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BTO report

Research agenda setting: experiences in the water sector

KWR Watercycle Research Institute

BTO

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BTO *Managementsamenvatting*

Onderzoeksagendering vraagt om systematiek met flexibiliteit

Auteur(s) Laurens Hessels en Andrew Segrave

Onderzoeksagendering vraagt om een gezonde combinatie van systematiek en flexibiliteit. Dat blijkt uit een inventarisatie waarbij voor zes wateronderzoeksprogramma's is onderzocht hoe zij inhoudelijke prioriteiten afwegen. Het agenderen van onderzoek vormt een cruciale stap in het onderzoeksproces. Afhankelijk van de precieze doelen van het programma, vraagt het stellen van inhoudelijke prioriteiten om een systematische aanpak, die voldoende ruimte biedt om in te kunnen spelen op onverwachte kansen. Verder kan op grond van deze studie worden overwogen om voor het Verkennend Onderzoek van het BTO meer ruimte te bieden aan initiatieven van individuele onderzoekers, bijvoorbeeld door jaarlijks een substantieel deel van de begroting te reserveren voor *calls for proposals*.

Programma	**Cranfield Discretionary funding**	**CRCWSC Integrated projects**	**CREW**	**Eawag Discretionary funding from MT**	**CIRSEE**	**WaterRA**
Doel	Intellectuele ontwikkeling van beginnende onderzoekers	Samenwerking en integratie aanmoedigen en versterken Proefuin voor bedrijfsprojecten	Besluiten in het waterbeleid ondersteunen	Concepten en technologieën voor duurzaam watermanagement	De business van SUEZ ondersteunen met nieuwe technologieën	Oplossingen vinden voor problemen door samenwerking
Financieringsbron	Institutionele financiering (van de universiteit)	Bedrijfsleven en universiteiten	Vooral overheidssubsidie	Overheidssubsidie	SUEZ groep (100%)	Leden (en andere organisaties)
Initiatief	Voorstellen van startende onderzoekers	CRCWSC	Stakeholdergroepen die hun onderzoeksbehoeften articuleren	Groepsleiders	Onderzoekers of business units	Bedrijfsleven en onderzoeks-instellingen
Invloeden	Academische gemeenschap	Workshopserie die 'behoeften en kansen' opleverde	Actuele beleidsbehoeften en opkomende uitdagingen	Academische niche, inschatting toekomstige behoeften van de watersector	Markt en technologische ontwikkelingen	Practische kwesties en ontwikkelingen
Beslissing	Onderzoeksbestuur (ondersteund door Research and Innovation Office)	Bedrijven	Tender onder academische gemeenschap	Management team	Interne evaluatiecommissies	WaterRA management en bestuur
Hoofdcriteria	Relevantie voor de watersector Bijdrage aan loopbaan van beginnende onderzoeker	Behoeften en belangen van bedrijven Uitdagingen die samenwerking vereisen tussen disciplines en sectoren	Relevantie voor stakeholders	Academische kwaliteit Gebrek aan externe financierings-mogelijkheden	TRL Waarde-analyse Levensvatbaarheid	Industriële relevantie Kwaliteit van de wetenschappelijke aanpak

Vergelijking van onderzoeksagendering bij zes wateronderzoeksprogramma´s.

Belang: agendering BTO onderzoek

Inhoudelijke prioriteiten kiezen is een cruciale stap in het onderzoeksproces. Binnen het BTO bestaat jarenlange ervaring om onderzoek te agenderen. Toch zijn er nog vragen. Hoe bewaken we de balans tussen urgente kennisvragen en capaciteitsontwikkeling voor de langere termijn? Waar liggen de afwegingen om behoeften van individuele bedrijven te vervullen tegenover het collectief? En hoe komen we tot een systematische aanpak om verkennend onderzoek te prioriteren? De start van het nieuwe BTO (2018-2023) vormt een goede aanleiding om deze vragen te overwegen.

Aanpak: vergelijkende analyse van zes prominente wateronderzoeksorganisaties

In dit project is een korte literatuurstudie uitgevoerd naar de theorie en praktijk van onderzoeksagendering. Ook is een vergelijkende internationale analyse gemaakt van de onderzoeksprogramma´s van zes waterinstituten: Cranfield, CRC WSC, CREW, Eawag, CIRSEE en WaterRA. Elke casus bestond uit desk research en een (telefonisch) interview.

Resultaten: doelen, financiering, stakeholders en sleutelpersonen bepalen agendering

De watersector kent uiteenlopende praktijken van onderzoeksagendering, zo blijkt uit de inventarisatie in dit rapport. Sommige programma's zijn bijvoorbeeld systematisch georganiseerd, met specifieke commissies die duidelijke verantwoordelijkheden dragen. In andere gevallen bestaat meer ruimte voor verschillende soorten initiatieven en besluiten. Ook bestaat een verschil tussen programma's met een evenwichtige agenda en programma's die inspelen op onverwachte kansen. Deels komen de verschillen tussen programma's door hun uiteenlopende doelen, financieringsmodellen en behoeften van stakeholders. Daarnaast hebben ook visies en overtuigingen van sleutelpersonen in de onderzoeksorganisaties invloed.

Een intensieve en interactieve agenderingspraktijk draagt bij aan een relevante en haalbare onderzoeksagenda, zo blijkt uit de analyse. Daarnaast kunnen langjarige onderzoekslijnen ontstaan als gevolg van onverwachte ontwikkelingen en informele processen of door bewuste planning.

Implementatie: opties voor verfijning agenderingsprocessen

Voor effectieve onderzoeksagendering is een systematische aanpak nodig met flexibiliteit, zo komt uit deze inventarisatie naar voren. Voor het thematisch onderzoek lijkt op dit vlak sprake te zijn van een adequate organisatie. Om het creatieve potentieel van de organisatie en haar onderzoekers nog beter te benutten zou voor het Verkennend Onderzoek kunnen worden overwogen om meer ruimte te geven aan initiatieven van individuele onderzoekers. Een mogelijkheid daartoe is om jaarlijks een substantieel deel van de begroting te reserveren voor *calls for proposals*.

Rapport

Dit onderzoek is beschreven in rapport *Research agenda setting: experiences in the water sector* (BTO 2018.052).

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Contents

1 Introduction

KWR has run a collective research program for the water sector since 1972, which is known as the Bedrijfstak Onderzoek (BTO). Over the years, the BTO partners have gained a lot of practical experience with selecting research topics and choosing priorities. The research cycle of the BTO consists of three main steps (see figure 1.1):

- Collective demand articulation KWR and drinking water firms
- Execution by KWR researchers with supervision from industrial experts
- Application of research results by drinking water firms assisted by KWR researchers

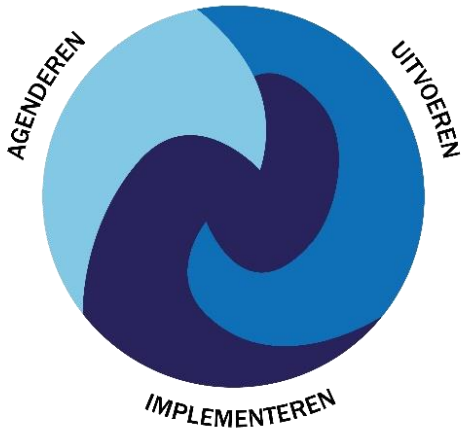

FIGURE 1.1: THE KNOWLEDGE CYCLE MODEL CURRENTLY USED FOR THE BTO (SINCE 2014)

This model of the BTO research cycle is based on theories and frameworks from the field of knowledge management and organizational learning. One of the basic assumptions of this literature is that to survive an organization must learn at a rate that is equal to or greater than the rate of environmental change (Garratt 1990). The basic purpose of knowledge management is to organize the knowledge cycle in such a way that (new) knowledge is available where and when it is most useful and valuable (Dalkir and Beaulieu 2017). Knowledge management models typically distinguish between various steps or phases, such as: Identify/Create; Store; Share; Use; Learn, and Improve (Evans et al. 2015).

In the late 1990's the Dutch water companies took the concept of Knowledge Management and applied it on the sectoral level in the BTO. One of the main functions of the BTO is to generate precompetitive knowledge and technologies for the water companies. The Knowledge and Program Management of the BTO organized their activities around a six-phase cycle, which included two steps for articulating the knowledge needs. Since the BTO is a joint research program, it was first necessary to determine the ambitions of and knowledge needs of the individual companies before defining the collective knowledge program based on overlapping knowledge needs. The six steps in the original knowledge cycle for the BTO were as follows: Define individual company ambitions; Define knowledge needs; Generate and absorb knowledge; Implement knowledge; Use knowledge, Evaluate (see figure 1.2).

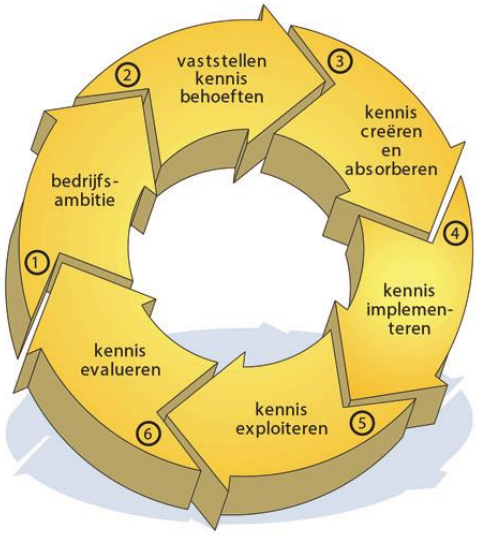

FIGURE 1.2: THE ORIGINAL KNOWLEDGE CYCLE MODEL USED FOR THE BTO 2001-2014

In 2014 this model was simplified into the three-phase model that is currently in use (figure 1.1). The new model emphasises the fact that the various steps do not necessarily follow each other sequentially and that some activities are undertaken in parallel. It also represents advancements in the field of knowledge management and the practice in the BTO, where processes like 'knowledge co-production' make distinctions between the steps of generating, implementing, and using knowledge much fuzzier than the earlier model suggests.

Around the turn of the century, while implementing the concept of Knowledge Management in the BTO, there was a good deal of emphasis placed on the first two steps in the knowledge cycle. In programming the research agenda, the companies recognised that producing new knowledge and technology would take time (years). To be properly prepared it would be necessary to identify emerging and future knowledge needs, in addition to the existing problems. The BTO was specifically charged with the task of identifying emerging opportunities and threats (the 'eyes and ears' function) and testing promising concepts and making them applicable in practice (the 'innovator' function). In their attempts to identify the social and technological trends that would shape the future of the sector, the Dutch water companies were also early adapters of the Scenario Planning methodology for anticipatory programming of research agendas (Koerselman et al. 2003).

Besides the 'eyes and ears' and the 'innovator' functions, the Dutch water companies have defined eight other specific goals, roles and characteristics for the development, continuation and application of knowledge in the BTO. Several of these characteristics (such as the mid-term focus) also provide important design criteria for managing this research program:

1. Eyes and ears: In the BTO, developments are signalled in society, science, technology and policy and regulations and evaluated regarding their significance for the Dutch water sector;
2. Knowledge generator: With the BTO KWR generates knowledge that supports the water companies in maintaining their license to operate, in operational excellence and in achieving their ambitions to design healthy, sustainable, progressive and efficient water systems for society;

3. Innovator: With the BTO, the water sector can test promising developments and make them applicable in practice;
4. Applied Science: BTO operates between science and practice and works on relevant and recognizable issues for the water sector. The developed knowledge and concepts are applied by the water companies and in the water sector;
5. Mid-term focus: By jointly programming the research agenda in the BTO, the knowledge development is less dependent of the current demands of an individual water company, which allows for a greater focus on medium-term developments;
6. Knowledge network: Through the broad national and international knowledge network, the best available knowledge is mobilized and strong joint ventures are generated in the (mainly European) water and knowledge sector that ensure the leading position and enable activities in a larger research context;
7. Leverage for co-financing: The knowledge network also creates possibilities for co-financing of the research and thus generates additional research resources.
8. Specialist: For some specialist knowledge and research facilities, centralizing activities in a collective research program is more efficient (synergies);
9. Compass: Joint knowledge development harmonises and strengthens the position of the water sector on social themes. Active participation in policy-relevant research helps to influence national and European laws and regulations. BTO provides a scientific basis for advocacy of the water sector in the Netherlands and Europe;
10. Knowledge platform: The BTO facilitates interaction between employees within the water sector on various knowledge themes.

In spite of the long history of the BTO program, the most recent evaluation shows that there is still room for improvement (BTO 2017.205(s)). Some issues around agenda-setting that deserve attention are:

1. Finding the right balance between addressing immediate knowledge needs and developing knowledge and building capacity for the longer term viability of the water sector
2. Serving the knowledge needs of individual companies and maintaining the overall thematic balance in the program
3. Prioritizing exploratory research topics in a systematic way, in order to make this component fulfil its mission of signalling scientific, technological and societal developments that go beyond the different BTO themes and/or can lead to new research themes.
4. How to find balance between interests of different companies, and at the same time establish sufficient commitment of individual firms to facilitate implementation?
5. How to formulate projects in the tailored research that address actual research questions, and go beyond implementation projects

In 2018, KWR has started a new BTO program, together with ten drinking water companies from The Netherlands and Belgium. This forms a good occasion to reflect on the agenda-setting processes in the program. For the new BTO period (2018-2021), the research program has been divided into five components. Each component emphasises several of the ten goals, roles and characteristics of the BTO. The intention is to realize all of the goals on the program level as a net product of these specific components:

1. Thematic Research Drinking Water. The Thematic Drinking Water part of the BTO includes the research themes that the water companies have identified as of collective interest. The research themes are characterized by the following criteria:
    a. Cutting edge

   b. Of collective interest for the drinking water sector
   c. Knowledge for shorter and longer term
2. Thematic Research Water in the Circular Economy: the drinking water sector has the ambition to play a role in the transition to a circular economy in a water cycle wide approach. Driving forces for this transition are dealing sustainably regarding raw materials (the Netherlands Circular 2050), making the energy demand more sustainable (the Netherlands' CO2-neutral in 2050) and improving water quality (Water Framework Directive). To be able to adequately respond to new developments and initiatives for cooperation, a more flexible way of managing and programming has been chosen for WiCE. The thematic focus and programming of the WiCE research agenda is thus determined by a core team who have been mandated by the Coordinated Consultation Committee that represents the water companies.
3. Tailored research: this research is intended to deal with questions arising in the business practice of individual water companies, and with added value for the collective/sector. For example, a smaller number of individual companies may finance research that expands on a theme that is of specific interest to them to accelerate the development and implementation of specific research subjects or technologies.
4. Exploratory Research: In the Exploratory part of the BTO, KWR systematically identifies (new) scientific, technological and social developments above and beyond the existing research themes in the BTO. One aim of this research is to define new research themes.
5. Policy-supporting Research: Technical-scientific subjects that play a role in the water agenda in The Hague or Brussels are substantiated by policy-relevant research for Vewin, the organisation of Dutch drinking water companies in the Netherlands. In this way, the Policy-supporting Research fulfils he BTO 'compass' role.

These five components of the BTO aim to address the ten goals, roles and characteristics of knowledge in the BTO as shown in Table 1.1. The program has developed different practices and procedures for agenda-setting in the various components of BTO in relation to their specific goals.

In this project we have made an inventory of agenda-setting practices in a number of water research organizations around the world. We will use this inventory to explore the relationships between agenda-setting practices and the nature of research that emerges from these practices. The insights gained can serve as input for discussions about possible improvements in the agenda-setting of the BTO. On a more abstract level the insights can also assist the coordinators of other water research programs, such as the dune water companies' program 'DPWE' and the *Kennisimpuls Waterkwaliteit* (in preparation).

Goals, roles and characteristics	Thematic Research Drinking Water	Thematic Research Water in the Circular Economy	Tailored research	Exploratory Research	Policy-supporting Research
1. Eyes and ears	*	*		**	
2. Knowledge generator	**	**	*	*	*
3. Innovator	*	*		**	
4. Applied Science	*	*	**		
5. Mid-term focus	*	*		**	
6. Knowledge network	**	*			*
7. Leverage for co-financing	*	**		*	
8. Specialist	**	*	*	*	
9. Compass	*	*			**
10 Knowledge platform	**	*			

Table 1.1: Intended coverage of goals, roles and characteristics by the six BTO components (**= main means; * = contributing means)

2 Concepts and definitions

2.1 Conceptualizing research agenda setting

Research agenda setting is essentially a choice problem: given a limited amount of resources available, how to define these over different programs and projects? In the strategies for addressing this problem, one can distinguish between the economist's view, according to which science basically deserves support because it generates industrial growth and a scientists view, representing technology 'as a kind of scientific roulette in which those who plunge deepest tend to win the biggest prize' (Toulmin 1964) (p. 348). In any case, research agenda setting includes the chalk-and-cheese problem: different activities categorized as science are in fact a multitude of incommensurable activities. This implies that agenda-setting can impossibly be a technical choice only, it also includes a political dimension, in the sense that decisions are also influenced by interests and preferences.

From an economic perspective, priority setting of R&D can be considered as a process of supply and demand of public goods (Dalrymple 2006). Supply then refers to the research output and demand to the interests of knowledge users. Agenda setting then boils down to finding an optimal match between supply and demand.

From a political science perspective, agenda setting can be seen as a principal-agent problem (Guston 2000; Dalrymple 2006). Given the asymmetry of information between research performers and research governors, it is difficult for the research governors to make rational decisions. The patrons, often ignorant about the content of research, have to make sure they can get their money's worth "while "the performers have to demonstrate the sufficiency of their performance" (Guston, p. 4).

A possible approach to overcome the principal-agent problem is to look at the research portfolio. Wallace and Rafols define a research portfolio as the 'ensemble or subset of research activities supported by a funding agency, a large research performing organization or a given subset of agencies/organisations' (Wallace and Rafols 2015). It is a heuristic and analytical tool for an organisation to contrast its missions against its de facto priority setting as illuminated by the portfolio analysis, i.e the areas in which it is putting effort, investments or achieving some outcomes.

Stewart has introduced a typology of priority setting based on systems-theory (Stewart 1995), based on three dimensions: who chooses, level of decision-making, and incentives to choosers. In this project we adapt this model to make a systematic characterization of agenda-setting processes, in terms of four aspects:

1. Who chooses?
2. Level of this decision (centralized or decentralized)
3. Who takes the initiative for new research topics?
4. Criteria (what considerations play in the selection and prioritization

Regarding the first aspect (who chooses) there are various characteristics of the individual and/or the group that influence how the choice problem of agenda-setting is solved. On the level of cultures there are various traits, such as uncertainty avoidance and long-term

orientation (Hofstede 1984), that influence people's priorities. The time perspective of the agenda-setters is one example that has been explored in more depth for the Dutch water sector in and the BTO (Segrave et al. 2014). The decisions and actions made by managers and practical workers are based on motivational objects (perceived threats/opportunities) on a less distant time horizon (not as far into the future) and more certain (likelihood of occurring) than that of scientists (see figure 2.1).

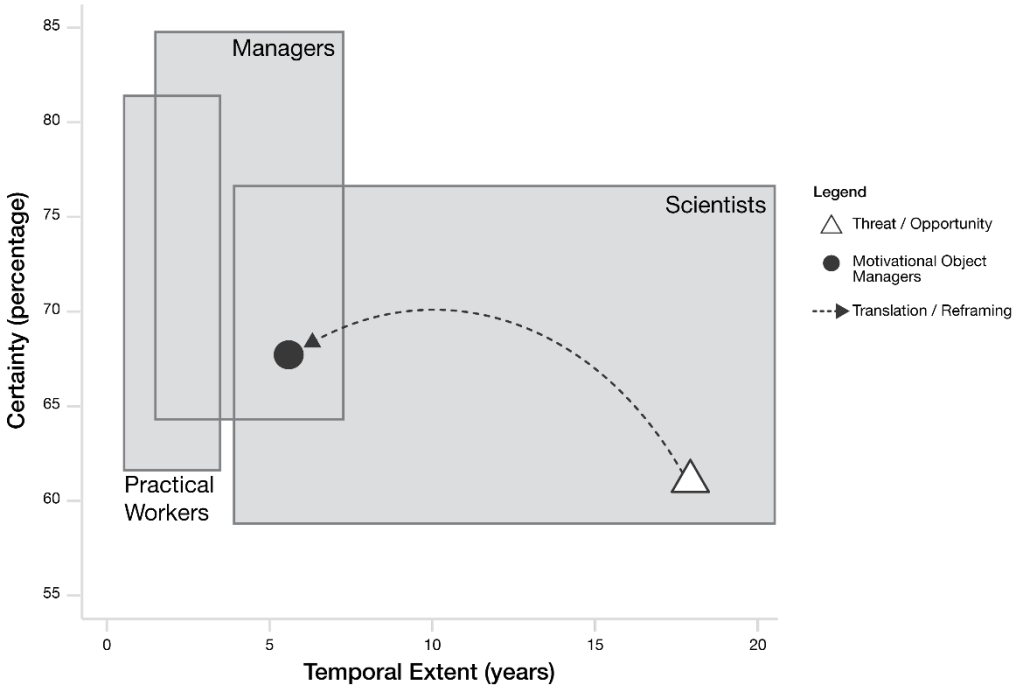

FIGURE 2.1: SIMPLIFIED MAP OF AMBIGUITY IN MOTIVATIONAL SPACE ACROSS PROFESSIONAL ROLES IN THE WATER SECTOR WORLDWIDE. THE SPACE IS DEFINED BY THE INTERQUARTILE RANGE OF THE VARIABLES TEMPORAL EXTENT (YEARS) AND CERTAINTY (PERCENTAGE) 25% TRIMMED.

A research agenda can be adapted to accommodate the diversity in Motivational Space of the people in a transdisciplinary team or the team of agenda setters can be chosen to program research of a certain type. Both alternatives explicitly attend to the Motivational Space of those involved. The former option might be favoured over the latter in Europe at present due to democratization of scientific knowledge and the demand for practical innovations. Research funding is increasingly directed at developing market-ready technological tools in collaborative projects between universities, government, and industry partners. To avoid that all research will accommodate the Motivational Space of all professional roles, which is likely to limit the problems to those with a time horizon of up to 4 years, one can allocate a portion of the research funding to research on different temporal scales.

2.2 Practices of agenda-setting

The literature on science and innovation policies reports a large variety of agenda-setting practices.

A traditional approach to agenda-setting in academic research is to use a research council as an intermediary organization representing the scientists, that can mediate between the policy context and political arena on the one hand, and the scientific performers on the other

hand. In this way, a research council can help to overcome the delegation problems predicted by principal-agent theory (van der Meulen 2003). Traditionally, research councils provide ample space for bottom-up initiatives, as they mainly employ scientific peers to prioritize proposals, and use academic criteria such as novelty and scientific relevance. Over the past few decades, however, research councils have also become involved in other types of research programs, sometimes co-funded by industry or other stakeholders, in which the agenda-setting also includes a wider range of interests and participants (Slipsaeter et al. 2007).

In applied research, intermediary organizations can also help to mobilize knowledge users, and to articulate their knowledge needs. For example, the Ministry of Agriculture has delegated the authority over research funding to network organizations such as Bioconnect (Klerkx and Leeuwis 2008). This organization controls the agenda-setting process of projects paid with farmer levy funding. Product working groups (PWG) represent both research users and researchers, organized according to different agricultural sub-sectors. Within themes established by the government with earmarked budget, each PWG can decide which particular topics to be researched.

In the medical sector, there are also positive experiences with involving stakeholders (patients in particular) in the agenda-setting process, for example by consultation workshops (Caron-Flinterman et al. 2006; Elberse et al. 2012).

Transdisciplinary research programs, including contributions from academic researchers, applied researchers and knowledge users, use different combinations of academic agenda-setting and stakeholder consultation. A comparative analysis has shown that participation of knowledge users in the agenda-setting process is associated with strong involvement during the research execution phase (Hessels et al. 2014).

Participation of stakeholders and citizens can also be organized on a larger scale, as has been done in the National Science Agenda (de Graaf et al. 2017). This agenda-setting process started with a public call for input, to which any interested individual or organization could respond with suggesting a question that deserved to be researched. Next steps in this process included a series of three large stakeholder conferences, selection and prioritization by scientific experts, and the formation of coalitions to further develop a limited number of priority themes (so-called Routes).

In order to help research programs prepare for future developments, one can use foresight in research programming. Foresight exercises can help for selecting priorities for research investments, but also on a more strategic level, to inform innovation policy and strategies, (Georghiou and Harper 2011). Foresight can also help to alleviate coordination challenges in transnational research programming (Könnölä and Haegeman 2012).

2.3 Agenda setting in the BTO

The BTO has been given a mid-term focus, in order to make the knowledge development address strategic knowledge demands of the water sector. This is generally considered one of the benefits of a joint research agenda. This ambitions has also been translated into design criteria via the ‘eyes and ears’ and the ‘innovator’ roles. The researchers scan for emerging opportunities and threats beyond the 4-year time horizon and translate these back into applied science in the present. Agenda-setting for the BTO Exploratory Research is primarily in the hands of the scientists, to match the longer-term, innovative focus of this component. In contrast, the Thematic Research is programmed in close cooperation with representatives from the water companies so as to emphasise the need for generating

knowledge that supports the water companies in maintaining their license to operate, in operational excellence and in achieving their ambitions to design healthy, sustainable, progressive and efficient water systems for society.

In addition to the motivation space of the agenda setters, there is a historical bias towards expert, technical knowledge in the Dutch water sector. Since the late 1970s there has been growing awareness and understanding of problems associated with various socio-political aspects of water management. Up until that point, the dominant mode of water management was the 'command and control' approach, which is centred around technological solutions and regulations. The main criticism of the technocratic and technocentric tendencies in the water sector has been that the decision making is exclusive, with a technocratic, top-down management style side-lining various stakeholders and omitting certain knowledge types (such as local, experiential knowledge). Socio-political solutions were often underdeveloped and neglected in favour of technological solutions.

In the face of complex problems, such as climate change and rapid urban development, new water management approaches are needed in order to overcome the shortcomings of the 'command and control' approach. The theoretical ideal that was developed for the technocratic and technocentric shortcomings is 'participatory' water management (Von Korff et al. 2012). Transdisciplinary research and knowledge co-production are also meant to deal with these issues to some degree (Lang et al. 2012; Brouwer et al. 2018). A more participatory approach, including new Citizen Science initiatives, as also part of the solution to this issue. In connection to these developments, the BTO has also provided an increasing space for social scientific research, in areas such as future studies, governance and knowledge management. One of the central themes chosen for the BTO 2018-2022 is called 'Client', and will address questions about the relationships between water companies and their clients, in a changing societal context.

To design a fitting approach to agenda-setting, the ten goals, roles and characteristics of the BTO can serve as design criteria. Details about the current agenda-setting process of the BTO can be found in the 'Protocol Gezamenlijk Drinkwateronderzoek 2018-2023' (BTO 2017.206(s)). The current management and agenda-setting of the BTO takes place at three levels, each with their own role:

1. Strategic level: Directors' Committee (DO)
2. Tactical level: Coordinating Committee (for the Drinking Water themes) and Core Team WiCE (for Thematic Research WiCE)
3. Operational level: Theme Groups

Theme groups are responsible for the operational coordination of the thematic research projects. Together with KWR-researchers they define the research questions, develop them into projects, they conduct and supervise the research, they take care of the reporting, transfer and publication of research results and the evaluation of their research theme.

Research in the Exploratory Research is programmed by KWR. KWR annually accounts ex-post for this part of the program towards the drinking water companies.

The Tailored Research component, in contrast, is steered by knowledge demands from individual water companies. They are encouraged to coordinate their projects among each other in the theme groups to identify possible synergies and collaboration. The final decision about funding allocation is made by the coordinating committee.

The Program Management team of KWR is responsible for preparing the meetings of the Directors' Committee and the Coordinating Committee and for explaining and substantiating the agenda. The Chief Science Officer of KWR and the BTO program manager thus play a central role in the agenda-setting, both formally (front-stage) and informally (back stage). Their roles involve facilitating and mediating communication in both directions between the BTO participants and the researchers. They are supported by 14 coordinators of the various themes and platforms of the program. Research ideas can be informally and/or formally advocated and supported or opposed and rejected. The varying degree to which research ideas are explained and defended can solicit more or less support for a research idea, and thus influence the agenda-setting. Personal factors, such as the educational background of the agenda setting individuals, also play a role. Agenda setters are more likely to support research ideas that they understand in fields of work that they have an affinity with.

3 Analytical approach

3.1 Overview of cases

For this study we have selected six water research programs around the world, that together represent a reasonable variation in terms of organizational setup and strategic orientation towards industrial versus academic goals. For each case we have explored the available information on the web and conducted a (telephone) interview with a key representative, with responsibility over or detailed information about the agenda-setting process (see table 3.1).

TABLE 3.1. OVERVIEW OF THE INTERVIEWS

	Research organization	Country	Organization	Contact person	Position
1	Cranfield Water Science Institute	UK	University of applied science	Paul Jeffrey	director
2	CRC for water sensitive cities	Australia	Public-private partnership	Jurg Keller	Chief research officer
3	CREW	Scotland	Public partnership	Bob Ferrier	director
4	Eawag	Switzerland	Academic institute	Bernhard Truffer	Head of Department Environmental Social Sciences
5	CIRSEE (Suez R&D)	France	Private industry	Zdravka Do Quang	Head of Analytical Solutions Division
6	Water Research Australia	Australia	Not-for-profit company	Karen Rouse	CEO

3.2 Analytical framework

For each program, we will report the mission of the responsible research organization and its overall funding model. We will provide detailed information about the program under study, in terms of:

- Topic/name/background info of the program
- Mission / goal of program
- Target group of program (knowledge users)
- Funding sources
- Procedure
  - Who takes initiative
  - What factors or triggers influence these initiators
  - Who decides about priorities
  - What are the decisive criteria
- Assessment in relation to mission

Note that in some cases (such as CREW and WaterRA) the program under study more or less coincides with the research organization that is responsible for it, since its sole purpose is to fund the particular program.

4 Results

4.1 Cranfield Water Science Institute

This institute is located at Cranfield University (UK). It has an applied orientation. The respondent primarily defines the mission in terms of excellence, which suggests an academic orientation, but he operationalizes this term in a rather practical way: 'Our research clients want to see excellence in terms of credibility of the research, about quality of interaction with clients, speed of turnaround (effective communication), being a good partner (mentioning clients in marketing and promotion etc.), giving value in terms of their science missions from working with us.'

Most of the research is externally funded. A rough estimation of the funding sources:

- Research councils (40%)
- Industry: water utilities, consultancies, equipment manufacturers (25%)
- Private foundations (20%)
- Horizon 2020 (10%)
- University funding in the form of donation funds and discretionary spends (5%)

In most of the cases ('80%+'), new projects are initiated in response to a call for proposals or to a client with a problem. The project portfolio of the institute simply results from the aggregation of individual projects, the institute management hardly does any strategic steering towards particular research areas or types of project. There is a regular meeting with senior staff to discuss current projects and the project ´pipeline´, but the only way to really influence this is by encouraging or discouraging staff to make particular project applications and bids. The director prefers to rely on the initiatives of the individual researchers in the institute, since this helps to guarantee a match between the projects and the interests and competences of available staff.

In spite of the limited strategic planning, there are emerging research lines of multiple years. Water utilities also fund PhD projects, and the institute sometimes attracts several sequential projects on a similar topic. The director does recognize longer threads of research, that have not been planned, but which can be identified with hindsight.

The funding source that offers the strongest possibilities to intervene in the agenda-setting is the discretionary funding of the institute management (see table 4.1). The institute uses this money to support early-career academics in their intellectual development. They are expected to leverage this funding with money from industry. The initiative for these projects lies with the researchers who spot a particular opportunity, influenced or inspired by their academic peers. The criteria for allocating this funding are whether it can help to support an individual career and the practical relevance for the water sector, either on the short or on the longer term.

TABLE 4.1. CHARACTERIZATION OF DISCRETIONARY FUNDING AT CRANFIELD WATER

Program	**Discretionary funding**
Goal	Intellectual development of early career scholars
Disciplinary focus	Water science, water engineering and water

	management
Funding source	Institutional funding (from university)
Initiative	Proposals from early career scholars
Influences	Academic community
Decision	Research board (supported by Research and Innovation Office)
Main criteria	Relevance for water sector Contribution to career of early career scholar

This people-centred approach has helped Cranfield Water to grow its competences in an appropriate way.

4.2 CRC for Water Sensitive Cities

The Cooperative Research Centre for Water Sensitive Cities (CRCWSC) is an Australian research centre that brings together different research disciplines, experts, and industry thought leaders to address urban water management. The rationale for working on water-sensitive cities, is the observation that cities are critically affected by three challenges: population growth and changes in lifestyle and values; climate change and climatic variability; and challenging economic conditions.

CRCWSC aims to contribute to sustainable, resilient, productive and liveable future cities and towns. In a more practical sense the institute wants to create awareness from different elements or sectors in the urban development space that are influenced by water, and then create collaboration and integration across a wide range of organisations including local and state governments, utilities, consultants and other private sector companies.

The CRCWSC has received government funding (30 Million Australian dollars) for its first seven years, and has acquired a similar amount of money from industry. From this funding the CRCWSC has first ran a thematic program (2012-2016), and then started a number of integrated projects. These latter have been funded from joint government and industry contributions first, but their final two years are solely funded by contributions from industry and universities, without government funding (see table 4.2). There are currently five integrated projects, dealing with visions and transition strategies, an economic evaluation framework, integrated urban planning across different scales, infill developments and groundwater impacted environments. There is also a separate sub-program on “Tools and Products” which is further developing product-related outputs from the initial projects into end-user-ready tools (mostly software-based).

The development of the integrated projects was a highly interactive process. As a first step, the CRCWSC has run 5 two-day workshops across the country, for which both CRC-participants and additional key people with regard to the topic were invited. Out of those workshops, CRCWSC has created a combined summary of ‘needs and opportunities’, addressing the common needs across the 5 regions. Based on this document, the CRCWSC brought researchers together, and asked them to come up with possible research approaches that could address these needs. In this phase the initiative was with the researchers to secure scientific quality and feasibility. Their ideas were then put back to the industry partners in all regions to prioritize at a national level, which formed the basis for the five identified ‘integrated research projects’. They are not only integrating different academic disciplines, but also bringing together a number of industry sectors to jointly address challenges that are typically at the interfaces of disciplines and institutional structures. This is further supported by broadly based ‘project steering committees’ that

have been actively involved in the co-development and then delivery of the integrated research projects, hence ensuring relevance and applicability of the outputs from the onset.

TABLE 4.2. CHARACTERIZATION OF INTEGRATED PROJECTS AT CRCWSC

Program	**Integrated projects**
Goal	Foster and enforce collaboration and integration Provide a test-bed for industrial projects
Disciplinary focus	Water technologies, economics, urban design and planning, social sciences
Funding source	Industry and universities
Initiative	CRCWSC
Influences	Workshop series that produced ´needs and opportunities´
Decision	Industry
Main criteria	Industry needs and interests Challenges requiring collaboration from different research disciplines and industry sectors

The agenda-setting process for the integrated project has helped to generate strong stakeholder support. Most of the projects have unanimous support from the five regions involved. However, the process has been a quite costly exercise. According to the interviewee, it had a lot of value, but has been very time consuming. It has been an iterative process, that the CRCWSC has developed and refined step-by-step.

4.3 CREW

The Centre of Expertise for Waters (CREW) is a partnership between the James Hutton Institute and Scottish Universities, funded by the Scottish Government. Its mission is to provide information and knowledge to support decision making predominantly in policy. CREW is a demand-driven service, managing the engagement between policy and researchers. Its formal goals are to

- 'Deliver timely and accurate advice
- Coordinate and fund research, analysis and interpretation
- Stimulate innovative and proactive thinking
- Develop an ethos of co-production and genuine knowledge exchange
- Develop the networks and skills of researchers, policy makers and practitioners to make best use of available science leading to improved environmental, social and economic outcomes.' (http://www.crew.ac.uk/about)

CREW works as a knowledge broker between researchers and knowledge users. Given its mission and aims, CREW has a relatively short term orientation. It both addresses immediate policy needs and helps to vision out where policies need to go on a medium term.

CREW's first step in the agenda setting process is to convene thematic groups to discuss existing and ongoing projects, and emerging challenges, either technological or policy related. The groups are connected to four themes: catchment management, drinking water, flooding and sustainable rural communities.

Based on the discussions in the stakeholder groups, a list of draft proposals is produced, which is then discussed with the various stakeholders with the aim to reach consensus about the priorities. Once prioritized and cross-checked for duplication between the thematic

groups, the proposals are tendered. The tenders are primarily drawing from the CREW community, but when particular specialisms are lacking they will be sought elsewhere.

To keep the balance right across the four thematic stakeholder groups, the division of funding between them is reviewed every year by a steering group. The steering group has a key role in making sure that the stakeholder groups are fit for purpose and contemporary. To this end they can also identify new and emerging topics that deserve attention.

CREW does not work with formal criteria, but leaves it up to the various stakeholders to choose their own priorities. CREW aims to reach consensus in the stakeholder groups.

TABLE 4.3 CHARACTERIZATION OF THE AGENDA-SETTING PROCESS AT CREW

Goal	Support decision making in water policy
Disciplinary focus	Water technologies and water governance
Funding source	Mainly state support
Initiative	Stakeholder groups who articulate their research needs
Influences	Current policy needs and emerging challenges
Decision	Tender for academic community
Main criteria	Relevance for stakeholders

In order to facilitate internal learning, CREW has institutionalized a small project to annually evaluate the center's functioning. Some lessons from these evaluations are the need of flexibility and adaptability and the need to developed shared language and trust among stakeholders.

4.4 EAWAG

Eawag is the Swiss Federal Institute of Aquatic Science and Technology and is part of the ETH Domain, which includes the two universities of ETH Zurich and ETH Lausanne (EPFL), and four independent research institutions. Eawag is concerned with concepts and technologies for dealing sustainably with water bodies and with water as a resource. In collaboration with universities, other research institutions, public bodies, industry and non-governmental organizations, Eawag works to harmonise ecological, economic and social interests in respect of water usage. The institute thus serves as a bridge between the scientific world and the 'real world'. Eawag has 12 research departments in areas that cover the natural sciences, engineering and social sciences.

The funding composition roughly amounts to:

- 77% federal contribution
- 14% other national public funding
- 5% industry
- 4% Horizon 2020

In correspondence with its status as an ETH-organization, Eawag has a rather academic mission. Rather than catering to the everyday needs of water organizations and water professionals, Eawag focuses on more fundamental research questions and radical innovations.

The large majority of Eawag's funding constitutes a contribution from the federal state. The distribution of this money across the research departments of the institute is largely fixed, related to the number of tenured staff and the research instruments.

The institute hardly has any programmatic research. The group leaders are quite autonomous in choosing their research priorities, which they can address by combining the institutional funding with additional funding from various sources. From the institutional funding, the salaries of group leaders are covered. To start research activities the group leaders typically require money for PhDs or Postdoc.

An interesting instrument is the discretionary funding (see table 4.4), which the management can use to give additional strategic impulses to specific research topics. The MT uses this money in particular to stimulate interdisciplinary collaboration, that is, projects that are carried out by a combination of research departments. The groups typically use this money as a start-up grant to explore a novel research area, to do a preliminary analysis or a PhD student that they supervise jointly. This often forms the start of a larger research program. These programs are defined bottom-up rather than top-down. But in order to succeed, the topics have to prove that they can potentially generate a large practical impact, which typically requires a lot of interaction with practitioners from the water sector.

TABLE 4.4 CHARACTERIZATION OF DISCRENTIONAYR FUNDING AT EAWAG

Program	**Discretionary funding from MT**
Disciplinary focus	Water technologies and water governance (emphasis on natural sciences)
Goal	Concepts and technologies for sustainable water management
Funding source	Basic funding from the state
Initiative	Group leaders
Influences	Academic niche, perceived future needs of the sector
Decision	Management team
Main criteria	Academic quality
	Lack of external funding opportunities

The respondent is satisfied with the agenda-setting procedure, since it works efficiently and helps to fulfill mission of the institute. There are low transaction costs. He considers it key to choose the group leaders wisely: 'If they are internally motivated people, that know a lot about their field of expertise. And they will do on average the right things.'

4.5 CIRSEE (SUEZ R&D)

SUEZ Group is a commercial company with six competence centres around the world, employing a total of almost 400 researchers and experts to develop new solutions and validate technologies for its operational entities and customers. The Paris-based International Water and Environmental Research Centre (CIRSEE) specializes in the production of drinking water, water distribution networks, the treatment and reuse of waste water, waste recycling, the management of health and environmental risks, and data analysis.

CIRSEE is 100% funded from SUEZ group. The institutes mission is to do applied research, the results of which can be applied in the water and (solid) waste domains. The work covers TRL 3 to 6, including the development of prototypes that can be commercialized in the business lines of the company. The research is aligned to the strategic priorities of the

business units and business lines of SUEZ. CIRSEE participates in some academic collaborative projects with European partners.

In addition to its research tasks, CIRSEE is also responsible for supporting the business lines and business units with technical assistance or technical support in their everyday work. This includes troubleshooting, training on new technologies and training new skills.

The initiative for new projects can come either from researchers at CIRSEE or from business lines or business units. They are influenced either by the market (a drive for cheaper solutions or to differentiate from competitors) or by technological developments (solutions that work elsewhere, which may be transposable to SUEZ business).

To assess new projects there are internal evaluation committees using a number of evaluation tools. They consider the TRL of a new project, assess whether it responds to a real issue and the viability of the project (whether it is realistic and whether clients will buy it). Another consideration within the company is the make-or-buy choice: in some cases it is more sensible to invest in another firm or to form a partnership rather than developing the technologies in house.

TABLE 4.5. CHARACTERIZATION OF AGENDA-SETTING AT CIRSEE

Goal	Support business of SUEZ with new technologies
Disciplinary focus	Water technologies, data science and asset management
Funding source	SUEZ group (100%)
Initiative	Researchers or business units
Influences	Market
	Technological developments
Decision	Internal evaluation committees
Criteria	TRL
	Value analysis
	Viability

The agenda-setting process at CIRSEE helps to secure a strong connection between the research field and the operations of the company. It helps to prioritize projects in the higher TRLs, relatively close to the market.

4.6 Water Research Australia

This organisation has a practical mission: 'Our mission is to find solutions to problems through collaborative research. And build capability to undertake that research and achieve those solutions.'

The organization started as the Cooperative Research Centre (CRC) for Water Quality and Treatment, with government funding to support university-industry collaboration (1995-2008). When the government funding for the CRC ended, the collaboration continued as a not-for-profit, member funded company called Water Quality Research Australia, which in 2013 evolved into Water Research Australia which today addresses the breadth of water sector needs (beyond water quality).

In its current organizational setup, cash funding of WaterRA comes primarily from membership fees paid by its industry members, which include water utilities and government

departments, regulators and a few consultants[1]. Membership fees mainly cover operational costs of the business with research projects funded by members on a subscription basis. The number of subscribers to each project and the amount of their contributions varies.

To initiate new projects, industry usually takes the first step (see table 4.6). In some cases the initiative comes from research organizations or the WaterRA secretariat based on information from the sector. As a next step a Community of Interest (CoI) is set up to bring together industry and research members with an interest and/or expertise related to the issue. This is usually followed by a face-to-face or virtual Workshop where members of the CoI get together to further explore and understand the problem - and evaluate the options, defining the research that will provide the best outcomes. An important criterion to develop an industry need into an actual project is that multiple members show an interest.

A combination of internal scientific criteria and external societal criteria will be discussed by the CoI in a project definition workshop. Ideally the research members in the room have the necessary expertise to define the project and to form a united team to execute the research proposed but in some cases it is necessary to invite other expertise onto the project team or seek multiple proposals.

Once a project plan has been articulated, WaterRA will seek funding from its members and any other interested stakeholders. WaterRA usually puts out a request for the rough amount of money that is needed, and then members just indicate how much they are prepared to pay. If there are multiple project proposals, WaterRA appoints a project review team to evaluate proposals, composed of representatives of members and the WaterRA office. This review team gives advice to WaterRA, which makes the final decision to award a project. There is an extensive set of project selection criteria, most of which concern the industry relevance and the quality of the scientific approach.

TABLE 4.6. CHARACTERIZATION OF AGENDA-SETTING AT WATERRA

Goal	Find solutions to problems through collaboration
Disciplinary focus	Water management, water technologies and governance
Funding source	Members (and other organizations)
Initiative	Industry and research organisations
Influences	Practical issues and developments
Decision	WaterRA management and board
Criteria	Industry relevance
	Quality of scientific approach

The first experiences at WaterRA with this new agenda-setting model have been very positive. However, one concern was that the process tended towards shorter duration research. Several members have expressed the importance of research with a longer term view, which looks 10 year ahead or even longer. As a first step the CoI process has been adapted so that it can potentially lead to research programs that form the basis for longer term initiatives with potential to attract Australian government funding. In addition this year a CoI is to be formed to specifically focus on how projects of this nature can be initiated without government funding. Early signs are that there seem to be sufficient members willing to contribute funding, but this will probably need to come in another composition than is

[1] WaterRA's research members contribute 0.5 FTE per annum in-kind in lieu of cash fees.

common: smaller amounts from many members rather than substantial contributions from a few members.

5 Comparative analysis

The inventory presented in this report shows that research agenda setting practices in the water sector are very diverse. The initiative for new projects lies in some cases with individual researchers (Cranfield, CRCWSC), in other cases with industry (WaterRA) and/or other stakeholders (CREW). Various factors influence these initiatives, ranging from academic developments, the market, policy needs or other practical issues. Interestingly several programs attempt to incorporate knowledge about the future, by organizing workshops with stakeholders or by taking into account emerging challenges. The decisions about project priorities are taken sometimes by academic managers (Cranfield, Eawag), sometimes by business representatives (CRCWSC, CIRSEE), and sometimes by a board with mixed representation (CREW and WaterRA). The selection criteria used by these decision makers are mainly about academic/research quality and industrial relevance, but the relative emphasis on these aspects varies across programs.

The differences we found can be explained to a great deal by different goals of the programs, funding models and stakeholder demands. These factors, in turn, depend on the organizational setup of the water sector, the national research system and other context variables which lie beyond the primary focus of the current project.

In most cases we found a strong connection between the goals of the program, and the main criteria for selecting proposals. Cranfield's program to stimulate the intellectual development of young scholars uses the (estimated) contribution of a proposed project to a scholar's career as a main criterion. And the industrially oriented criteria used in CIRSEE match with its mission to support business.

The actor taking the initiative for a new project seems also related to the goals of a program. In many cases the first initiative is with a researcher. The programs in which industry or stakeholders (can) take the first step, are the programs with the most practical orientation: CREW, CIRSEE and WaterRA.

In terms of funding models, the two programs solely funded by industry (WaterRA and CIRSEE) also allow industry a strong role in the agenda setting. Firms or business units can initiate a new proposal, they directly participate in prioritizing decisions, and industrial relevance or commercial potential are decisive criteria. To a lesser extent, these features can also be recognized in the case of CRCWSC, which is partly funded by industry.

But different stakeholders can also influence agenda-setting in cases they do not provide funding. In the case of Cranfield, relevance for the water sector is an important criteria, even for a program that is funded from institutional resources. And CREW is mainly funded by the state, but its agenda-setting process includes a wider range of stakeholders.

When taking the above factors into account, the different agenda setting practices can be explained to a great deal, but not completely. It seems that - apart from rational explanations - the practices are also a matter of contingency. Some of our interviews suggest that the visions and convictions of key people in the research organizations also play a vital role.

The organizations also learn and adapt over the years, as illustrated by the following quote: 'We have looked in the past at formalizing [the decision-making processs], and found out that consensus works the best.' (interview CREW). And some research organizations (WaterRA and CRCWSC) have recently undergone major changes in organizational setup and funding composition, which have led them to change their agenda setting practices as well.

An interesting variation we have observed is that some programs are organized in a systematic way, with specific boards or committees with clear responsibilities (CRCWSC, CIRSEE, WaterRA). Others are more informal and leave room for different types of initiatives and decisions (Cranfield, Eawag, CREW).

Most practices are based on a combination of formal and informal criteria. In all cases there are explicit criteria to formally guide the selection process, but to a varying extent informal or implicit criteria that have not been defined officially also influence the priorities. These typically have a stronger influence in the programs that are less formalized.

An interesting variable is the tension between systematic versus emerging agendas. Some organizations strive for a balanced agenda. They work with a number of themes, and attempt to distribute their activities in a strategic way across these themes (e.g. CREW and CIRSEE). Others act upon emerging opportunities. The strongest examples of this are the academic organizations Eawag and Cranfield. Together they show that opportunism is not necessarily connected with either a fundamental or an applied orientation. In both institutes the management is strongly concerned with the quality of their staff, and considers a strong team of researchers more important than a balanced research portfolio. Their management chooses to use its discretionary funding to support talented people or novel interdisciplinary connections that can attract external funding in a later stage. In doing so, the institutes use different criteria, that match with the research markets they address. Eawag is more strongly oriented at academic funding sources such as the national and European research councils, so here academic quality counts more strongly. At Cranfield, practical relevance receives more attention, in accordance with their reliance on funding from industry and government organizations.

TABLE 5.1. OVERVIEW OF THE AGENDA SETTING PRACTICES IN SIX WATER RESEARCH ORGANIZATIONS

Program	**Cranfield Discretionary funding**	**CRCWSC Integrated projects**	**CREW**	**Eawag Discretionary funding from MT**	**CIRSEE**	**WaterRA**
Goal	Intellectual development of young people	Foster and enforce collaboration and integration Provide a test-bed for industrial projects	Support decision making in water policy	Concepts and technologies for sustainable water management	Support business of SUEZ with new technologies	Find solutions to problems through collaboration
Funding source	Institutional funding (from university)	Industry and universities	Mainly state support	Basic funding from the state	SUEZ group (100%)	Members (and other organizations)
Initiative	Proposals from young scholars	CRCWSC	Stakeholder groups who articulate their research needs	Group leaders	Researchers or business units	Industry
Influences	Academic community	Workshop series that produced ´needs and opportunities´	Current policy needs and emerging challenges	Academic niche, perceived future needs of the sector	Market Technological developments	Practical issues and developments
Decision	Research board (supported by RIO)	Industry	Tender for academic community	Management team	Internal evaluation committees	WaterRA board
Main criteria	Relevance for water sector Contribution to career of young scholar	Industry needs and interests Challenges requiring collaboration from different research disciplines and industry sectors	Relevance for stakeholders	Academic quality Lack of external funding opportunities	TRL Value analysis Viability	Industry relevance Quality of scientific approach

6 Concluding discussion

A silver bullet for research agenda-setting does not exist. All programs have their own context, with different goals, funding sources and stakeholders. An effective process of agenda-setting does justice to this context. In our inventory, we found quite some variation in agenda-setting practices. The variation in terms of the initiative, influence, decision and criteria can be understood, given the variation in goals, funding sources and stakeholders of the various programs. Programs with practical goals should provide room for practical criteria and facilitate representatives of knowledge users in steering decisions. Leaving the decisions regarding prioritization of research topics completely to researchers would risk developing a research agenda steered by internal criteria (such as intellectual curiosity) that does not match with practical knowledge needs and 'real world' problems. Regarding the funding source, allowing its representatives to influence decisions seems rational, but if those providing funding differ from the targeted knowledge users, additional stakeholders should be involved.

Although our analysis suggests that the agenda-setting practices investigated are tailored to the demands and conditions of the individual programs, personal factors and practical circumstances also play a role. This does not necessarily indicate a problem, since programs tend to change over time and the development of agenda setting practices deserves to be subject to internal learning processes.

From our inventory of agenda-setting practices a number of lessons can be drawn about the relationship between agenda-setting and the nature of research that emerges from these practices.

1. The programs of CRCWSC, CREW and WaterRA show that an intensive and interactive agenda-setting practice can help to prioritize research that is at the same time scientifically feasible and practically relevant and topical. In these programs the agenda-setting starts with demand articulation at the side of clients or knowledge users. Next, researchers develop project proposals (in consultation with knowledge users), after which knowledge users make a selection or prioritization. The intensive interactions increase the cognitive and social proximity between funders (principals) and researchers (agents), and in this way help to overcome the delegation problem predicted by principal-agent theory (Guston 2000).
2. The case of Eawag illustrates that interdisciplinary research can be facilitated by dedicated funding. Given the challenges of acquiring funding for interdisciplinary research at research councils or other regular funding sources, dedicated programs can fulfil a role in supporting these research areas, which are often of high societal relevance.
3. The case of Cranfield shows that a lack of formal strategic planning does not imply that there is no coherence or continuity in the research agenda. In this case, longer research lines can be recognized in hindsight, which have not been formally planned. Strategies emerge and are informally adjusted to match the demands.
4. Perhaps surprisingly, in our sample we found few instances of programs that divided their budget ex ante over different topics in order to maintain a thematic balance. In the case of CREW an annual check is conducted on the thematic balance, but this is

done ex post to check for major deviations (a form of portfolio analysis (Wallace and Rafols 2015)) rather than by earmarking the budgets for specific themes ex ante.

5. The agenda-setting practice at CIRSEE indicates that the involvement of industrial managers with a commercial orientation in combination with a strict set of selection criteria can help to prioritize projects with a high TRL. Related, from the WaterRA case we learn that a strong influence of end-users in the prioritization of projects can lead to an emphasis on projects with a short duration, directed at topical issues. This can be explained by the time perspective of managers, which is typically a lot shorter than the one of scientists (Segrave et al. 2014).

To conclude, we explore the relevance of our findings for the agenda-setting in the BTO, in particular in relation to the issues that were introduced in chapter 1.

In order to maintain the balance between addressing immediate knowledge needs on one hand, and developing knowledge and building capacity for the longer term viability of the water sector on the other hand, the chosen compartmentalization of the BTO-budget seems to be an effective instrument. Our inventory suggests that generating knowledge with different time horizons in mind requires different agenda-setting practices: in particular different initiators, different criteria and different decision-makers.

The decision-making structures of the Thematic Research component have evolved over the years as a result of a learning process, and they seem to match well with the strategic goals of this program component. This has been confirmed in the latest evaluation of the BTO program (BTO 2017.205(s)). Putting aside some earmarked funding for explorations within each theme will hopefully further improve the balance between different types of knowledge production and strengthen the links between the Thematic Research and the Exploratory Research.

The Tailored Research component, with its current agenda-setting practice, complements the other two parts of the BTO by allowing more influence for individual firms. One concern from the latest program evaluation was to make sure that this part goes beyond implementation projects only, in the sense that it addresses actual research questions. The responsibility for this risk lies primarily with the KWR-researchers involved in the project definition: when writing the project plan, they can make sure that the project has a sufficient research dimension. In the case that concerns about this issue remain, it can be considered to organize an additional check to be performed by the scientific council of the institute.

The Exploratory Research serves to complement the other components by signaling scientific, technological and societal developments. Inspired by the cases analyzed in this report, the question can be raised whether the program benefits sufficiently from the creative potential of the institute. In the current situation, this initiative often lies with the program management, members of the Science Council or with senior managers of the institute, based on a combination of scientific, strategic and tactical considerations. One possibility that can be considered to create space for initiatives of individual researchers by reserving a certain part of the budget for annual calls for proposals. In this way, the initiative for new research topics lies primarily by researchers, inspired by scientific or technological developments or information from clients. Such a call would require a systematic selection of the project proposals with an explicit set of criteria such as scientific innovativeness, feasibility, relevance for BTO clients, and synergies with other programs. This would also contribute to the transparency of the decision-making in this program component. Furthermore, inspired by the Cranfield case, the potential of projects to support the

development of talented early-career researchers could also be incorporated as a selection criterion.

From the Cranfield and Eawag cases we learn that a certain degree of flexibility can be functional. There can be a trade-off between the degree of anticipation (agenda-setting based on foresight) and the degree of adaptive capacity (agenda-setting based on opportunities that present themselves). In the case of an annual call for proposals, the program should make sure to maintain sufficient flexibility to act upon emerging opportunities. Such opportunities can be of various natures, such as emerging research topics, strategic collaborations, or attractive research projects requiring 'co-funding'.

7 References

Brouwer, Stijn, Chris Büscher, and Laurens K. Hessels. 2018. Towards transdisciplinarity: a water research programme in transition. *Science and Public Policy* doi: 10.1093/scipol/scx058.

Caron-Flinterman, J.Francisca, Jacqueline E.W. Broerse, Julia Teerling, Melissa L.Y. van Alst, Simon Klaasen, L. Edwin Swart, and Joske F.G. Bunders. 2006. Stakeholder participation in health research agenda setting: the case of asthma and COPD research in the Netherlands. *Science and Public Policy* 33 (4).

Dalkir, Kimiz, and Marco Beaulieu. 2017. *Knowledge management in theory and practice*. MIT press.

Dalrymple, Dana G. 2006. Setting the agenda for science and technology in the public sector: the case of international agricultural research. *Science and Public Policy* 33 (4):277-290.

de Graaf, Beatrice, Alexander Rinnooy Kan, and Henk Molenaar. 2017. *The Dutch National Research agenda in perspective: a reflection on research and science policy in practice*. Amsterdam University Press.

Elberse, Janneke Elisabeth, Carina Anna Cornelia Maria Pittens, Tjard de Cock Buning, and Jacqueline Elisabeth Willy Broerse. 2012. Patient involvement in a scientific advisory process: Setting the research agenda for medical products. *Health Policy* 107 (2-3):231-242. doi:http://dx.doi.org/10.1016/j.healthpol.2012.05.014.

Evans, Max, Kimiz Dalkir, and Catalin Bidian. 2015. A holistic view of the knowledge life cycle: the knowledge management cycle (KMC) model. *The Electronic Journal of Knowledge Management* 12 (1):47.

Garratt, Bob. 1990. *Creating a learning organisation: A guide to leadership, learning and development*. Director Books.

Georghiou, Luke, and Jennifer Cassingena Harper. 2011. From priority-setting to articulation of demand: Foresight for research and innovation policy and strategy. *Futures* 43 (3):243-251.

Guston, David H. 2000. *Between Politics and Science: Assuring the Integrity and Productivity of Research*. Cambridge: Cambridge University Press.

Hessels, Laurens K., Tjerk Wardenaar, Wouter P. C. Boon, and Matthias Ploeg. 2014. The role of knowledge users in public–private research programs: An evaluation challenge. *Research Evaluation*. doi:10.1093/reseval/rvu007.

Hofstede, Geert. 1984. Cultural dimensions in management and planning. *Asia Pacific journal of management* 1 (2):81-99.

Klerkx, Laurens, and Cees Leeuwis. 2008. Delegation of authority in research funding to networks: experience with a multiple goal boundary organization. *Science and Public Policy* 35:183-196.

Koerselman, W., A.M. Hummelen, and T. Ramaker. 2003. *Toekomstverkenningen voor de drinkwatersector*. Nieuwegein: Kiwa Water Research.

Könnölä, Totti, and Karel Haegeman. 2012. Embedding foresight in transnational research programming. *Science and Public Policy* 39 (2):191-207. doi:10.1093/scipol/scs020.

Lang, Daniel J, Arnim Wiek, Matthias Bergmann, Michael Stauffacher, Pim Martens, Peter Moll, Mark Swilling, and Christopher J Thomas. 2012. Transdisciplinary research in sustainability science: practice, principles, and challenges. *Sustainability science* 7 (1):25-43.

Segrave, AJ Andrew, MW Mariëlle van der Zouwen, and W Wim van Vierssen. 2014. Water planning: from what time perspective? *Technological Forecasting and Social Change* 86:157-167.

Slipsaeter, Stig, Benedetto Lepori, and Michael Dinges. 2007. Between policy and science: research councils' responsiveness in Autria, Norway and Switzerland. *Science and Public Policy* 34 (6):401-415.

Stewart, Jenny. 1995. Models of priority-setting for public sector research. *Research Policy* 24 (1):115-126.

Toulmin, Stephen. 1964. The complexity of scientific choice: A stocktaking. *Minerva* 2 (3):343-359.

van der Meulen, B. 2003. New roles and strategies of a research council: intermediation of the principal-agent relationship. *Science and Public Policy* 30 (5):323-336.

Von Korff, Yorck, Katherine A Daniell, Sabine Moellenkamp, Pieter Bots, and Rianne M Bijlsma. 2012. Implementing participatory water management: recent advances in theory, practice, and evaluation. *Ecology and Society* 17 (1).

Wallace, Matthew L, and Ismael Rafols. 2015. Research portfolio analysis in science policy: moving from financial returns to societal benefits. *Minerva* 53 (2):89-115.