciation, and in some cases it was also mentioned that the amount of appreciation the institution receives from society, ultimately also influences the budget that is made available by the government.

R.8[b] – 'What ultimately shapes the legitimacy of the institute is the way society judges us. In this, you don't want to receive a bad mark, because that would mean that your institute is irrelevant.'

R.3[b] - 'Independency is something that can be quite exciting, and it's inseparably connected to the received appreciation from society and especially from the government. For independency can be a budget thing, and that budget is guaranteed by the government.'

The way in which these three quality principles (independence, trustworthiness and social relevance) are given form and spoken of shows a predominantly modernistic view. This can be seen in the interpretation of the values of independence, trustworthiness and social relevance. The interpretation given to this by the respondents speaks about continuity, reproducibility, quality assurance and internal assessment systems. Nothing speaks of an interpretation of these values as seen from the reflexive point of view. From the reflexive viewpoint, reliable research is socially robust, which means that the different perspectives of the stakeholders are included in the formulation of the research goal, and the research itself. In the reflexive view, qualitatively good research means that this social robustness is guaranteed, and that the multiple perspectives and knowledge types are integrated.

6.5. Inter- and transdisciplinary approach

In the context of societal relevance, the RKIs increasingly perform the role of Participatory expert, which in this thesis was categorized under reflexive logic. The increase in the role of Participatory expert is shown by the increasing need for interdisciplinary contact with other institutions, and is demonstrated by the fact that six RKIs are using a transdisciplinary approach in their work.

R.5[a] – 'Without the other parties, we cannot achieve this kind of innovation. Therefore, we often try to create co-creative processes, in which we sit and interact with all the stakeholders. Sometimes the job can be done in a one-dimensional way, and other times you need all of the parties.'

Parties with whom the RKIs interact in these interdisciplinary or transdisciplinary projects are universities, other knowledge institutions, policy, interest groups and non-governmental organizations. Furthermore, according to the RKIs there is an increase in interaction with the other RKIs. They exchange information and knowledge regarding certain research techniques in the field of big data, microdata or other relevant topics. The knowledge that is created during those interactions is, whenever relevant, integrated in the daily activities of the participating parties and used to create Socially robust knowledge (one of the attributes of reflexive logic). Almost all organizations have connections with leading universities through, for example, professors affiliated with them or joined research. This need for exchange and cooperation originates from the realization that there are a lot of things the different parties can learn from each other, and that some innovation issues are too big for a single party. In this, the RKIs are Knowledge brokering, which is one of the attributes of reflexive logic. Despite the fact that interaction already takes place between the different RKIs, most respondents indicated that there is a need to exchange more (experiential) knowledge regarding certain topics. The opinions differ regarding the form in which this exchange should take place, in what kind of context (fixed, not-fixed), regularly or not, and with whom.

The RKIs that are represented by R.5[a, b], R.7, R.8[a, b] and R.10 make use of (experiential) knowledge from citizens, and use methods and techniques to stimulate interaction with citizens. Examples of these methods and techniques are village labs, the presence of so-called environment managers, workshops and citizen science measuring days. In these kind of projects, it emerges that it is difficult to make connections between the different (knowledge) worlds. This is caused, among other things, by each party having its own starting point and interest to pursue. In addition, very often it is uncertain 'who' will ultimately be responsible for the costs of such projects. According to R.5[a] this is because of the fact that the subjects that everyone has to deal with, such as the sustainable living environment, are *'everyone's, and at the same time nobody's'* and that *'the underlying organizational structure in society is no longer adequate for what is now being asked of almost all parties in society '*.

Citizen science

One of the ways in which a transdisciplinary approach can take form is through citizen science. In citizen science citizens are involved in the collection of data, and sometimes also involved in the interpretation of the data. For most of the institutions this form of transdisciplinary work only takes place in pilot form. At the RIVM and KNMI there is experience with a joined citizen science pilot, called the I-SPEX project.

KNMI – 'With the help of a special attachment on their smartphone citizens were able to take measurements of the air, in order to determine air quality. By means of a prism in the smartphone attachment, the light could be separated in different wavelengths. On the basis of these wavelengths separation the degree of air pollution could be determined. However, the I-SPEX pilot is no longer running, for in practice the measuring method proved to be too complex to be carried out on a daily basis. In addition, the optimal conditions for the measurements only occurred three to five times a year. In this pilot we managed to involve a lot of people, for example during special measuring days, and because of this we know that there is coherence between the citizen science data, and our own satellite data'.

Five other RKIs also have experience with citizen science projects. The use of citizen science brings challenges with regard to the reliability of the data, as well as in the way the data can be processed and turned into meaningful information.

Although citizen science is a form of transdisciplinarity, the extent to which citizen science can be called transdisciplinary seems to differ per project, and also seems to lead back to the key tasks of the RKI. For example, the organizations of R.5[a, b] and R.7 use village labs and so-called environment managers to achieve integration of the different types of knowledge. They do this from the perspective that inclusion of (non-) scientific (experiential) knowledge contributes to the creation of a socially robust action plan. Looking at the other RKIs, the initiatives for citizens science take place from the point of view that citizen science is a means to increase and maintain legitimacy. The citizens are used to collect data, which the institutions then use without further involvement of the citizens. In the latter case, therefore, no full form of knowledge exchange takes place. Furthermore, the institutions that are part of the latter group are not talking about the transdisciplinary projects in terms of transdisciplinary work. They see these kind of projects more as a means to go with the flow, and a means to preserve their position. This demonstrates that attributes for both the modernist and the reflexive logic are guiding the RKIs in how they fulfill their scientific role for policy.

Learning by doing

In the experience of the RKIs it is not possible to learn about inter- and transdisciplinarity by solely consulting literature. The most important thing to do when wanting to know more about these approaches, is to take action. 'Learning by doing will always give you valuable lessons for the next time', says R.7. Through learning by doing R8[a, b] and R.10 have learned that using citizen science brings challenges in terms of reliability of the collected data. Therefore, R.8[a] says that it is important that *'. . . before the process is started, the researchers realize that the data collected in this way is different data than data collected by the use of valid measuring instruments'*. So, data that is collected using citizen science differs from data that is collected by proven valid methods, and the data cannot be integrated together. This brings challenges in the area of data processing, as R5[b] says: *'We are working very hard to identify research areas in which the use of citizen science can be of added value. If we include citizens, this will mean that there is a lot of extra work, because you have to find a way to save the data, process it, and transform it into useful information'.*

Learning by doing is one of the ways in which the RKIs can find out in what ways citizen science can be of added value. It also provides a chance to see what kind of steps will need to be taken in the case the pilots would be integrated in the daily methods of working. The fact that the RKIs are starting to experiment with citizen science demonstrates an Attitude of humility, in which they are prepared to address uncertainties, and engage in deliberation as well as collective learning. Further lessons that can be learned from the experiences that the RKIs already have with inter- and transdisciplinary approaches will be described in Paragraph 6.10.

6.6. Additional quality principles

Since the role of Participatory expert is being used more frequent, and this role was categorized under reflexive logic, it can be expected that the attributes that are associated with the reflexive logic (Socially robust knowledge, Knowledge brokering and Attitude of humility) will also occur more frequently.

This is the case, however when we look at the presence of these reflexive attributes, we can see something striking. There is a clear distinction between when, how and which attribute is used. For example, the Attitude of humility still hardly occurs within the transdisciplinary projects. This becomes evident when looking at the initiative from which a large part of the RKIs enter the transdisciplinary processes. This initiative starts at the idea that interaction with, for example, interest parties or residents of a location is for the benefit of the good name, and thus indirectly good for the existence of the organization.

R.8[b] - 'Ultimately, we try to work as efficiently as possible, but we also have to adjust our ways of working to the new legitimacy. People have to see that your work contributes something, and nowadays that means including a transdisciplinary approach whenever the circumstances allow for it'.

In some cases, the initiative to use a transdisciplinary approach comes from the observation that a project assignment could not be carried out successfully if the perspectives, interests and knowledge of the other parties were not taken into account. In these cases, there is a beginning Attitude of humility.

R.2[a] – 'Within a certain project we quickly realized that the arena had become very complex, and that the traditional way we normally used for evaluations would not work. That is why we opted for a more iterative and participatory way of working, in which all important parties were actively involved.'

Only two RKIs mention that the most important reason for looking for interaction with other (non-scientific) parties, is the (experiential) knowledge that these parties can add to the project. For the RKIs that are represented by R.5a, b and R.7 it applies that they have a lot of interaction with local parties during research processes. During their interaction with these parties the added value of their knowledge has become apparent, and therefore they see integration of stakeholder knowledge as added value. This speaks of a pure Attitude of humility.

The interdisciplinary projects that take place between the RKIs and the university, other knowledge institutions, policy, interest groups and non-governmental organizations are often specifically aimed at exchanging knowledge and learning from each other. Within these types of interdisciplinary

projects, the Attitude of humility is more present. There is more acknowledgements for the uncertainties and the aspects in which the institutions want to learn. The RKIs strongly believe that the institutions should be able to benefit from each other's experiences and knowledge.

The RKIs that, beside their research tasks, do not have any executive tasks, talk about learning from each other on the level of knowledge issues. In this sense they do not speak about a necessity for exchanging knowledge and questions about the implementation of the knowledge. However, this is what the more executing institution talk about when they mention what drives them to have interdisciplinary contact with other knowledge organizations.

6.7. Role of experts at the science-policy interface

In trying to find which logics are represented within the national knowledge institutions, some interesting subjects emerged with regard to the attribute that concerns the role of experts at the science-policy interface. From the modernist point of view, the role of experts is to bridge the gap, and in this they mediate domains of science and policy, and work to keep these apart. From the reflexive point of view, the experts bring different perspectives and rationales in line, and organize interactions between them. With this in mind, the following points demonstrate that the RKIs show considerations for both the logics.

Value-laden choices

An interesting subject that emerges from the data is the discussion that the RKIs have about whether they should, or should not recognize value-laden choices. During the interviews it was revealed that there are challenges in this area. To a certain extent it seems to be accepted that value-laden choices are inevitable, because scientist cannot be separated from their personal value and norms system.

R.7 – 'What we have noticed, is that there are differences between the advice that our advisors are giving. These differences originate from the personal coloring that every advisor unconsciously adds to the advice. We have seen that this causes friction for our clients. Therefore, we have to internally upgrade the way we organize the advice-procedures, so that we can guarantee the quality of our advice.'

Therefore, the choices that the practitioners make cannot be called completely neutral. The recognition of this shows an Attitude of humility. On the other hand, the respondent mention that value-laden choices should be avoided as much as possible, because those value-laden choices reduce the reliability and reproducibility of the research. In order to prevent value-laden choices as much as possible, procedures for reliability, and scientific methods and techniques are used. These procedures and methods have to ensure that the research is as neutral as possible. These results show that a discrepancy between on the one had the recognition of 'value-ladenness', which speaks of a more reflexive way of thinking. On the other hand, the results show that the RKIs are aiming to minimize value-laden choices, which shows a more modernistic line of thought.

Abovementioned paragraph concerns the recognition of value-laden choices at an individual level. However, the stakeholders that participate in the projects also bring in certain values and interests. It was mentioned that sometimes acknowledging the questions of policy regarding certain policy evaluations or cost-benefit analysis would actually lead to a justification of the policy. This leads to discussions and discomfort, because the RKIs all explicitly agree that it is not their task to justify policy. The RKIs solve this problem by providing policy with 'broad' recommendations in which various policy options are sketched. Policy is not always happy with these broad recommendations.

However, with regard to their independent position and the wish to conduct socially relevant research, the RKIs are making a stand for this.

R.3[b] – 'We never change conclusions, not even if there is political pressure. What we can do is make changes in factual inaccuracies, and listen to arguments. This means that the wording may be slightly modified. Regardless of the consequences, the message stays the same and we stick to the official conclusion.'

Another way to ensure the quality of the research is through the use of reading- and supervisory committees. However, all of this is a basis for discomfort. It is important for the RKIs that policy, their client, is satisfied with the way the RKIs work. Therefore, the question 'how far can we go in these broad recommendations and assuming an agenda-setting position' is very relevant at the moment.

R.6[b] - 'The reading- and supervisory committee aim to guarantee the scientific quality of the research. Supervisory committees are always there for large research studies, and they consist of stakeholders of the research field. It is their role to review whether the conclusions of a research are just (according to them), and recognizable from their own experiences. This is our reality check. In doing so, we also take into account that every participant of the supervisory committee has their own agenda.'

There are differences in the way the RKIs discuss their (possible) agenda-setting role. There are organizations that did not mention this potential role at all, but there were those that believe that wen policy does not address certain social relevant topics, it is the duty of the knowledge institutions to assume an autonomous agenda-setting role. However, all RKIs are cautious in actually taking an agenda-setting position.

R.2[a] – 'I think that as a planning office we should take an agenda-setting role whenever we notice that the government is setting the wrong priorities. However, this is challenging, because taking this agenda-setting role means that we are influencing the government, and that is risky.'

It was mentioned that assuming an agenda-setting role would bring the institution to the interface between science and policy. If they would assume this role they are no longer just producing knowledge, but they are also implying what should be done with this knowledge. Despite the fact that the RKIs see it as their duty to bridge the gap between science and policy, the agenda-setting positions is a position in which the RKIs are not (yet) comfortable.

Interpretation
As already mentioned, for the RKIs it has become increasingly important to 'keep their eyes open' in order to find out what is happening in society, and what the position of the institution in society is. In their communication with society they try to adapt to the needs of society. For example, they give more explanation about research results. For this explanation the RKIs have to interpret the research results. Because of this, a discussion has arisen bout this interpretation, and the coloring of research results that this interpretation leads to.

Interactive forms of communication are very simplified representations of reality. This gives rise to discussion between researchers and those responsible for the external communication of these research results. Concerns that have been raised in discussions like this are about how trustworthy the communication about the research results is when so much is left out. In addition, giving interpretation to research results is an activity that takes place at the interface with other knowledge

institutions. This leads to discussions about the role of each institution and how far that role goes. Accompanying the research results with or without value-laden interpretations (decrease of biodiversity is bad for humans, because ... ..) creates discussions about the role of knowledge institutions, and can be seen as a manifestation of both logics at the same time.

R.1 – 'Society is changing, and we are changing too. In the past our organization gave very neutral statements. For example, when there was an increase of something, we would only report that there was an increase. We did not mention anything regarding whether this increase was small or big, and good or bad, because that would be a value judgement. In this, we have gradually moved forward. We dare to say more about the data and the figures. We still try to exclude opiniated judgements, but we try to give clarification. Because of this interpretation, questions are being raised regarding our territory: ''Is this or is this not part of the key task of our organization, how far can we go in giving clarification, and in interpreting the data?''

RQ 3: Which conditions can be identified that influence the performance of national knowledge institutions?

In this Chapter the data was used to identify the conditions that are enabling or constraining the RKIs in navigating between the modernist and reflexive logic. The enabling and constraining conditions, as operationalized in Paragraph 4.3, were used to structure and analyse the data.

6.8. A changing context

When asked why the RKIs feel the need to make more use of inter- and transdisciplinary approaches, different reasons are mentioned. Some think these approaches are becoming more necessary because society has become more complex, while other say that these kind of approaches have always been part of sciences toolkit for policy. Even within institutions, the opinions regarding this can differ. Where R.2[a]'s opinion is that these approaches originate from the increasing complexity of the arena, a colleague has a very different opinion.

R.2[b] – 'I don't agree with the notion that we need more participative and reflexive methods because the complexity in society is increasing, and research questions have changed. What is needed, is that we give transparency towards society regarding what we are doing and why. That is the way we need to shape the involvement of science in society.'

There are some changes that have been experienced by every RKI, and these changes seem to have an influence on the increasing need for inter- and/or transdisciplinary approaches. These are: 1) changes in the clients, and 2) the democratization of science.

Clients

The traditional clients of the RKIs are the ministerial departments and the government (including various political parties). Due to a decentralization of governmental tasks, the provinces, municipalities and water boards have more responsibility in the governing of the Netherlands. In order to carry this responsibility, they have an increasing need to use the knowledge and expertise of the RKIs. For the RKIs, this means that there is a change in the kind of requests they receive, the type of subjects for which an evaluation is requested, the size of the evaluation, and the amount of knowledge and information that is available to work with.

R.6[a] – 'It is very challenging when we are asked to give a central evaluation, and the information regarding this evaluation is only available on a local scale. Usually we don't have direct access to the decentralized information, and the information is often not homogenous. So out of this, we need to formulate reliable information, this takes time and it is very complicated.'

This creates challenges, but it also creates new fields of research.

R.2[b] – 'I pay a lot of attention to the development and the effects of this decentralized way of governing. What does it means when you no longer govern in an hierarchical way, but in a facilitating way. How realistic is the picture of society, and the individuals and organizations in it, governing themselves?

The decentralization of governmental tasks has initiated a discussion regarding the tasks of the RKIs. When looking at the original key tasks of the RKIs, are the decentralized governmental institutions (provinces, municipalities) clients of the RKIs, or not? In order to deal with these questions, there are

several RKIs that have developed guidelines and programs. These guidelines and programs can be used as a guiding framework for working with decentralized governmental parties.

R.3[b] –'In principle we only work for the national government, and in this, the governmental departments are our clients. Since the decentralization of governmental tasks, we are debating about what to do with the municipalities and the provinces.'

Decreased authority of science

Almost all respondents noted that the authority of science is decreasing, and some mentioned the concept of democratization of science. To get recognition it is no longer sufficient to 'just' publish a research report. It was mentioned that society has become more critical, better organized and more expressive. The RKIs agree that these changes *require* scientists to leave the 'ivory tower', to give more transparency regarding their research and how this affects society, as well as how a neutral position in this is guaranteed.

R.11[b] – 'In these times, we find ourselves under a magnifying glass. We have to justify everything we do, why we do it, and how we do it. We don't want to infer a causal connection. However, the need to prove the credibility of our work has become increasingly necessary'.

According to the RKIs it becomes more apparent that the viewpoint of today's society is increasingly 'science is just another opinion'. Whether the respondents want to leave this proverbial ivory tower was not discussed.

For the national knowledge institutions it has always been important to think about which communication channels are most suitable for reaching their target groups. However, it seems that in response to the decreasing authority of science, the knowledge institutions are more conscious of handling their visibility. There is more interaction with society, and there is more communication towards society regarding the outcomes of research and what these outcomes entail. This communication mostly takes place via the digital route. For example, via interactive communication expressions such as card stacks, digital info graphics and video clips.

RIVM 1[b] – 'For the RIVM, it is very important to work in an interactive way and involve the stakeholders. For example, we have the platform VTV, in which we continuously communicate research results regarding the health effects of intensive livestock farming to citizens, farmers involved and to municipalities. Of course, we also explain what the results mean.'

Another way in which the RKIs attempt to create more understanding for science is through citizen science. In this way, they also try create ownership for societal topics.

R.8[b] – 'We will have to involve citizens in the articulation of the knowledge questions, and in the actual data-collection to answer the knowledge questions. The research questions will have to be in line with their questions and value system. It's no longer a possibility to simply 'send''.

6.9. Innovation

These changes are stimulating the RKIs to innovate. For some of the RKIs this innovation is partly manifested by inter- and transdisciplinary approaches. However, there are also other forms in which the RKIs innovate. With regard to the question what innovation exactly is there is a homogenous view. This view varies from innovation in methods and techniques in response to the arrival of big

data, but also to innovation in the way processes and thinking are organized. This last form of innovation is reflected in the increasing need for the exchange of knowledge with other disciplines, in the way the communication with society has changed and increased, and in some cases in the way the RKIs try to look from the perspective from their clients.

R.3[b] – ' Innovation can occur in methods and techniques, but also in the way we communicate with customers, or in internal processes'.

The need for innovation can arise for different reasons. In general the need to innovate is always there because the context in which the RKIs have to work always changes. However, to be more specific the need for innovation can arise because in practice a traditional approach to a certain project seems to be insufficient in reaching project goals, or it can arise as a reaction to the developments in technology. Other reasons that the respondents gave are new types of data that emerge, that require the development or adaption of methods and techniques to analyze the data.

R.5[b] – 'I am involved in the innovation department. In this department we are all stimulated to think in a new and creative way. At the moment, we are trying to decide how we are going to stimulate this way of thinking throughout the whole organization'.

Between the RKIs there are several data labs that specifically focus on innovation. In these data labs, methodological innovation takes place. However, as to the question where innovation occurs different views are presented, varying from; only within data labs, throughout the whole organization through the use of an innovation strategy, or innovation takes place anytime, anywhere. Within the RKIs there are also different views about this. Innovation is one of the ways in which the RKIs try to increase the impact of their work. Another way in which the RKIs innovate is through the (experimental) use of citizen science (see Paragraph 6.5).

Challenges for innovation
With regard to innovation, there are two challenges that the RKIs experience. These challenges concern the ownership of big data, and the conditions that have been identified that stimulate innovation.

Ownership of big data
One of the challenges that presents itself with regard to big data, is that many 'owners' of big data are commercial organizations. These parties prefer to sell the big data, instead of just giving it for free. This creates a problem for the RKIs, because both legally as financially they have little space to establish themselves in a commercial way.

Conditions for innovation
Several conditions were mentioned that can enable and stimulate innovation, and ultimately influence the performance of the RKIs. In general, the institutional framework should give space to innovate. The way an institution is managed can strongly influence the capacity to innovate, and to take inter- and/or transdisciplinary approaches.

R.8[b] - 'We are a knowledge institute, and nothing is as changeable as knowledge. So as knowledge institutions we have to ensure that we stay connected with universities, with policy and with (inter)national organizations that are relevant in our field of business. This cannot be done without investing effort and finances, so it is essential to invest in this'.

The management of the RKIs should ensure that they give space to experiment with new methods and techniques. This space should consist of finance, time, but also the acceptation of risks, and the capability to deal with 'failed' innovation experiments.

R.5[a] – 'The capacity to innovate can be stimulated through the human resource policy. By hiring people who have worked on the 'other side' of the coin (executive/theoretical) an exchange of knowledge and experiences can be achieved. Another essential is support from the management of the institution. Existing frameworks should not hamper creativity'.

So, innovation can be stimulated or hampered by the way the institution is managed. Another factor that influences the innovation capacity is the expertise practitioners of the institution have. In order to innovate, there should be enough expertise to be able to assess whether innovation suggestions are viable or reliable. To be able to do this, the team composition should consist of people with the right expertise and knowledge. The teams should consist of a mix of connectors between different worlds and specialists. This ensures that actual substantive work can be done, and that there are people who can communicate with 'the outside world' or other disciplines. A number of respondents also mentioned that a specific business strategy aimed at innovation, a so-called 'innovation strategy', has been stimulating for achieving innovation.

R.8[b] – 'Since five years we have an innovation policy. Because of this, there are finances that can be used for innovation experiments. The innovation projects don't necessarily have to be fruitful, which gives a lot of space to be creative and experiment'.

It became apparent that in the RKIs who do not have an innovation strategy some of the respondents are dearly missing one.

6.10. Conditions for inter- and transdisciplinary approaches

During the interviews several conditions came forward that are of influence on the way the RKIs can perform. These conditions were mentioned as enabling or constraining conditions for inter- and transdisciplinary approaches.

The *first condition* is that the institutional setting should offer space to seek interaction with other disciplines, or with non-scientific parties. The way the institution is managed can stimulate or hinder inter- and transdisciplinary approaches. The institutional setting and the way the institution is managed can be of big influence on the capacity to assume an inter- or transdisciplinary approach, just as this is of influence on the innovation capacity.

R.10 –'Years ago we (the researchers) made a plan to set up an integrated network with all the other disciplines and organizations that are working on the same topics. We hoped that through a network like this, we could achieve a better connection with the policy staff in The Hague. Unfortunately it appears to be very difficult to establish this network. In my opinion, this originates from a part of the senior management that is not experienced enough in interacting with policy. In addition to this, the management has a short term view, while for the long-term health of the organization a long term view is necessary. It is necessary to look at macro level, and not just at micro level. On top of this, it is difficult to interact with the policy staff.'

The *second* and *third condition* that are important consist of financing and time. These conditions fall under the institutional setting. Several respondents who have experience with inter- and transdisciplinary approaches suggest that these approaches are very intensive because of the time that has to be taken for the process. This process means that from the onset of a project, the stakeholders and their knowledge and perspectives are taken into consideration in the discussion, as well as in the formation of the project. It was mentioned that forsaking spending time on this process will increase the chance of project failure. This is because in this initial phase, the integration of stakeholders can create social support for the project.

R.5[a] – 'I think that society is not yet convinced about the necessity of the energy transition. But when inhabitants of a region in which wind turbines are planned are involved in the exchange regarding the reason for these windmills, and the foreseen problems from the onset on, you can make them a part of the discussion. In the end if you allow the inhabitants to watch, discuss and you involve them, you will create social support'.

Time should be made available to do so, both in the wider context and in the institutional setting. By investing in this, a reduction of the sense of risk due to experienced time pressure can be achieved. Furthermore, taking time for integration of the multiple stakeholder perspectives increases the social robustness of the outcome. And last, the respondents mentioned that uncertainty regarding the finances is a very hindering factor. Not knowing who will pay what, and when, is not contributing to a creative habitat.

The *fourth condition* that can stimulate inter- and transdisciplinary approaches concerns the team composition. The team should, equal to when the aim lies on increasing innovation capacity, consist of a mix of connectors and specialists. Several respondents indicated that the connectors will have to be talented in guiding the process of the project, as well as in communicating with the different (knowledge) worlds. According to the respondents, there is a need for connectors with these competences, because the need for transparency and openness towards society is increasing. However, the respondents also mentioned that the specialist should not disappear, and should not be undervalued. Without the specialists, no substantive work would be carried out, and thus projects would end unsuccessful. Concerns were raised that in the future practitioners will become too one-sided in terms of skills, and that the specialists will increasingly disappear from the spotlight that they to deserve.

R.2[b] – 'We have to guard the core of every disciplinary team, for example, the real specialist in certain models. I fear that because of the observation that issues have become more complex, we will lose the balance between specialists and generalists. In my view, the team should represent both of these. We need people with analytical, specialist skills, as well as people who can bridge the gap and communicate about the importance of the job we do. With only generalists, we will not make it'.

According to the respondents, losing the balance between the different skills that are required to deal with complex problems will have disastrous consequences. Particularly because in an inter- and transdisciplinary approach it is very important that one has a clear understanding regarding the stakes of the every participant. According to the respondents, these stakes can only be properly assessed when there is a good mix of skills and specialties in the team. Furthermore, to limit the influence of inclusion of other parties, and at the same time to promote creative thinking, it is necessary to be 'anchored' in a discipline. When the participators have no anchor in a certain discipline, this raises the risk of 'going with the flow', and eventually the risk of nothing really

happening. Because no human being can have all of these qualities at once, variation in the team and internal communication are important.

A _fifth condition_ is that when one enters a inter- or transdisciplinary project, one has to know the subject, and know where the knowledge that is created will be applied. According to R.5[a], this is not always the case. Therefore, R.5[a] suggest exchanges of position, in which some researcher will become more involved in the application of the knowledge, and the executors are more involved in the process of (more theoretical) knowledge production. In this way an exchange of practical and theoretical knowledge is achieved and socially robust action plans can be created. At the knowledge institution represented by R.8[a, b], a start has already been made on such an exchange.

R.8[a] – 'Within a certain project I more or less positioned myself in the setting of the stakeholder. This was done to find out how we could give the stakeholder the most effective assistance in the future'.

The idea that an exchange of position can contribute to the creation of socially robust action plans is supported by the RCE as well. This is another knowledge institution that has a lot of experience with interdisciplinary and transdisciplinary projects. Both parties have a number of executive tasks, and on the basis of practical experience they encourage the use of different types of knowledge in the formation of a total overview. In their opinion, the inclusion of (non) scientific (experiential) knowledge raises the chance of a robust and socially accepted action plan.

RCE 1 – 'The national manager of Coastal zone said the following to me: ''Based on your story about the historical relics that can still be found in the area, and the information we can derive from that regarding the development of this area, I can now take the right decisions''.
Now, the national manager of Coastal zone will choose not to build a harbor in an area that the locals call 'the sandy spot', because that is the place in which sand always builds. If the harbor would've been build there, it would have to be dredged all the time. It is precisely this kind of knowledge that resides in the mind of locals'.

Ultimately, all the above mentioned conditions influence the extent to which reflexive initiatives such inter- and transdisciplinary approaches, can be taken.

7. Conclusion

In this chapter, the research questions will be answered. Paragraph 7.1, 7.2 and 7.3 start with concluding what the answers to the three research questions are. Following this, Paragraph 7.4 will conclude what the answer to the main research question is.

7.1. Conclusion RQ 1: How do national knowledge institutions perceive the role of science for policy?

The main goal of the RKIs is to provide the Dutch government with scientifically grounded information. This information is of use for policymakers in the formulation of evidence-based policy for the benefit of society. In doing so, the RKIs show considerations for all four roles of science for policy. The role perception first and foremost depends on the key tasks of the RKI, which are of influence on the research context and the problem structure of the subjects the RKIs have to deal with. The roles are therefore not static.

7.2. Conclusion RQ 2: How are the modernist and reflexive logic represented within national knowledge institutions?

When looking at how the modernist and reflexive logic are represented within the national knowledge institutions, all RKIs show a very modernistic view on quality principles for science. The RKIs show awareness of a need to change the way in which interaction with society takes place, and awareness of a need to exchange knowledge and experience with other disciplines in order to answer societal questions. This has led to a complementation of the modernist view with more reflexive elements, such as transdisciplinary approaches in (pilot)projects, and increasing moments of interdisciplinary contacts. However, the implementation of these reflexive elements mostly initiates from modernist motives, such as increasing legitimacy. This shows that the modernist logic dominates the reflexive logic, and that the reflexive elements are seen as optional. There is an exception of two RKIs, who show both a modernist and a reflexive role perception. The RKIs show considerations for both the modernist attributes, as well as the reflexive attributes. This demonstrates that the logics are not static. In some cases this causes discrepancy in the way the role of science for policy is given shape.

7.3. Conclusion RQ 3: Which conditions can be identified that influence the performance of national knowledge institutions?

The RKIs experience changes with regard to (potential) clients of research, a decrease in the authority of science and data science possibilities. These changes in the wider context are stimuli for innovation in the way the role of science for policy is given shape. Inter- and transdisciplinary approaches are a way of innovation, but also a way to achieve innovation. Conditions in the institutional setting can either obstruct these ways of innovation, or stimulate them. Stimulating conditions acknowledge that innovation means taking risks, that there are financial means, and that in order to innovate the team should consist of people who have disciplinary knowledge and/or competences to make connections between different non-scientific or disciplinary knowledge worlds. In the RKIs not all these conditions are met, and although these conditions do not influence the perspective the RKIs have of the role of science for policy, the presence or absence of these conditions is of influence on the performance of the RKIs.

7.4. Conclusion MRQ: How do Dutch national knowledge institutions respond to the changing demand for knowledge production?

The results of research question 1 show that the RKIs role perceptions are not freely chosen, but are shaped depending on the research context, the problem structure, the key tasks of the RKIs and the way in which the diverse research subjects are reflected within the key tasks of the RKIs. Because of the diversity in subjects, and the way these are reflected within the key tasks, the RKIs show considerations for all roles of science for policy, sometimes alternating between the different roles, or using two or more roles at once. The RKIs show considerations for both roles of science that were assigned to the modernist logic (Issue advocate and Science arbiter) as well as considerations for the roles of science that were assigned to the reflexive logic (Broker of policy alternatives and Participatory expert). This information gives an indication that both the modernist and reflexive logic are represented within the RKIs, and that the RKIs have a way to deal with being in-between logics. Through answering research question 2 it is now known that attributes for both the modernist and the reflexive logic are guiding the RKIs in how they fulfill their scientific role for policy. Elements for both logics come forward when discussing the purpose of scientific advice, the role of experts at the science-policy interface, and the quality principles that are leading in this. In this, the RKIs again show considerations for all four roles of science for policy, with a modernistic view on the quality principles. This leads to discussions with regard to the acknowledgement of value laden choices. On the one hand, it is acknowledged that value free research is not possible, on the other hand, the RKIs implement strategies to improve value free research. This can be seen as a manifestation of both logics at the same time. All the RKIs experience societal changes that are of influence on the position of knowledge institutions and on their role perception. Because of this, there is rising need to use interdisciplinary partnerships to exchange how to deal with these changes. As one way to deal with these changes, six out of ten RKIs make use of transdisciplinary approaches. The extent to which a transdisciplinary approach is applied, and the extent to which there is stakeholder interaction and integration within the transdisciplinary approaches, differs between the RKIs. These differences can assigned to the considerations that form the basis of the transdisciplinary initiatives, and are connected to how these initiatives are reflected within the key tasks of the RKIs. These differences can also assigned to the extend in which conditions for innovation and for inter- and transdisciplinary approaches are met. The results of research question 3 shows that these conditions can either obstruct, or stimulate these initiatives, and that the most important conditions to meet lie within the institutional setting (the ability to take risks, financial means), the broader context (the will to meet and learn from each other), and on the project level (the team and competences within the team). The presence or absence of these conditions is of influence on the performance of the RKIs.

When combining the results of research question 1, 2 and 3, it can be concluded that the RKIs are caught between logics. This is shown by the presence of considerations for all four roles of science for policy, and the presence of a modernist as well as reflexive view, and the manifestation of both these logics at once. In most RKIs the modernist logic is dominant. In dealing with this 'in-betweenness' the RKIs with a dominant modernist view encapsulate the reflexive elements within the modernist logic. This is shown by the modernistic quality principles that are guiding the RKIs in the performance of the role of science for policy. From a modernistic perspective there is acknowledgement for the need to use reflexive elements, such as inter- and transdisciplinary approaches, but these reflexive elements tend to be implemented in a modernistic way and evaluated from a modernistic point of view. The presence of enabling conditions for innovation and inter- and transdisciplinary approaches can influence the performance of these RKIs, but this will not change their modernist perspective. Two RKIs differ from this, for in their reflection upon the research context, the problem structure, the subjects and their key tasks, they show considerations

for both modernist and reflexive logic. Furthermore, in dealing with being caught between logics these two RKIs use a different alignment strategy. They make loose connections between the attributes that constitute both logics, and in this they value components of both logics as important for the formulation of societal robust advice. In these last two RKIs most of the conditions for innovation and inter- and transdisciplinary approaches are met. This enables these RKIs to use elements of both the modernist and the reflexive logic. However, what ultimately enables the RKIs to use the loose connections strategy is the absence of a dominant modernist logic, and the presence of a reflexive view on science for policy.

8. Discussion

In this Chapter the research findings and conclusions will be discussed. Paragraph 8.1 will discuss the findings in the light of the theoretical framework and in the light of relevant literature. Finally, in Paragraph 8.2 the limitations of the research are discussed.

8.1. Theoretical discussion

By answering the research questions, a contribution was made to the understanding on how Dutch boundary organizations respond to the changing demands of knowledge production of science for policy. When looking at how the research results are reflected in the literature, there are some things that are noteworthy.

8.1.1. Key tasks and role fixedness

The results in this thesis have shown that the key tasks of the RKIs play a role in the interpretation of the role of science for policy, and in determining which role is the most leading. It is suspected that the RKIs succeed in assuming these different roles alternately and simultaneously by a continuous reflection and re-evaluation of the key tasks of the institution. On the basis of these key tasks it is reflected how a (potential) research subject falls under the responsibility of the RKI, and how the research will be approached. This is demonstrated when we take a look at the way in which the RKIs respond to the decentralization of governmental tasks. The discussion regarding whether the municipalities and provinces are clients of the RKIs illustrates that the key tasks are used as a point of reference. The guidelines and programs that have been developed to offer a conceptual framework in this discussion shows that the key tasks are subject to evaluation and reflection. So, the role of the RKIs is considered every time a (potential) research subject does not clearly fall under one of the key tasks of the RKI. This is demonstrated in Figure 8:1.

Figure 8:1. Dynamic between key tasks, the problem context and problem structure

The arrows show the influence of the key tasks on the problem context and the problem structure, and that this influence also occurs the other way around. This (brief) re-consideration of the key tasks, and the way in which these key tasks influence the role perception, is different for each RKI (Maasen et al., 2006). The RKIs constantly look from the point of view from the key tasks and whenever necessary make small adjustments in the way these key tasks are interpreted. Because of this, it is possible to perform the key tasks in a modernistic way, but to use a reflexive way whenever this seems necessary.

8.1.2. Roles and logics

The observation that the RKIs cannot be classified into one singe role, and that depending on the context they switch between the different roles, or make use of several roles at once, is not a new observation. Huitema and Turnhout (2009) already found that depending on the context in which a research takes place a certain role will be leading in the way that boundary organizations carry out their tasks. Furthermore, in the work of Hisschemöller and Hoppe (1998) it is also mentioned that not only scientists determine what role they end up playing, but the degree of problem structuring determines which role is possible. Every societal problem that is presented to the RKIs has a certain dynamic that is of influence on the role repertoire. This explains why the RKIs cannot be classified into a single role, but use all roles. The range of subjects the RKIs have to deal with is very diverse, and within this, the structure of the problems they have to research is also varying. These factors all determine whether a transdisciplinary approach or transdisciplinary elements can be useful within a research situation (Hisschemöller & Hoppe, 1998; Huitema & Turnhout, 2009). The results of this thesis show that based on the logics certain attributes are leading in the way the practitioners work. Based on the logics, the scientific advice, the role that is assumed, and the quality principles that are used in this, are given shape. On the basis of these elements, as well as the key tasks, problem context and problem structure, a certain role repertoire is used. The subdivision of the roles under modernist or reflexive logic is therefore not static. The modernist roles can be performed simultaneously or alternately with the reflexive roles. Figure 8:2 shows how the attributes (green) are connected to the different roles of science for policy (blue).
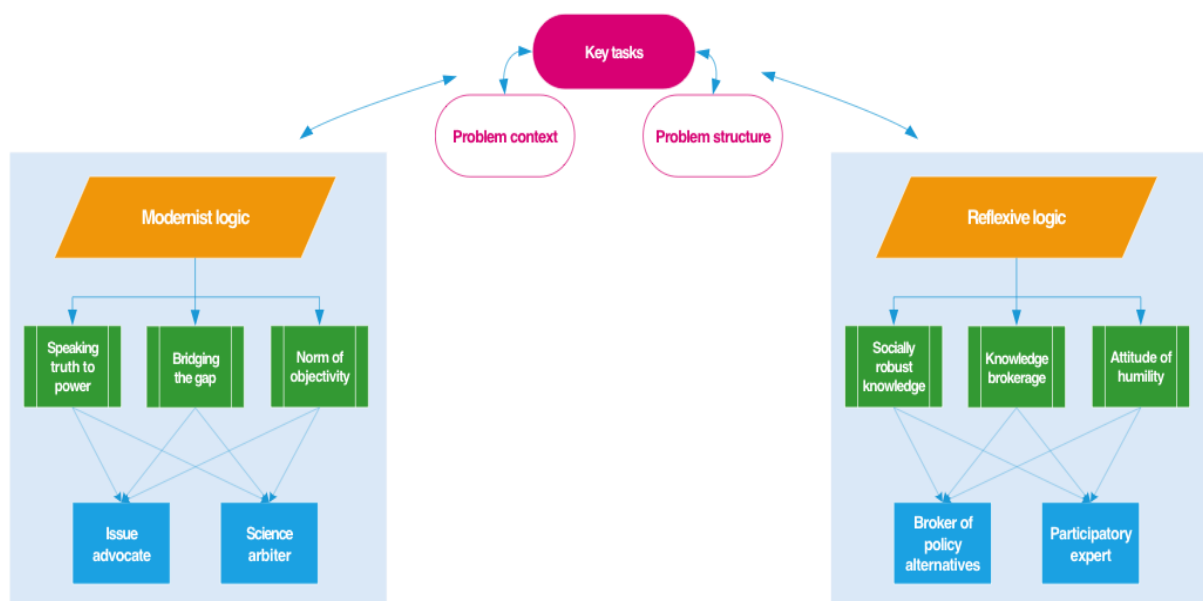
Figure 8:2. Dynamic between the key tasks, problem context, problem structure and the role repertoire

Practitioners who have a predominant modernistic view, give shape to the roles of science for policy from that point of view. This means that the roles that are categorized under the reflexive logic, are given shape from a modernist point of view. The other way around, the same happens. From a practitioner with a predominant reflexive point of view, the reflexive attributes are determining how the modernist roles are performed. This means that both the modernist and the reflexive logic will always exist, and that these logics can interact with each other. For example, the RKIs have mentioned that they experience challenges with regard to the structuring of citizen science data, and the conversion of this data in reliable information. At the RKIs the modernist quality principles are dominating, and interference of reflexive methods that not have been proven yet (from a modernist viewpoint), can influence the reliability of the data. So the aim is to ensure the trustworthiness of the

research results, whatever methods have been used, as well as increase legitimacy of the institution by using citizen science. At the same time, using citizen science raises questions with regard to this trustworthiness. This example shows the interaction between the different roles, fuelled by the logic that is dominating, and demonstrates that the RKIs are caught between logics.

8.1.3. A transdisciplinary approach and Attitude of humility

Based on the different ways in which a transdisciplinary approach is used, it seems that there are different degrees of transdisciplinarity. In this the role of the RKIs varies between facilitating, consulting and participating in the process (Mobjörk, 2010). The degree of transdisciplinarity within these approaches seems to be related to the role perception. For example, when in a project the RKIs have the role of facilitator or consultant there is a certain separation between them and the other participants. Therefore, their position is not equal to the position of the other participants. The degree of transdisciplinarity also seems to be related to presence or absence of the Attitude of humility, one of the attributes of reflexive logic. Despite the fact that the RKIs describe an increase in the need for inter- and transdisciplinary approaches this Attitude of humility is hardly present. This is striking, for according to literature about reflexive logic, participatory research and transdisciplinarity, this attitude forms the core of transdisciplinarity (Jahn et al., 2012; Kunseler, 2017; Turnhout et al., 2013). The results also show that the initiative for a transdisciplinary approach at the majority of the RKIs originates from a need to maintain and increase their legitimate position, which suggests that the Attitude of humility is absent. Only at a few RKIs the initiative for a transdisciplinary approach originates from the believe that the input of stakeholder knowledge and experiences are of great value, which suggests that the Attitude of humility is present. In literature, these considerations can be traced back to positive and negative considerations for a transdisciplinary approach identified by In't Veld (2010). In this, a positive consideration speaks about the integration of non-scientific knowledge, in which citizens are representatives of a certain emotion, or interest. According to In't Veld (2010) a negative consideration speaks of a lack of legitimacy of the official representative politicians, or institutions that are assisting policy. The discussion regarding the acknowledgement of value-laden choices that is taken place at the RKIs, shows an Attitude of humility. To a certain extent it seems that the RKIs have accepted the fact that value-laden choices are inevitable. This corresponds with the observation of In't Veld (2010) that scientists cannot be disconnected from their personal values and norm system, that is (unconsciously) guiding them in their life and perspective of life. This is another example of how the RKIs are caught between logics.

8.1.4. Enabling and constraining conditions for performance

During the data collection it became apparent that conditions that were mentioned actually outline under which circumstances the RKIs are able to provide quality. These conditions apply to inter- or transdisciplinary approaches but also to innovation, and are thus important in both modernist and reflexive approaches. These conditions are influencing the role repertoire that can be used. This becomes apparent when looking at the RWS and RCE. Because they have the means to meet and influence conditions on project level, the institutional setting, as well human capacity (intern, or extern), they are capable of using both modernist as well as reflexive elements in their work. When the conditions are not met, or the RKIs do not have the ability to influence the conditions, the performance of the necessary roles can be hampered. The influence of the conditions on the role repertoire is shown in Figure 8:3.
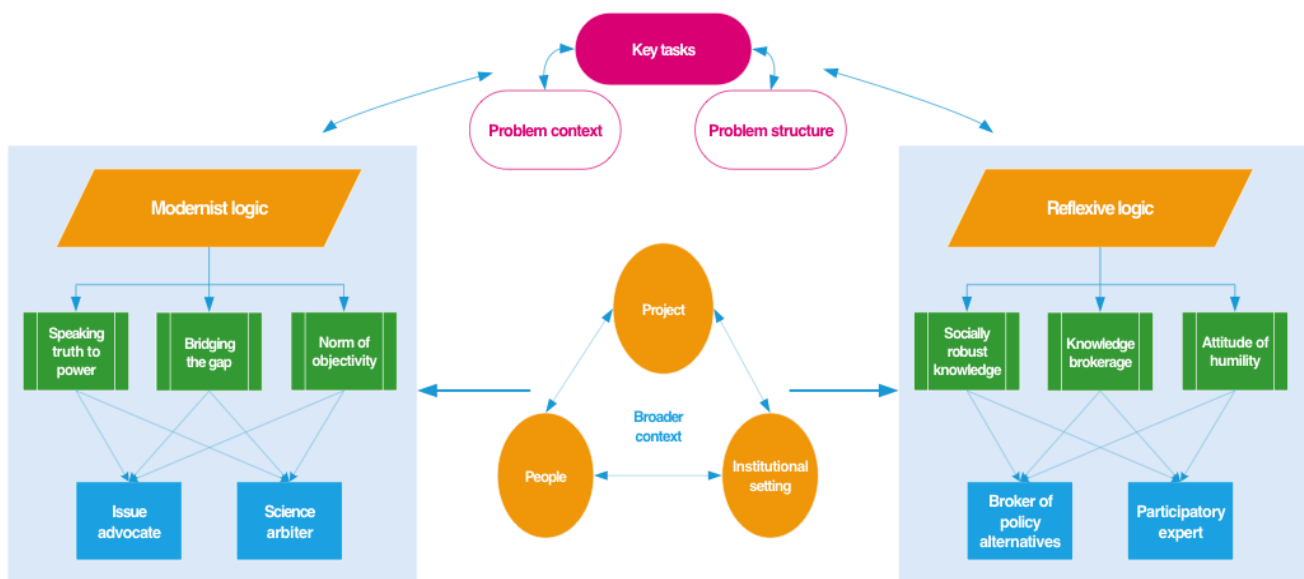
Figure 8:3. Interaction between the key tasks, problem context, problem structure, role repertoire and conditions

For example, the _first condition_ entails that the institutional setting should offer space to seek interaction with other disciplines, or with non-scientific parties. If this condition is not fully met, this can strongly influence the extent to which interactive methods, such as inter- and transdisciplinary approaches, are needed, and can successfully be used (Regeer & Bunders, 2007).

Regeer and Bunders (2007)also mention the _second_ and _third condition_, financing and time, as factors that, when there is clarity about how much time, and who is responsible of the finances, can stimulate innovative and inter- and transdisciplinary efforts. What is striking is that all respondents mention that inter-and transdisciplinary approaches require a lot more time compared to more traditional methods, while In't Veld (2010) mentions that these approaches do not necessarily take more time when taking into account the time that unilateral processes sometimes need to tackle resistance from unsatisfied parties. It is a possibility that in practice the different project approaches take the same amount of time, but this is not noticed yet because for the interactive approaches the RKIs still have to invent 'how' such processes need to be designed, and who is responsible for what. Because this is unfamiliar, it can feel very time-consuming and intensive.

The _fourth condition_ regarding the team composition shows that there is a need for so-called 'T-shaped professionals'. T-shaped professionals possess competencies for substantive disciplinary work, as well as organizing and connecting competencies that are needed to bridge the gap between the different (knowledge) worlds (Barile, Franco, Nota, & Saviano, 2012). Studies regarding the development of science that were carried out in the '70's show that only when a discipline is fully developed, it becomes possible to step outside of the paradigm and become more creative in research approaches. Before a 'trip' can be taken to other paradigms, or post-paradigms, it is essential that the researchers are at home in their own discipline (Schäfer, 2012). When looking at the fourth condition from the perspective of this literature, the question arises whether transdisciplinary approaches are part of a new paradigm, or a post-paradigm. In 1962 the concept paradigm was introduced by Thomas Kuhn as _'. . . a shared foundational set of theoretical beliefs and priorities that interpret the way one or several disciplines interpret their data'_ (Kristiansen, 2014, p. 22). Several researcher added to this definition that within a paradigm the way humanitarian and

social sciences interact with society is also laid down (Kristiansen, 2014)., Further research into this would be a valuable contribution for transdisciplinary literature.

8.1.5. Coping strategies

In order to deal with being caught between logics, with conditions that are not always met and the influence of this on their work, the RKIs make use alignment strategies that were identified by Kunseler (2017). The alignment strategies show the way in which the practitioners at the RKIs can connect the two logics and the accompanying attributes. Figure 8:4 shows how all of the above mentioned concepts interact with each other in the process of knowledge production. The arrows show that the way a knowledge production process is shaped is influenced by the key tasks, the reflection on these tasks, the problem context and problem structure. Based on this, the fitting role repertoire becomes apparent. Whether the most fitting roles can be used, and which alignment strategy can be used to navigate between these roles and the logics, for a small part depends upon the degree to which the conditions are met. However, ultimately what determines the performance and the way the RKIs respond to changing demands, is the logic that is dominant within the RKIs. From the perspective of that dominant logic, the elements of the other logic can be used and
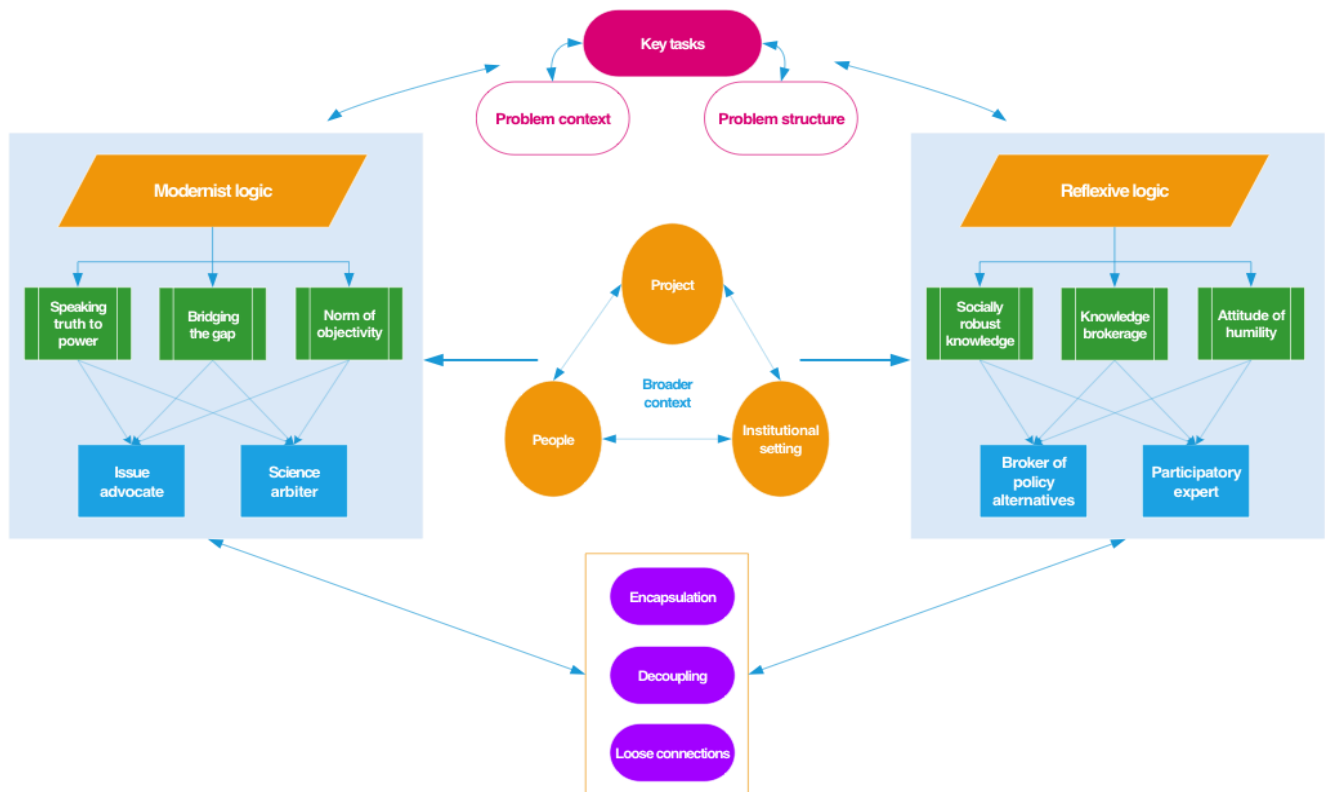
implemented.

Figure 8:4. Influencing concepts in the way knowledge is produced

8.2. Limitations of the research

In this paragraph the limitations of the research are discussed, including the ways in which the researcher has tried to ensure the validity of the research and the overall conclusion. First, in Paragraph 8.2.1 the validity of the units of analysis will be discussed. After this, in Paragraph 8.2.2 the validity of the study as a whole will be discussed.

8.2.1. Validity of the units of analysis

Measurement validity

In this study, the units of analysis were practitioners working at Dutch national knowledge institutions. The methods that were used to gather data consisted of semi-structured interviews and participant observation. These methods were used to contribute to the understanding of how Dutch national knowledge institutions respond to the changing demands of knowledge production of science for policy. The use of semi-structured interviews did raise the chance of random errors, because every interview situation was different, and every respondent had his own unique perspective. This influenced the way topics were interpreted. This could not be prevented, however the researcher tried to identify the way the respondents interpreted the topics through the use of follow-up questions. These follow-up questions have helped to identify the individual interpretations of each respondent. The use of participant observation as a method on its own would not have been a valid, since observation without interaction gives to much chance for bias. However, the participant observation was solely used to confirm whether the interview questions that were made were good questions, and to check whether the interpretation that the researcher gave to the interviews was consistent with the interpretations of the discussion that took place during the participant observation. The methods gave the opportunity to gain in-depth insights into ideas, background, motives, argumentations and assumptions of the practitioners (Silverman, 2013), which has been of great value to answer the research questions.

Internal validity

By interviewing practitioners of the national knowledge institutions the researcher was able to identify which roles they perform in the science-policy interface, as well as what according to them the purpose of science for policy is, and which quality standards guide their interpretation of this. The researcher was able to identify how modernist and reflexive logic are represented in the organization, and which factors influence the use of modernist or more reflexive approaches. Each audio fragment was transcribed, after which a summary was made of this transcript. This summary was send to the respondent for confirmation or feedback. In this way, the respondents have gotten the chance to check the material before the coding-process started. If feedback was given, this feedback was transferred into the transcript, without deleting original content. In this way, the internal validity is guarded. Furthermore, whenever possible the researcher interviewed two respondents per selected national knowledge institution. Through this triangulation of sources has provided a check for the consistency of the findings.

External validity

In the RKI-network (the selected case) a number of thirteen institutions participate. Due to non-response it was not possible to interview two persons from each of these institutions. In total there have been nineteen respondents, which represent ten national knowledge institutions. Through the snowball sampling technique the institutions themselves directed the researcher to the most relevant person to speak with. On the basis of this, and the results, it can be assumed that the research has used the right respondents. Furthermore, the aim to speak with someone who has a

management position, and to speak with someone who has practical experience with innovation has been achieved. On the basis of this the respondents are a good representation for the population as a whole, while keeping in mind that each organization has key tasks of its own and therefore is unique.

8.2.2. Validity of the study as a whole

Internal validity

Through the use of semi-structured interviews, as well as participant observation, triangulation of methods was applied. The participant observation gave the researcher the opportunity to see how and about what the representatives of the organizations interacted with each other. This gave both insights for the formulation of the interview questions beforehand, as well as insights for the interpretation of the transcripts. In this way, the consistency of the data, and the researchers interpretation could be checked.

A limitation of this research is that the institutions that are part of the RKI-network are not a very homogenous group. Although each institution has official tasks for the Dutch government, the diversity in these tasks is quite high, ranging from conducting research that is used for the administration of justice, to conducting policy assessments or implementing policy measures. However, since the institutions have voluntary joined the RKI-network, as well as provided response for this thesis, it can be assumed that the bonding part, the fact that they are national knowledge institutions, weighs heavier than the differences. Therefore, these differences are not of big consequence for the conclusions of this research. Moreover, the differences between the RKIs provided for a possibility to check for consistency of the data, and to identify reasons for (in)consistency.

External validity

Both within the selected organizations, as in literature, changes in society have been described that are of influence on the position and the role of knowledge institutions. It therefore can be assumed that Dutch public knowledge institutions that were not part of this study experience the same kind of changes. Since public knowledge institutions base their work on scientific standards, as well as put their knowledge into practice to serve society, the conclusion of this research can be generalized for the other public knowledge institutions. However, is has to be kept in mind that for this research only nineteen respondents participated, representing ten RKIs, while the Rathenau Institute identified 29 public knowledge institutions and around thirty> other knowledge institutions (such as museums, research councils, etc (Koens, Meza, Faasse, & de Jonge, 2016).This means that at least 1/3 of the public knowledge institutions was not officially represented within this study. Therefore, the conclusion should be seen as an indication for what happens at the other public knowledge institutions.

9. Recommendations

In this Chapter some recommendations regarding additional research have been formulated, as well as some practical recommendations.

9.1. Additional research

When looking at the three alignment strategies that are used to make connection between the modernist and reflexive logic, one can wonder whether these strategies form a sliding scale, and whether the RKIs that are using the alignment strategy 'encapsulation' should ambition to make connections between the logics by means of the 'loose connections' strategy. However, based on the results these are not the right questions to ask. The challenge for the RKIs lies within knowing which methods are appropriate, and when. So, there is no sliding scale in terms of the one strategy being better than the other. Ultimately, the key tasks, the reflection on these tasks, the problem context and structure determine which method is the most appropriate. In this, there is no right or wrong. Based on the work of Pohl (2011) it is expected that as the RKIs will get more experience with the use of reflexive elements (either through practical experience, or training sessions), they will get better at estimating which method is needed when. It is recommended to investigate how the RKIs determine which method is appropriate when, and how the evaluation and reflection of the key tasks takes form. Empirical research into these subject will help in giving a more detailed answer to the question of how Dutch national knowledge organizations respond to the changing demand for knowledge production.

Another question that comes to mind when looking at the alignment strategies is whether the third alignment strategy, loose connections, is possible at all from a predominantly modernist perspective. For from a modernist perspective, there is a very strict view on what the purpose of science is, what role scientists at the science-policy interface should have, and what quality principles are guiding in this. One could argue that from that dominant perspective, it is impossible to make connections with these attributes of reflexive logic, for in the reflexive logic these attributes have a complete different constitution (Kunseler, 2017). Furthermore, it raises the question whether the presence of enabling conditions for reflexive logic will actually help RKIs with a predominant modernistic view to use reflexive elements, or whether something else or more is needed for the RKIs to be able adequately respond to the changing demand for knowledge production. It is recommended to investigate these questions both theoretically and empirically. This will help in uncovering how a balance between modernist and reflexive logic can be reached, as well as finding whether a balance between these logics is possible at all. The answers to these questions have potential to help the RKIs in navigating the changing arena, and will be a contribution to the academical literature regarding the modernist and reflexive logic.

9.2. Practical recommendations

Based on this thesis some practical insights have been worded that are important in the case the RKIs find the need to use more reflexive element.

– Ensure that the institutional frameworks offer space for interaction with other disciplines, or whenever necessary, with non-scientific parties. Depending on the key tasks of the RKI, the problem context and the problem structure, there are several ways in which the RKIs can create this space. Suggestions for this can be found in Attachment V.1.

– Ensure that the institutional frameworks offer space to try out new or different approaches. For example, by means of an innovation policy. In this innovation policy, it should be clear that the practitioners can take time for the process of more reflexive projects. Furthermore, the innovation policy should provide space to experiment with methods of which the success rate is unclear yet, and should give clarity regarding who has main responsibility for the experiments and for the financing. The innovation policy can be used to assign finances to the pilots. In Attachment V.2 some suggestions are worded that can help in the design of such an innovation policy.

– Ensure a T-Shaped team composition, in which a good ratio of generalists and specialists can be found. Through staff policy it can be ensured that in the team members there is a variety in practical and theoretical knowledge and skills. This will enable an exchange of the different types of knowledge and skills, on the basis of which more robust perspectives for action can emerge. In Attachment V.3 some suggestions can be found as to how said knowledge and skills can be exchanged.

– Organize internal and external moments of intervision, where the group discusses value-laden choices, and how they navigate in this. In this way, a platform is created in which the practitioners can learn from one another. Regarding this, Attachment V.4 shows some suggestions.

References

Baarda, B., Bakker, E., Julsing, M., & Fischer, T. (2014). *Basisboek kwalitatief onderzoek*: Noordhoff.

Bammer, G. (2013). *Disciplining interdisciplinarity: Integration and implementation sciences for researching complex real-world problems*: ANU Press.

Bammer, G. (2015). Toolkits for Transdisciplinarity*. *GAIA - Ecological Perspectives for Science and Society, 24*(3), 149-149.

Bammer, G., McDonald, D., & Deane, P. (2013). *Research integration using dialogue methods*: ANU Press.

Beck, U. (1992). *Risk society : towards a new modernity*: London [etc.], GB: SAGE.

Belcher, B. M., Rasmussen, K. E., Kemshaw, M. R., & Zornes, D. A. (2016). Defining and assessing research quality in a transdisciplinary context. *Research Evaluation, 25*(1), 1-17.

Bennett, L. M., Gadlin, H., & Levine-Finley, S. (2010). *Collaboration & team science: a field guide*: NIH Office of the Ombudsman, Center for Cooperative Resolution.

Bergmann, M., Jahn, T., Knobloch, T., Krohn, W., Pohl, C., Schramm, E., & Klein, J. T. (2012). *Methods for transdisciplinary research: a primer for practice*.

Bernard, H. R. (2017). *Research methods in anthropology: Qualitative and quantitative approaches*: Rowman & Littlefield.

Bijker, W. E., Bal, R., & Hendriks, R. (2009). *The paradox of scientific authority: The role of scientific advice in democracies*: MIT press.

Brandt, P., Ernst, A., Gralla, F., Luederitz, C., Lang, D. J., Newig, J., . . . von Wehrden, H. (2013). A review of transdisciplinary research in sustainability science. *Ecological Economics, 92*, 1-15.

Bressers, D., & Poldermans, S. (2018). *Leeratelier omgaan met een veranderend speelveld, Planbureau voor de Leefomgeving*.

Broerse, J. E., & Bunders, J. (2000). Requirements for biotechnology development: the necessity for an interactive and participatory innovation process. *International journal of biotechnology, 2*(4), 275-296.

Bunders, J. F., Broerse, J. E., Keil, F., Pohl, C., Scholz, R. W., & Zweekhorst, M. B. (2010). 11 How can transdisciplinary research contribute to knowledge democracy?

CBS. (2017). Organisation. Retrieved from https://www.cbs.nl/en-gb/about-us/organisation

CBS. (2018). Organisatie. Retrieved from https://www.cbs.nl/nl-nl/over-ons/organisatie

Dirkse-Hulscher, S., & Talen, A. (2007). Het groot werkvormenboek. *De inspiratiebron voor resultaatgerichte trainingen, vergaderingen en andere bijeenkomsten. Den Haag: Academic Service*.

Edelenbos, J., van Buuren, A., & van Schie, N. (2010). Knowledge synchronisation: interactive knowledge production between experts, bureaucrats and stakeholders *Knowledge Democracy* (pp. 153-167): Springer.

Felt, U., Igelsböck, J., Schikowitz, A., & Völker, T. (2013). Growing into what? The (un-) disciplined socialisation of early stage researchers in transdisciplinary research. *Higher Education, 65*(4), 511-524.

Fischer, F. (2000). *Citizens, experts, and the environment: The politics of local knowledge*: Duke University Press.

Funtowicz, & Ravetz, J. (2008). Values and uncertainties. *Handbook of transdisciplinary research*, 361-368.

Funtowicz, & Ravetz, J. R. (1994). Uncertainty, complexity and post-normal science. *Environmental Toxicology and Chemistry, 13*(12), 1881-1885. doi:10.1002/etc.5620131203

Giddens, A. (1990). *The consequences of modernity*: Cambridge, GB: Polity Press.

Goven, J., Langer, E. L., Baker, V., Ataria, J., & Leckie, A. (2015). A transdisciplinary approach to local waste management in New Zealand: Addressing interrelated challenges through indigenous partnership. *Futures, 73*, 22-36.

Hart, H. (2005). t, Boeije, H., & Hox, J.(2005). *Onderzoeksmethoden. Amsterdam/Meppel: Boom*.

Hilgartner, S. (2000). *Science on stage: Expert advice as public drama*: Stanford University Press.

Hirsch, Biber-Klemm, S., Grossenbacher-Mansuy, W., Hoffmann-Riem, H., Joye, D., Pohl, C., . . . Zemp, E. (2008). The emergence of transdisciplinarity as a form of research. *Handbook of transdisciplinary research*, 19-39.

Hisschemöller, M., & Hoppe, R. (1998). Weerbarstige beleidscontroverses: een pleidooi voor probleemstructurering in beleidsontwerp en analyse. *Hoppe, R. en A. Peterse (red): In Bouwstenen voor argumentatieve beleidsanalyse, Den Haag, Elsevier*, 53-75.

Hollaender, K. (2003). Success factors in inter-and transdisciplinary research: selected results from the program urban ecology. *Interdisciplinarity and Transdisciplinarity in Landscape Studies: Potential and Limitations. Delta Series, 2*, 91-99.

Hoppe, & Halffman, W. (2004). Wetenschappelijke beleidsadvisering in Nederland: Trends en ontwikkelingen. *Beleidswetenschap, 18*(1), 31-61.

Huitema, D., & Turnhout, E. (2009). Working at the science–policy interface: a discursive analysis of boundary work at the Netherlands Environmental Assessment Agency. *Environmental Politics, 18*(4), 576-594.

In't Veld, R. (2010). Kennisdemocratie: opkomend stormtij: Den Haag: Sdu Uitgevers.

Jahn, T., Bergmann, M., & Keil, F. (2012). Transdisciplinarity: Between mainstreaming and marginalization. *Ecological Economics, 79*, 1-10. doi:10.1016/j.ecolecon.2012.04.017

Jasanoff, S. (2005). Judgment under siege: the three-body problem of expert legitimacy *Democratization of expertise?* (pp. 209-224): Springer.

Kaufman, S., M. Elliot en D. Shmueli. (2003). Frames, Framing and Reframing: Beyond intractability. Retrieved from http://www.beyondintractability.org/essay/framing

KiM. (2017). KiM, Netherlands institute for policy analysis, about KiM. Retrieved from https://english.kimnet.nl/about-kim

Klein, J. T., Grossenbacher-Mansuy, W., Häberli, R., Bill, A., Scholz, R. W., & Welti, M. (2012). *Transdisciplinarity: Joint problem solving among science, technology, and society: An effective way for managing complexity*: Birkhäuser.

KNMI[a]. (2017). Project RKI. Netwerk van rijksinstellingen en planbureau's. Retrieved from https://www.knmi.nl/kennis-en-datacentrum/project/rki

KNMI[b]. (2017). About KNMI. Retrieved from https://www.knmi.nl/over-het-knmi/about

Koens, L. (2012). *Onderzoek voor beleid: de invloed van het beleid op de taakinvulling van kennisinstituten. Een international-vergelijkend onderzoek*. Retrieved from Nijmegen:

Koens, L., Meza, C. C., Faasse, P., & de Jonge, J. (2016). De Publieke Kennisorganisaties, Feiten en Cijfers 17.

Kønig, N., Børsen, T., & Emmeche, C. (2017). The ethos of post-normal science. *Futures*. doi:http://dx.doi.org/10.1016/j.futures.2016.12.004

Kristiansen, K. (2014). Towards a new paradigm. *The third science revolution and its possible consequences in archaeology. Current Swedish Archaeology, 22*(4), 11-71.

Kumar, S., & Phrommathed, P. (2005). *Research methodology*: Springer.

Kunseler, E.-M. (2017). Government expert organisations in-between logics: Practising participatory knowledge production at the PBL Netherlands Environmental Assessment Agency.

Lentsch, J., & Weingart, P. (2011). *The politics of scientific advice: Institutional design for quality assurance*: Cambridge University Press.

Maasen, S., Lengwiler, M., & Guggenheim, M. (2006). Practices of transdisciplinary research: close (r) encounters of science and society. *Science and public policy, 33*(6), 394-398.

Merkx, F. (2012). Samenwerken aan werkzame kennis. *Methoden en technieken voor*.

Mobjörk, M. (2010). Consulting versus participatory transdisciplinarity: a refined classification of transdisciplinary research. *Futures, 42*(8), 866-873.

NFI. (2011). General information about the Netherlands Forensic Institue. Retrieved from file:///C:/Users/pauli/Downloads/brochure-general-general-information-about-the-netherlands-forensic-institute-%2528nfi%2529.pdf

NFI. (2018a). Missie en visie, over het NFI. Retrieved from https://www.forensischinstituut.nl/over-het-nfi/organisatie/missie-en-visie

NFI. (2018b). Trainingen en cursussen. Retrieved from https://www.forensischinstituut.nl/wetenschap--innovatie

NFI. (2018c). Wetenschap en Innovatie. Retrieved from https://www.forensischinstituut.nl/trainingen--cursussen

PBL. (2017). About PBL. Retrieved from http://www.pbl.nl/en/aboutpbl

Petersen, A. C., Cath, A., Hage, M., Kunseler, E., & van der Sluijs, J. P. (2011). Post-normal science in practice at the Netherlands Environmental Assessment Agency. *Science, Technology, & Human Values, 36*(3), 362-388.

Pielke, R. A. (2007). *The honest broker: making sense of science in policy and politics*: Cambridge University Press.

Pohl, C. (2011). What is progress in transdisciplinary research? *Futures, 43*(6), 618-626.

R.J. In't Veld. (2010). *Knowledge democracy: Consequences for science, politics, and media*: Springer.

RCE. (2017). About the cultural heritage agency. Retrieved from https://culturalheritageagency.nl/en/about-us

Regeer, B. J., & Bunders, J. F. G. (2007). *Kenniscocreatie: samenspel tussen wetenschap & praktijk: complexe, maatschappelijke vraagstukken transdisciplinair benaderd*: RMNO.

Regeer, B. J., Hoes, A.-C., van Amstel-van Saane, M., Caron-Flinterman, F. F., & Bunders, J. F. (2009). Six guiding principles for evaluating mode-2 strategies for sustainable development. *American Journal of Evaluation, 30*(4), 515-537.

Reinecke, S. (2015). Knowledge brokerage designs and practices in four european climate services: A role model for biodiversity policies? *Environmental Science & Policy, 54*, 513-521.

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences, 4*(2), 155-169. doi:10.1007/bf01405730

RIVM. (2017). About RIVM, organization. Retrieved from http://www.rivm.nl/RIVM/Organisatie

Rowe, G., & Frewer, L. J. (2005). A Typology of Public Engagement Mechanisms. *Science, Technology, & Human Values, 30*(2), 251-290. doi:10.1177/0162243904271724

RWS. (2017). Rijkswaterstaat. Retrieved from https://www.rijkswaterstaat.nl/english/index.aspx

Schäfer, W. (2012). *Finalization in science: the social orientation of scientific progress* (Vol. 77): Springer Science & Business Media.

SCP. (2017). English homepage SCP. Retrieved from https://www.scp.nl/english

Silver, C., & Lewins, A. (2014). *Using software in qualitative research: A step-by-step guide*: Sage.

Silverman, D. (2013). *Doing qualitative research: A practical handbook*: SAGE Publications Limited.

Smith, J., & Flowers, P. (2009). Larkin m: Interpretative Phenomenological Analysis: Theory, Method and Research: London: Sage Publications.

Stockmann, R. (2016). The Future of Evaluation in Modern Societies. In R. Stockmann & W. Meyer (Eds.), *The Future of Evaluation: Global Trends, New Challenges, Shared Perspectives* (pp. 36-50). London: Palgrave Macmillan UK.

Stroud, K. (2016). Social learning.

Thomspon, K. (2004). Prospects for transdisciplinarity. *Futures, 36*(4), 515-526.

Turnhout, E., Dewulf, A., & Hulme, M. (2016). What does policy-relevant global environmental knowledge do? The cases of climate and biodiversity. *Current Opinion in Environmental Sustainability, 18*, 65-72.

Turnhout, E., Stuiver, M., Klostermann, J., Harms, B., & Leeuwis, C. (2013). New roles of science in society: different repertoires of knowledge brokering. *Science and public policy, 40*(3), 354-365.

van Lieshout, M., Aarts, N., & van Woerkum, C. (2006). *De straat is van ons allemaal: een studie naar conflicten in de publieke ruimte en de rol van de overheid*: Communicatiemanagement, Wageningen Universiteit.

Veendrick, H. (1977). *Behandeling van een case volgens de incidentmethode*. Tilburg: Ons Middelbaar Onderwijs.

Verwoerd, L., Regeer, B., & de Wildt-Liesveld, R. (2017). The value of reflexive evaluation-a review of the Natuurpact evaluation (2014-2017).

Wadsworth, Y. (1993). *What is participatory action research?* : Action Research Issues Association.

Winder, N. (2003). Successes and problems when conducting interdisciplinary or transdisciplinary (= integrative) research. *Interdisciplinarity and transdisciplinarity in landscape studies: potential and limitations. Delta Program, Wageningen*, 74-90.

Young, J., Shaxson, L., Jones, H., Hearn, S., Datta, A., & Cassidy, C. (2014). RAPID OUTCOME MAPPING APPROACH: a guide to policy engagement and influence. *Overseas Development Institute: London*.

Attachments

Attachment I. Additional operationalization round 2

Rol	Indicator	Signaalwoorden
Science Arbiter	Wetenschap en beleid hebben uiteenlopende functies.	De functie van wetenschap onderscheidt zich van die van beleid door x; De functie van beleid onderscheidt zich van die van de wetenschap door x.
	Interactie wetenschap en beleid kan niet vermeden worden	Interactie wetenschap-beleid is noodzakelijk; Kritische afstand tussen wetenschap en beleid moet bewaard worden.
	Beantwoordt vragen van beleidsmakers	Het antwoord op de gestelde vraag is x; Uit dit onderzoek blijkt dat x; Verwijzingen naar conclusies uit eerder direct gerelateerd onderzoek; We kunnen concluderen dat; De omvang van het fenomeen; Het blijft onduidelijk; De resultaten zijn niet voldoende om, Is volgens plan verlopen.
	Erkent geen waardegeladen keuzes	Wetenschappelijk onderzoek dient ter ondersteuning van beleid; Wetenschappelijk onderzoek is neutraal en objectief.

Figure 0:1. Additional operationalization for round 2 (Koens, 2012, pp. 36, 37)

Rol	Indicator	Signaalwoorden
Issue Advocate	Wetenschap bepaalt de standaard van beleid	Beleid moet evidence-based zijn; Bewijs voor beleid moet via de wetenschappelijke methode verkregen zijn.
	Doet (versmallende) aanbevelingen	Wij bevelen aan/wij adviseren; Optie x te kiezen, X te doen, Dit beleid niet door te zetten. Uit het onderzoek volgt (onomstotelijk) dat x gedaan moet worden/ x het beste is; Uit onderzoek volgt dat x verworpen moet worden/niet moet worden uitgevoerd; Het is belangrijk dat X gedaan wordt; Het is noodzakelijk dat.
	Verdedigt belangen van beleidsmakers, belangengroepen en/of wetenschap	In de discussie is belang x overwegen; De resultaten ondersteunen de visie van partij/groep x.
	Waardegeladen keuzes noodzakelijk	Advies volgt noodzakelijk uit onderzoek; Verantwoordelijkheid wetenschap zich uit te spreken.
Broker	Wetenschap en beleid moeten samen onderzoeken wat wetenschap bij kan dragen aan beleid; waar de twee samen komen.	Samenwerking wetenschap-beleid; Wetenschap moet relevant zijn voor de maatschappij; Wetenschap moet bijdragen aan beleid.
	Verduidelijkt en verbreedt beschikbare opties	Om te verhelderen/verduidelijken; Een andere mogelijkheid; Een alternatieve optie; Een mogelijkheid is; Een vraag die we moeten stellen.
	Doet (verbredende) aanbevelingen	Wij bevelen aan/wij adviseren; Dat er ook naar x gekeken wordt, Dat x overwogen wordt.
	Overweegt belangen van beleidsmakers, belangengroepen en/of wetenschap.	In de discussie spelen belangen x,y,z een rol; De belangen van beleidsmakers, belangengroepen zijn x,y,z.
	Waardegeladen keuzes kunnen niet vermeden worden	Advies volgt soms noodzakelijk uit onderzoek.

Figure 0:2. Additional operationalization for round 2 (Koens, 2012, pp. 36, 37)

Attachment II. Interview guide

Since the interview will take place in Dutch, the interview questions have been constructed in Dutch.

<u>Introductie van het interview</u>   5 min

Ik ga u zo meteen een korte introductie voor het interview geven, maar eerst wil ik <u>u toestemming vragen</u> om het interview op te nemen. Het interview zal naar verwachting binnen een uur klaar zijn, en het staat in het kader van een veranderend maatschappelijk speelveld. Uit onderzoek uitgevoerd door medewerkers van het PBL (Kunseler, 2017)(Kunseler & Verwoerd, in productie) is gebleken dat het PBL vanuit de samenleving te maken heeft met vraag naar een andere manier van kennisproductie voor beleid. *Zo is er het verzoek vanuit EZ en de provincies voor een lerende evaluatie van het Natuurpact en werken we in EU-verband aan stedelijke nature-based solutions vgl. een transdisciplinaire aanpak in nauwe samenwerking met Gemeente Utrecht en maatschappelijke partners.* Binnen deze vraag naar een andere vorm van kennisproductie bevindt het PBL zich in een spanningsveld tussen enerzijds traditionele manieren van kennisproductie, en anderzijds een meer interactieve manier van kennisproductie waarbij meerdere stakeholders betrokken zijn. Op basis van deze resultaten is de vraag ontstaan hoe andere publieke kennisorganisaties in Nederland de vraag naar een andere manier van kennisproductie ervaren, en hoe zij hier mee om gaan. Als onderdeel van mijn MSc scriptie en ter voorbereiding van een seminar die het PBL in april 2018 beoogt te organiseren, ben ik hier om u hierover enkele vragen te stellen.

De vragen zullen zich richt op 1) <u>innovatie</u>, dat wil zeggen: hoe de organisatie omgaat met veranderende eisen uit het speelveld waarbij innovatie van methoden passend is, 2) <u>implicaties</u>, dat wil zeggen: welke implicaties dit heeft voor de werkwijze en de methoden die de organisatie hanteert en 3) <u>randvoorwaarden</u>, dat wil zeggen: welke omstandigheden maken dat innovatie in werkwijze en methoden wel of niet plaats kan vinden. Over elk onderwerp wil ik u een aantal vragen stellen. U krijgt aan het eind van elk onderwerp ook de ruimte om vrije input te geven.

<u>Interviewvragen per onderwerp</u>

Wat is uw functie en hoe lang bent u hier al werkzaam?

Innovatie (hoe gaat de organisatie om met veranderende eisen)   15 min

- Waar denkt u aan bij innovatie?
- Wat zijn belangrijke kernwaarden voor uw organisatie?
- Kunt u hiervan een paar noemen en illustreren?
- Heeft uw organisatie te maken met veranderingen in de omgeving die deze kernwaarden raken?
- Zo ja, hoe gaat u daar mee om in aanpassing van type methoden en producten? (Geef ruimte voor voorbeelden/ervaringen)
- Wat is het spectrum aan werkzaamheden en hoe krijgt innovatie daarin plek? Bij welke van deze werkzaamheden bent u bij betrokken en heeft u met innovatie te maken gehad?

Voorbeeld van type werkzaamheden PBL: Beleidsstudies (evaluaties, verkenningen) en kennisbeheer zoals modelontwikkeling, datamanagement. In beleidsstudies vindt innovatie on the spot plaats – in nauwe afstemming met opdrachtgevers en academische partners. Bijv. rondom evaluatiemethode (meer lerend, participatief) of producten (infographics, interactieve websites e.d.). Rondom kennisbeheer vindt innovatie plaats ten bate van up-to-date blijven, bijv. rondom big data, serious gaming, visualisaties. Vaak in nauw samenspel met beleidsstudies omdat daar de toepassings 'behoeften'/ urgentie zit.

- Welke daarvan hebben een interactief en/of participatief karakter? Of meer interdisciplinair?

- Iedere stakeholder participeert vanuit zijn eigen perspectief, belangen en positie. Hoe geef je dit vorm tijdens de samenwerking?
- Welke instrumenten zetten jullie in om innovatie te bewerkstelligen?

Voorbeeld van instrumenten: Visievorming, kennisuitwisselingsactiviteiten intern (CoP's) en met externen (lezingen e.d.), trainingen ten bate van ontwikkeling/vaardigheden medewerkers, experimenten met nieuwe werkwijzen (bijv. rondom serious gaming biJ PBL), inhuur van academische partners etc.

- Hoeveel capaciteit is er voor innovatie?
- Heeft u binnen de innoverende methoden ook meer interactie heeft met stakeholders?
- Op wat voor manier zou jullie organisatie de maatschappelijk impact van kennis die jullie produceren nog meer kunnen verhogen?

Implicaties (strategieën voor het integreren van innovatieve methoden en werkwijze) 15 min
- Wie heeft er binnen jullie organisatie echt te maken met de implicaties van innovatie?
- Wat merkt u van de gevolgen van deze innovaties?
- Wat betekent dat voor uw organisatie en voor de manier waarop jullie te werk gaan?

Voorbeeld van implicaties van innovatie voor PBL: cultuur van 'fouten maken mag' moet ontwikkeld worden, want innovatie vraagt om experimenteren en kan dus ook fout gaan. Veel aandacht voor kennisuitwisseling tussen innovatieve sporen nodig omdat het een zoekproces. Daarnaast belang van monitoren: leidt innovatie echt tot leren/nieuwe inzichten onder medewerkers en gaan zij hun routines veranderen (bijv. wordt het nu meer gangbaar om procesontwerp te maken voor interactie met stakeholders?)

- Wat voor gevolgen hebben deze veranderingen voor de rol die jullie organisatie kan en wil spelen?

  Voorbeeld van gevolgen bij PBL: Opdrachtgevers moeten wennen aan nieuwe type producten (infographics) en intensievere betrokkenheid (bijv. bij lerende evaluatie); stakeholders en nieuwe partijen leren PBL kennen dus PBL komt meer in the picture buiten beleidskringen om. Intern moeten medewerkers wennen aan nieuwe werkwijzen en producten, bijv. opener over aannames zijn en tussentijdse bevindingen naar buiten durven brengen. En ook: workshops organiseren en daarin veel meer de deelnemers de koers laten bepalen (dus niet PBL presenteert + discussie, maar stakeholder presenteert + PBL reflecteert bijv).

- En hoe zit dat met objectiviteit en onafhankelijkheid?

  Voorbeeld PBL: er is veel discussie interne over hoe onafhankelijk en objectief te blijven in bijv. lerende evaluatie. Vraagt om gelijke afstand tot alle betrokkenen. Er is dan ook veel meer reflectie op welke rollen/activiteiten nodig zijn in bepaalde onderzoeksfases en hoe je dat goed afstemt met de opdrachtgevers/ stakeholders.

- Welke rol had jullie organisatie eerst in de productie van kennis?

Voorbeeld van rol PBL: we staan bekend als rekenmeesters en rekenen dus beleidsplannen door. Daar zijn we goed in en hebben we de instrumenten (modellen e.d.) voor in huis. We zijn ook goed in scenario-ontwerp (verkenningen), veelal technisch ingestoken.

- Hoe is deze rol nu verandert?

Voorbeeld PBL: Nog steeds wel deze rollen, maar dan nu ook veel meer aandacht voor governance-context. Dus, ook de maatschappelijke vraag achter de beleidsplannen in beeld brengen en inzicht geven in de actorenconstellatie die daarbij betrokken is en hoe zij er tegen aan kijken (bijv. discoursanalyse). Dus veel meer dan technisch verhaal. Ook het bestuurlijke en sociale verhaal krijgt nu een plek in onze analyses. En om die verhalen goed in beeld te brengen en met elkaar te verbinden heb je input van stakeholders nodig, dus dan wordt het vanzelf interactief op sommige punten in het onderzoek.

- Kunnen jullie de vraag naar een andere manier van kennisproductie rijmen met de traditionele rol die grensorganisaties eerst hadden, als bruggenbouwer tussen kennis en beleid?

Voorbeeld PBL: Ja! Maar we moeten wel heel scherp reflecteren op welke rol relevant is in bepaalde setting. En ook meer durven te werken als kennismakelaar.

- Hoe gaan jullie om met spanningen en trends die door deze veranderingen naar voren komen?
- We willen de bevindingen van dit onderzoek bespreken bij een seminar, met het idee dat publieke kennisorganisaties door uitwisseling van elkaar kunnen leren. Bent u hierin geïnteresseerd en wat maakt het voor u waardevol om hierbij aanwezig te zijn? Wat zou u tijdens deze seminar graag doen/horen?

Randvoorwaarden (organisationele inbedding, individuele eigenschappen, context, project) 15 min
- Hoe haalbaar is het voor jullie organisatie om aan de veranderende vraag voor kennisproductie tegemoet te komen?
- Waaraan merk je dat dit lastig is of juist makkelijk gaat?
- Op welke wijze proberen jullie deze belemmeringen uit de weg te ruimen?
- Onder welke omstandigheden is (intensieve) interactie met stakeholders mogelijk of juist niet mogelijk gebleken en waar ligt dat aan?
- Kunt u dat met voorbeelden illustreren?
- Welke randvoorwaarden zijn er om aan de vraag naar een andere manier van kennisproductie tegemoet te kunnen komen?

<u>Afronding</u> 5 min
We zijn nu aan het eind gekomen van dit interview. Heeft u nog suggesties voor mensen binnen uw organisatie die mij over de onderdelen uit dit interview nog belangrijke informatie kunnen geven?

Ik stuur u binnen een paar werkdagen een samenvatting van dit gesprek, zodat u kunt nagaan of ik u goed begrepen heb. Indien ik in de resultatenfase van het rapport gebruik wil maken van quotes uit dit gesprek, leg ik dat ook aan u voor. U wordt in het gehele rapport alleen met functie beschreven, verder blijft het anoniem.

Heeft u nog toevoegingen of vragen over dit gesprek of de vervolgstappen die ik neem?

Attachment III. List of codes for data-analysis

The different colors indicate that the codes belong to one category.

Table 0:1. Codes used in round 1, 2 and 3

Code
AH ATTITUDE OF HUMILITY
AH bewustzijn van eigen normatieve en epistemologische aannames
AH erkenning complexiteit en onzekerheden
AH gezamenlijk leren
AH iteratief werken
AH leren van elkaar
AH meerdere zienswijzen vormen totaalplaatje
AH openheid over onzekerheden
AH samenwerking met andere partijen
AH wetenschap niet alleswetend
AH zelfreflectie
Autoriteit wetenschap
B bijdrage w.o. aan beleid
B BROKER
B doet verbredende aanbevelingen
B overweegt belangen beleidsmakers, belangengroepen en wetenschap
B verduidelijking en verbreding beschikbare opties
B waardegeladen keuzes onvermijdelijk
Beïnvloeding in inter/transdisciplinaire processen
BG BRIDGING THE GAP
BG connectie tussen verschillende werelden
BG grensorganisaties informeren beleid
BG scheiding beleid en wetenschap vergroot onafhankelijkheid
BG toepassen kennis vindt ergens anders plaats
BG waarheidsvinding t.b.v. beleid
BG wetenschap informeert beleid
Big data
Citizen science
Communicatie
Consequenties interdisciplinair werken
Consequenties transdisciplinair werken
Decentralisatie overheden
Dienstjaren
Ervaringen trans/interdisciplinair werken
Functie
IA doet (versmallende) aanbevelingen
IA ISSUE ADVOCATE
IA verdedigt belangen beleidsmakers, belangengroepen en/of wetenschap
IA waardegeladen keuzes mogelijk
IA wetenschap bepaalt standaard van beleid
Innovatie
Institutionele condities
Interne discussie over veranderingen
Iteratief staat tegenover gestructureerd en veilig
KB co-creatie van kennis

KB continue verkennen en definiëren grenzen
KB deelname aan het proces
KB flexibele rollen
KB input verschillende partijen vormt karakter grenswerk
KB iteratief en non-lineair proces
KB KNOWLEDGE BROKERAGE
KB rekenschap houden met verschillende zienswijzen en waarden
Lokalere partijen
Meer ad-hoc werkzaamheden
Microdata
modernist logic
Motivatie medewerkers
Nieuwe methode
NO besluitvorming op basis van waarheidsvinding
NO disciplinaire kwaliteitsnormen
NO kennisproductie en gebruik gescheiden
NO NORM OF OBJECTIVITY
NO objectief door autonomie wetenschap
NO objectief door neutrale basis wetenschap
NO objectiviteit verhoogd kwaliteit van kennis
NO onafhankelijke en losgekoppelde kennisproductie
NO procedures voor betrouwbaarheid
NO strategieën voor verhoging legitimiteit
NO ten dienste van beleidsmakers
NO wetenschappelijke retoriek
Omgaan met risico's
Open data
OPG bedrijven
OPG decentrale overheden
OPG Europese unie
OPG financiële instellingen
OPG OPDRACHTGEVERS
OPG overheidsdepartementen
OPG politieke partijen
PE navigatie tussen creatie en gebruik kennis
PE PARTICIPATORY EXPERT
PE samenwerking met kennisgebruikers en stakeholders
PE sociaal leerproces
PE vage grens creatie en gebruik kennis
Randvoorwaarde interdisciplinair werken
Randvoorwaarde transdisciplinair werken
Randvoorwaarden innovatie
Reactie op afname autoriteit wetenschap
Reflectief en lerend evalueren is minder wetenschappelijk
Reflexieve logica ingekapseld?
Reflexive logic
SA beantwoordt vragen beleidsmakers
SA erkent geen waardegeladen keuzes
SA interactie wetenschap en beleid onvermijdelijk
SA SCIENCE ARBITER

SA Uiteenlopende functies voor wetenschap en beleid
Samenwerking andere instituten
SP al dan niet erkennen waardegeladen keuzes
SP onafhankelijkheid in iteratief/participatief project
SP SPANNING
Spanning samenwerking andere instituten
SRK acceptatie door alle partijen
SRK adviserende rol
SRK focus op kwaliteit proces
SRK integratie van kennis en perspectieven
SRK interactieve vormen van kennisproductie
SRK mode-2 wetenschap, transdisciplinair werken, post-normale wetenschap
SRK publieke besluitvorming
SRK SOCIALLY ROBUST KNOWLEDGE
SRK uitwisseling van informatie en argumenten
SRK verschillende vormen van kennis
SRK wetenschappelijk adviesproces
Stakeholders
STP betrouwbaarheid
STP consistent
STP maatschappelijk relevant
STP neutraal
STP onbetwiste kennis
STP reductie geloofwaardigheid bij inmenging actoren
STP reproduceerbaarheid
STP SPEAKING TRUTH TO POWER
STP waarheidsvinding
STP wetenschappelijke standaarden
Strategie omgang met verandering
Taal
Takenpakket/rol wetenschap voor beleid
Teamsamenstelling disciplinair/interdisciplinair
Ten dienste van..
Transparantie
Verandering
Veranderingen in het speelveld
Voordelen disciplinair werken
Vraagstukken rondom big data
Vraagstukken rondom microdata
Wetenschappelijke methode

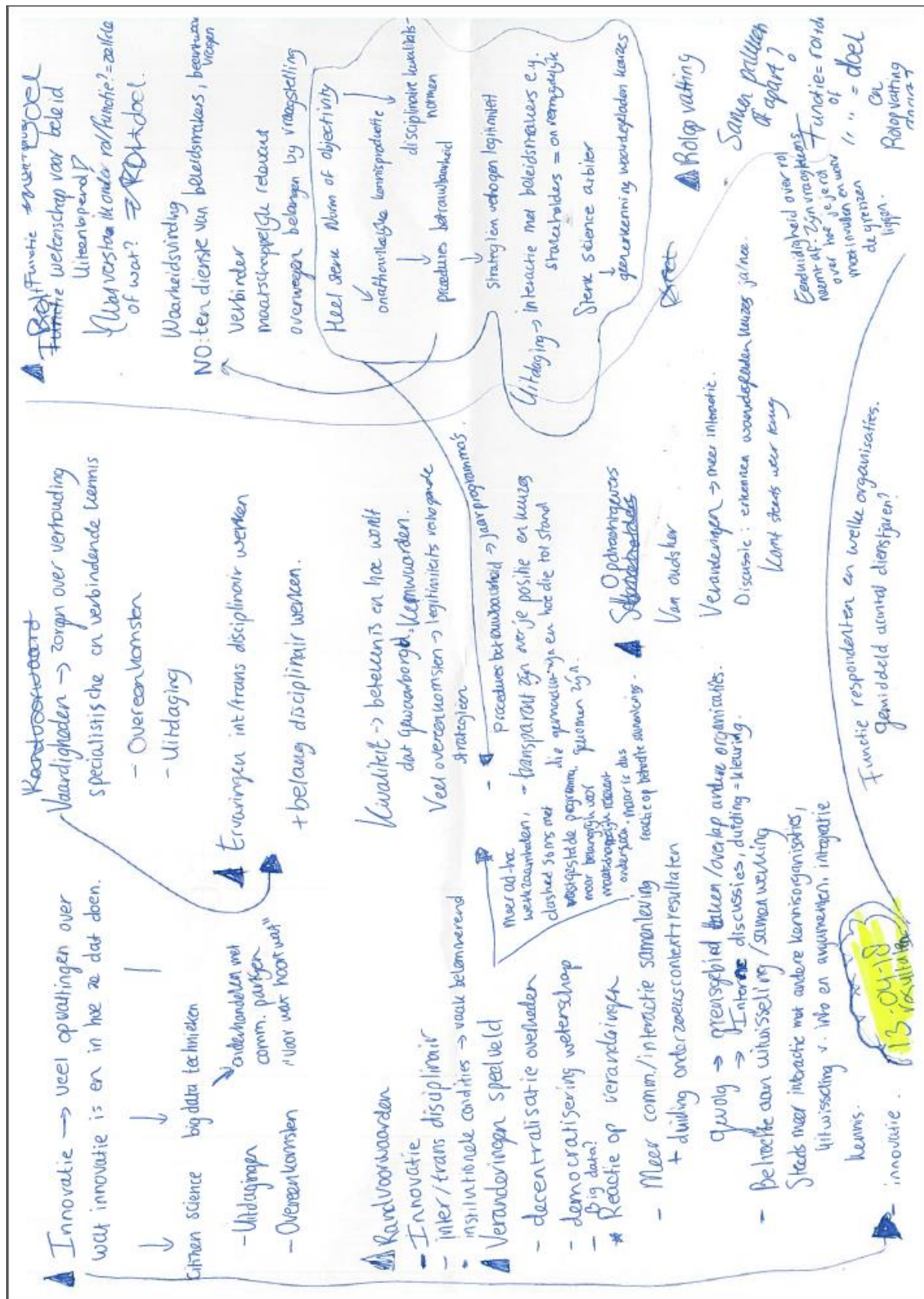# Attachment IV. Sketch result of phase 2 and 3 data-analysis process

Figure 0:3. Sketch of phase 2 and 3 data-analysis process

Attachment V. Work forms for meetings

Work form 1. Zooming in on the problem

In case the main focus of the interaction is to exchange information, one can make use of the work form 'Zooming in on the problem'. This work form is based on the work of Veendrick (1977).

'In one group, or in multiple groups, one person will share a situation with the rest of the group. After a short introduction by the introducer of the situation, the group will take turns in asking questions that will help to create clarity on the presented situation. After the questioning round, every member of the group will personally formulate his vision of the problem. These problem statements will then be presented to the introducer of the situation, who will then point out the statement closest to his own perspective. It is only until after the problem phase that an exchange of tips and suggestions can take place' (Dirkse-Hulscher & Talen, 2007, p. 45).

Due to the fact that the problem analysis and the problem solution are done in different phases, it becomes possible to analyze what the actual problem is. This again makes it possible to give and receive recommendations regarding the problem *(Dirkse-Hulscher & Talen, 2007)*. Through the use of this work form, it will become possible to identify similarities and/or differences between the problems that the RKIs, or practitioners in the RKIs, encounter.

Approach   *(Dirkse-Hulscher & Talen, 2007, p. 45)*

Step 1   Case selection
Ask the group to reflect on difficult situations that they have encountered in their work, which they would like to discuss with their colleagues. Choose a situation that will be discussed in this meeting.

Step 2   Introduction of the problem
Ask the owner of the selected situation to introduce the problem (around five minutes). The rest of the group should note down any questions that pop up during this short introduction.

Step 3   Question round
After the introduction, the rest of the group can ask questions in order to create clarity on the presented situation. Give everyone the possibility to ask their questions. In this phase, only one person is speaking at a time. If necessary, have additional questioning rounds.

Step 4   Summarize the problem
Ask the members of the group (minus the owner of the selected situation) to summarize the problem situation, and let them wright this down on a flip over.

Step 5   Highlighting the core
Give the marker to the owner of the selected situation and show the written down summaries. Let him/her highlight the words that are most familiar. Based on the highlighted words, the owner of the selected situation can choose regarding which topics he/she would like to receive feedback and suggestions.

Step 6   Feedback and suggestions
In this stage, the group can give feedback and suggestions to the owner of the selected situation. In this, they stick to the topics that were selected in step 5. Ask the group to connect their feedback and suggestions to real life experiences.

Step 7   Summary by the owner of the selected situation
The owner of the selected situation can now summarize the whole process, and what he/she has learned.

Work form 2. Past, present and future

When looking at topics that are to be prioritized by means of an innovation policy, the work form 'Past, present and future' can be used. This method uses three flip over sheets, where the left side represents the past, the middle represents the current and the right represents the future. Depending on the purpose of the meeting (for example, setting up an innovation policy), these sheets can be used to write down questions, goals, experiences or actions. *'By reflection on the past and the current situation, it is easier to define which direction you ambition for the future. By involving the whole team in this, a shared frame of reference can be created'* (Dirkse-Hulscher &

Approach   *(Dirkse-Hulscher & Talen, 2007, p. 203)*

Step 1   Preparation

Attach three flip over to a wall, and categorize them by writing down Past, Present and Future.

Step 2   Past

Let the participants consider which tasks or projects in the past year (other timeframes can be chosen) were a success, which were not, and which have never been finished. Let someone write this down on the flip over 'Past'.

Step 3   Present

Repeat the same, but then for the present situation. Write down the successes of the projects that are taking place in the present on the flip over 'Present', and let the participants think about difficulties they experience.

Step 4   Future

Let the participants discuss which tasks and projects are important in the near future, and therefore deserve special focus. Use the experiences from the past and the present to fuel the discussion. Discuss what the participants would like their organization to achieve in the future, and which actions are necessary to obtain those objectives. Write this down on the flip over 'Future'.

Step 5   To continue

Based on previous discussion, write down actions that should be taken to achieve the future objectives.

Talen, 2007, p. 203).

Work form 3. Different angles of approach

In enabling exchange of knowledge and experience with colleagues or external parties, the work form 'Different angles of approach' can be useful. In this work form, one participant presents a problem situation. All other participants will get a specific angle of approach assigned, from which perspectives they can give feedback and suggestions for dealing with the problem. Using the allocated angles of perspectives will help the participants to break free from their own frame of reference, and to look at the problem from a new perspective. *'Because all participants have to think about solutions from a different angle, you fully utilize the brainpower of the whole group. This will increase the variety of ideas'*(Dirkse-Hulscher & Talen, 2007, p. 157).

Approach   *(Dirkse-Hulscher & Talen, 2007, p. 157)*

Step 1   Introducing the problem

Shortly introduce the problem or the question for which you would like to receive feedback.

Step 2   Assigning the angles of approach

Ask the participants which actors are involved in the problem, which stakes are involved and what different perspectives they can identify. Write this down, and in consultation with the participants select which angles of approach will be used to look to the problem. Assign the angles of approach to the members of the group.

Step 3   Additional explanation

Because the participants now know from which angle of approach and which perspective they will have to look at the problem, it might be necessary to give additional explanation about the problem.

Step 4   Inventory of ideas

Ask the participants to consider the problem from the perspective that was assigned to them. Ask them for feedback or suggestions to deal with the problem, formulated from that specific angle of approach. In this, it is important that there is no right or wrong, good or bad. All ideas are inventoried. When there is time, after this the group can discuss the ideas.

Step 5   Selection

In this step, all the participants let go of their assigned angle of approach. All the ideas that were mentioned in step 4 will be evaluated and on the basis of this 'the best' approach(es) to deal with the problem can be selected.

Work form 4. Professional knowledge

In order to facilitate internal and external moments of intervision with regard to value-laden choices the RKIs can make use of the work form 'Professional knowledge'. One person should facilitate this work form, and divide the space in which the meeting takes place in two fields. *'The facilitator explains to the group that a couple of questions will be asked, on the basis of which every participants choses a position in one of the fields (these fields are categorized as true/untrue or agree/disagree, etc). The facilitator can choose to give a presentation, or directly start with the questions' (Dirkse-Hulscher & Talen, 2007, p. 69).*

This work form will help to move the participants from subconscious to conscious application of knowledge and values. In this way, it will be possible to discover the considerations that underlie the process of decision-making. *'It is not the answer that is of importance. The focus will lie on the reasoning that leads to the answer. Moreover, the method is an active form in which all participants simultaneously have to think about the knowledge field of discussion' (Dirkse-Hulscher & Talen, 2007, p. 69).*

Approach   *(Dirkse-Hulscher & Talen, 2007, p. 69)*

Step 0   Preparation assignment

To be able to facilitate a good discussion, the participants should read some literature to prepare themselves and learn about the topic that will be discussed. On the basis of this, they can already form an opinion. The facilitator should formulate questions that can be used to ask during the meeting.

Step 1   Introduction of the theme

Give the group an introduction of the theme and try to link this to the preparation assignment.

Step 2   Step up

Invite all the participants to take position in the middle of the two fields.

Step 3   Question round

Phrase a question, and point out the options that can be chosen (yes/no, agree/disagree, true/untrue, etc.) After a couple of moments, let the participants choose one of the options.

Step 4   Assign turns

Point out someone to explain their choice in every field. People in the other fields can ask additional questions for clarification.

Step 5   Watch

The point of this work form is to find out what reasoning's lead the participants to the different choice options, and to see whether there are different types of knowledge about the topic present in the group, and to exchange the reasoning's behind these knowledge types.