Anna Schwachula

SUSTAINABLE DEVELOPMENT IN SCIENCE POLICY-MAKING

The German Federal Ministry of Education and Research's Policies for International Cooperation in Sustainability Research

[transcript] **s**cienc**e**tudies

Anna Schwachula
Sustainable Development in Science Policy-Making

Science Studies

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List of abbreviations

AA Auswärtiges Amt/German Federal Foreign Office

AIM Assistance for Implementation, project accompanying IWRM and CLIENT funding initiatives

AvH Alexander von Humboldt-Foundation

BMBF Bundesministerium für Bildung und Forschung/German Federal Ministry of Education and Research

BMEL Bundesministerium für Ernährung und Landwirtschaft/German Federal Ministry of Food and Agriculture, in previous legislature periods with additional responsibility for Consumer Protection as German Federal Ministry of Food, Agriculture and Consumer Protection (BMELV)

BMF Bundesministerium der Finanzen/German Federal Ministry of Finance

BMFT Bundesministerium für Forschung und Technologie/German Federal Ministry of Research and Technology, BMBF predecessor

BMJV Bundesministerium der Justiz und für Verbraucherschutz, German Federal Ministry of Justice and Consumer Protection

BMU Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit/German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, in previous legislature periods with additional responsibility for Building as German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)

BMWi Bundesministeriums für Wirtschaft und Energie/German Federal Ministry of Economic Affairs and Energy

BMZ Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung/German Federal Ministry for Economic Cooperation and Development

BUND Bund für Umwelt und Naturschutz Deutschland, Friends of the Earth Germany

BRICS Brazil, Russia, India, China, and South Africa, group of large emerging economies

CAPES Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, Brazilian funding agency of higher education

CD Capacity development

CDU Christlich Demokratische Union/Christian Democratic Union of Germany

CGIAR Consultative Group on International Agricultural Research

CLIENT BMBF funding initiative for International Partnerships for Sustainable Technologies and Services for Climate Protection and the Environment

CNPq Conselho Nacional de Pesquisa, National Brazilian research funding agency

DAAD Deutscher Akademischer Austauschdienst/German Academic Exchange Service

DAC Development Assistance Committee of the OECD

DFG Deutsche Forschungsgemeinschaft/German Research Foundation

DIE Deutsches Institut für Entwicklungspolitik/German Development Institute

DS Decision support

DVWG Deutscher Verein des Gas- und Wasserfaches e.V./German Technical and Scientific Association for Gas and Water

DWA Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e.V./German Association for Water, Wastewater and Waste

EC European Commission

EE Anonymized interviewee classified as external expert

EU European Union

FONA BMBF-Rahmenprogramm Forschung für Nachhaltige Entwicklung/BMBF framework programme on Research for Sustainable Development

G20 Group of Twenty, annual multilateral policy platform of the world's largest economies

GDP Gross Domestic Product

GIZ Gesellschaft für Internationale Zusammenarbeit/German Federal Enterprise for International Cooperation

GlobE BMBF funding initiative on Global Food Security

GloWa BMBF funding initiative on Global Water

GNI Gross National Income

GWP German Water Partnership

HTS High-Tech Strategy of the German Federal Government

IMA Interministerieller Ausschuss/Interministerial Committee

IPCC Intergovernmental Panel on Climate Change

IWAS International Water Alliance Saxony

IWRM Integrated Water Resources Management

KfW Kreditanstalt für Wiederaufbau/German Development Bank

LDC Least developed countries

LiWa Lima Water, project funded within the BMBF Megacities funding initiative

MDG Millennium Development Goals

MPG Max Planck Gesellschaft/Max Planck Society

NGO Non-Governmental Organisation

NoPa GIZ-funded programme for Innovation for Sustainable Development – New Partnerships

NKGCF German National Committee for Global Change Research

ODA Official Development Assistance

OECD Organisation for Economic Co-operation and Development

PA Anonymized interviewee classified as policy maker/administrative staff

PIPA Participatory Impact Pathway Analysis

PP Anonymized interviewee classified as project participant

PROSIN Programm Spitzenforschung und Innovation in den Neuen Ländern/ funding initiative for excellence in research and innovation in the new federal states

PT Anonymized interviewee classified as project management agency staff

PT-DLR Projektträger DLR/Project Management Agency of the BMBF at the DLR (German Aerospace Center)

PT-J Projektträger Jülich/Project Management Agency at Research Center Jülich

PT-KA Projektträger Karlsruhe/Project Management Agency at the Karlsruhe Institute of Technology

RSSC Regional Science Service Center

SASSCAL Southern African Science Service Center for Climate Change and Adaptive Land Management, BMBF-funded RSSC

SDG Sustainable Development Goals

SKAD Sociology of Knowledge Approach to Discourse

SME Small and Medium Enterprises

SÖF BMBF-Programm Sozial-ökologische Forschung/BMBF programme for social-ecological research

SPD Sozialdemokratische Partei Deutschlands/Social Democratic Party of Germany

UFZ Helmholtz Zentrum für Umweltfoschung (Helmholtz Centre for Environmental Research)

UN United Nations

UNCED United Nations Conference on Environment and Development

UNDP United Nations Development Programme

S&T/ST&I Science and Technology/Science, Technology and Innovation

Td Transdisciplinarity

VDI/VDE-IT   Verein Deutscher Ingenieure/Verband der Elektrotechnik Elektronik Informationstechnik – Innovation + Technik/Project Management Agency at the Association of German Engineers/Association for Electrical, Electronic & Information Technologies

WASCAL   West African Science Service Center on Climate Change and Adapted Land Use, BMBF-funded RSSC

WBGU   Wissenschaftlicher Beirat Globale Umweltveränderungen/German Advisory Council on Global Change

WCED   World Commission on Environment and Development, the Brundtland Commission

ZEF   Zentrum für Entwicklungsforschung/Center for Development Research, University of Bonn

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1 Introduction

This book deals with the role of science policy for global sustainable development. Cooperation between researchers in the so-called developing as well as the so-called developed world has a great potential to foster sustainable development on a global scale. However, science policies are decisive in setting a supportive frame for research cooperation. Against this background, this book explores German science policy for cooperation with developing countries and emerging economies[1] for sustainable development and seeks to understand why under the surface, sustainability is *not* the core objective.

At a first glance, sustainable development is increasingly shifting into the focus of German policies. In its Sustainability Strategy, the Federal Government acknowledges the importance of sustainability for its policies in view of its responsibilities on the national as well as on the global level (Bundesregierung 2016). Funds for research cooperation between Germany and developing countries or emerging economies have been continuously growing in the last decade. The German Government has corroborated education and research as a priority area of cooperation with developing countries and emerging economies in consecutive governmental periods (Bundesregierung 2009a; 2013; 2018a).

The Federal Ministry of Education and Research (BMBF) and its policies play an important role in international cooperation on sustainability issues. The BMBF is the largest provider of public funds for research cooperation between German researchers and those in developing countries and emerging economies.[2] Decisively

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1 Throughout this book, I use the terms *developing country* and *emerging economy* to depict the countries, located mainly in the global South, that are enlisted as recipients of Official Development Assistance (ODA) by the Organisation of Economic Co-operation and Development (OECD). The classification draws on the World Bank's numbers on Gross National Income (GNI) (OECD 2018). In most developing countries and emerging economies, social and ecological problems persist. Compared to developing countries, emerging economies have a higher GNI and have presented higher levels of economic growth in the recent past (OECD 2010a). On the concept of development as such, see chapter 2.

2 Although no total numbers are available for expenditures on cooperation with all developing countries and emerging economies, the dimensions are illustrated by the numbers published on African Countries and BRICS: the BMBF allocated app. EUR 47 million on cooperation with BRICS

setting the course of cooperation, policies for research cooperation with developing countries or emerging economies are a field of science policy, and *not* of development policy in the German context. As a consequence, global development targets such as the former Millennium Development Goals (MDGs) or the current Sustainable Development Goals (SDGs) are of subordinate importance for international science policy.

In contrast to the Federal Ministry of Economic Cooperation and Development (BMZ), responsible for German development policy, the BMBF is not bound to fulfilling international agreements on development cooperation in funding science cooperation. Therefore, development-oriented agreements such as the Paris Declaration on Aid Effectiveness, or the Accra Agenda for Action and their follow up documents (OECD 2008) agreed upon in the Organisation of Economic Co-operation and Development (OECD) are no relevant policy frames of science cooperation. At the same time, science cooperation is not a central issue in economy-related international fora, either. As such, resolutions of the G20 – even in their non-binding legal function – rarely address the role of science cooperation (see Bundesregierung 2018b).

Given this absence of compulsory norms for international science policy, it is a question of empirical research to analyze on which basis the BMBF develops its specific policies and funds cooperation with developing countries and emerging economies. Throughout this book, I demonstrate that science policy always has a normative dimension and may potentially contribute to all possible scientific objectives – as well as to objectives beyond the boundaries of science, such as fostering economic development, solving societal or environmental problems or making better political decisions (Bucar 2010; STEPS Centre 2010). The discursive[3] direction chosen in science policy hence displays the choices and values underlying it.

Scrutinizing different science policies worldwide, scholars have shown that economic rationales are a commonly-accepted legitimation of science policy, while a rationale for non-economy related societal benefits seems to be less common (Nowotny et al. 2001; Sarewitz et al. 2004; Leach et al. 2010; 2012). German science policy, as I argue throughout this book, is not an exception to this general observation. Rather than contributing to global development targets, the BMBF's main objective is to secure German prosperity, as stated in a self-description of the ministry:

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in 2012 (BMBF 2014a: 410) and EUR 50.8 million on cooperation with African partner countries in 2013 (BMBF 2014b: 2), see chapter 5.

3 The term *discursive* generally signifies language-based, in contrast to *non-discursive*, not language-based. I do not examine symbolic or other non-language-based practices here, and the distinction above therefore is not required. In lack of a corresponding adjective, I use the term *discursive* in a meaning of *related to discourse*.

"Education and research are the foundations for our future. The promotion of education, science and research by the Federal Ministry of Education and Research represents an important contribution to securing our country's prosperity." (BMBF 2015a)

The BMBF's main policy goal is thus *not* to foster sustainable development in Germany or abroad, even though *sustainable development* is referenced as a policy frame in the national Sustainability Strategy as well as in specific research programmes, i.e. the BMBF's successive framework programmes on Research for Sustainable Development, FONA (BMBF 2005a; 2009a, 2015e). Hence, science policy could hypothetically envisage all types of effects on society, including global sustainable development. Empirical research shows, however, that it displays different directions. This book traces why this is so.

1.1   Shedding light on German science policy for cooperation with developing countries and emerging economies

This book describes the empirically grounded research conducted in the frame of a PhD thesis. As such, it is linked to fulfilling a specific research objective: Shedding light on German science policy for international cooperation. Specifically, I examine science policy and funding by the Federal Ministry of Education and Research (BMBF) in the field of sustainability research aimed at supporting research cooperation between Germany and emerging economies or developing countries. The focus of analysis within this study is first, on the *processes and actors* involved in policy discourse, *second*, on the underlying *ideas and objectives* of BMBF policies and programmes for cooperation with developing countries and emerging economies, and *third*, on the *effects* of the specific policy conceptualisations on project implementation.

Being interested in the *what* and *why* and *who* of German science policy on a social science background, I chose the *Sociology of Knowledge Approach to Discourse* (SKAD), developed by R. Keller (Keller 2005; 2011a; 2011b; 2011c; 2012; 2013) as analytical approach to research. A constructivist perspective thus forms the fundament of this research project.

Empirically, research is based on a qualitative approach – semi-structured interviews, participant observation and analysis of policy documents – among policymakers, employees of project funding agencies and project participants involved in designing policies, administrating funding and implementing research within the Integrated Water Resources Management (IWRM) funding initiative (BMBF 2004a) and the Megacities funding initiative (BMBF 2004b). In order to obtain deeper insights into the funding initiatives in practice, I carried out participant observation

in two research projects, LiWa, located in Lima, Peru, a German-Peruvian project funded in the Megacities initiative; and IWAS Agua-DF, carried out in Brasília, Brazil, a German-Brazilian research project funded in the IWRM scope.

The Sustainability Subdepartment's funding priority on Social-Ecological Research (*Sozial-ökologische Forschung*, SÖF), is often highlighted as an example of the BMBF's encompassing and inclusive orientation of sustainability research funding. However, I argue that SÖF funding, while crucial for transdisciplinary sustainability-oriented research in Germany, remains a niche and does not reflect the BMBF's core discourse (ch. 8). In view of its participatory agenda processes, its transdisciplinary approach and encompassing social-ecological focus, it is an outlier.[4] Furthermore, SÖF as a funding priority is not aimed at international research cooperation as such. While in some SÖF-related funding initiatives, such as the junior research groups, international cooperation is possible, it is not a crucial element of SÖF. The main funding for international cooperation in FONA takes place in the subareas of *Global Change* and *Resources and Sustainability* (BMBF 2009a). In consequence, I selected the Megacities and the IWRM funding initiatives *purposefully* to illustrate the process of transmitting the policy discourse into concrete objectives. The two initiatives are comparable in scope, but nevertheless are characterized by differences that promised interesting contrasts. As a common trait, both funding initiatives aimed at cooperation with developing countries and emerging economies. As unilateral initiatives, they were issued by the BMBF in 2004 and designed based on German interests. The projects funded within both initiatives took place outside of the frame of any bilateral agreements on science and technology between Germany and partner countries. I therefore expected comparable insights on modes of agenda setting, programme design and involvement of partner countries' governments. However, the funding initiatives demonstrated different orientations of research objectives, which seemed interesting points of differentiation: Although both funding initiatives aimed to fund inter- and transdisciplinary research, the IWRM initiative was rather oriented towards technological approaches, while the Megacities initiative targeted systemic research and initially did not prescribe a specific solution pathway.

While in my empirical analysis, I especially focused on Megacities and IWRM as exemplary funding initiatives, I also compared the findings to further funding initiatives for international cooperation in the BMBF's *Subdepartment for Sustainability, Climate, Energy* (that I abbreviate as *Sustainability Subdepartment* in the fol-

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4 This is mirrored by the amount of funding for SÖF. Between the years 2000 and 2015, SÖF received a total budget of EUR 120 Mio, less than 10 Mio per year (BMBF 2015h). Even though annual funding increased from EUR 13,3 million in 2012 to a planned EUR 20 million budget for 2019 (BMF 2014; 2019), the overall budget remains only a small part of the overall budget for FONA – which amounted to almost EUR 2 billion from 2010-2014 (BMBF 2019a).

lowing chapters). A few years have gone by since I conducted empirical research (in 2012-2014). Since then, both the IWRM as well as Megacities funding initiatives have come to an end. Some funding initiatives, such as CLIENT, have issued new rounds of calls for proposals – CLIENT II, in 2015 (BMBF 2015i, 2017). As a follow up for the ending projects within the Megacities funding initiative, the BMBF initiated the Rapid Planning project within the Megacities funding initiative's frame (BMBF 2018).

The ministry itself has undergone some changes, as well. Its organisational structure has been slightly rearranged (ch. 5). At the time of research, the subdepartment in charge of international cooperation in sustainability research was the *Subdepartment for Sustainability, Climate, Energy*. In the new organisational shape, it is now the *Subdepartment Sustainability, Provision for the Future.* The subdepartment's working units have been slightly reorganized, as well. New units, such as on *Systemic Mobility, City of the Future* have been established; previous units have extended their responsibilities, such as the Unit for *Resources, Circular Economy, Geosciences* (BMBF 2019b). Additionally, the *individuals* working within the BMBF, in projects and as experts have continued their paths through life. While some of the people interviewed have changed to different working positions, others have retired, new people have entered.

On the one hand, the developments show that changes in policy are happening, even though policy seems to be characterized by high discursive stability (ch. 6, 8, 11). On the other hand and nevertheless, I argue that my findings in view of the general orientation of science policy for cooperation with developing countries and emerging economies continue to be pertinent: Recent documents on policies for international cooperation document that the main political mindset remains without essential changes (see: BMBF 2017). I therefore argue that my findings reflect insights on the policy processes and policy discourse within the Sustainability Subdepartment's funding initiatives for cooperation with developing countries and emerging economies.

1.2   Sustainable development as normative background

Based on the view that science policy is inherently normative, I argue that *global sustainable development* would be a legitimate objective for German science policy targeting cooperation with developing countries and emerging economies. In fact, sustainable development (or the BMBF's interpretation thereof) has already turned into an explicit frame of reference for BMBF funding in the area of sustainability research. I am thus specifically interested in investigating and exposing in which way the concept of sustainable development is constructed in the BMBF's policies for international cooperation.

At the same time, I resort to *sustainable development* as a normative basis. I argue that in its current interpretation of sustainability as a concept of predominantly environmental problems to be solved by economy-driven, technological solutions, the BMBF does not adequately enable the German science system to fulfil its role in preventing, mitigating and coping with global challenges such as climate change.

Using sustainable development as a normative lens on science policy does not seem farfetched: Environmental challenges on the global level, such as climate change, as well as on the local level, such as unsustainable management of resources, become more and more pressing and affect developing countries as well as all other countries alike, and scientific concern with sustainability is ongoing. Research shows that *planetary boundaries* and a *safe operating space* – which can neither be negotiated nor extended – have to be maintained to prevent severe consequences for the planet (Rockström et al. 2009), while ensuring a socially just space for humanity (Raworth 2012). This will require substantial transformations within *all* societies (WBGU 2011). In addition, striving for global equality is presented as an *ethical* obligation of people in a world habited by a *common humanity*, while at the same time, global sustainable development – as collective benefit – is also a matter of *self-interest* on a planet with limited ecological boundaries and resources (Hulme 2016). Based on this insight, the Agenda 2030 and its Sustainable Development Goals (SDGs) have been internationally adopted as a political frame of reference by the UN states in 2015 (UN 2015). Indeed, in view of sustainable development, not developing countries, but high income-countries lag behind in view of most environmental targets, such as regarding SDG12 on responsible consumption and production, or SDG 13 on climate action (Sachs et al. 2017). Perceiving sustainable development as a *global* challenge and a *global* responsibility therefore shifts the emphasis of previous development agendas.

In parallel to the ongoing ecological concerns, global social and economic changes occur. In recent years, previous economic and social divides between *developed* and *developing* countries increasingly blur and new constellations between former donors and recipients of development cooperation emerge. This has led to discussions around the future of development cooperation in a Beyond Aid debate (Janus et al. 2015; Horner and Hulme 2017). Taking global development, as expressed in the SDGs, seriously as a new development paradigm requires substantial changes of national policies from national interests towards global sustainability and wellbeing (Hulme 2016; Horner and Hulme 2017). On this background, other forms of cooperation between developed countries and developing countries or emerging economies are worth scientific scrutiny. Research cooperation between Germany and developing countries and emerging economies presents such a case.

Two remarks seem necessary in view of taking over a critical perspective based on the normative standpoint of sustainable development. The analysis of German

science policy presented here reveals some critical issues in view of global sustainable development. Representations in research, as in this book, often compete with official, authorized representations of the informants and their organisations. On this background, it is important to point towards the power dynamics during research. The empirical research I carried out for this analysis was coined by a situation of *studying up*, thus researching among actors in higher levels of power and status. In order to the avoid risk of censorship and to maintain the interpretative authority over the contents, interview statements were anonymized instead of requesting authorized statements from interviewees (ch. 4).

At the same time, in being critical of the general BMBF discourse, I do not intend to discourage those actors within the BMBF who initiated novel approaches to encompassing sustainability research (ch. 9); project participants who used their room for agency to extend their projects' scope in order to redirect them to more sustainable pathways (ch. 10); or external experts who publicly and critically discuss the direction of current science policy (Box 7-1). The conclusive chapter provides recommendations for these actors (ch. 11).

1.3   Contributions to scientific literature

Science policy, the processes of its production as well as its aims are researched from various social science perspectives. My investigation of sustainable development as a concept of German science policy, especially as a frame for cooperation with developing countries and emerging economies, therefore potentially enriches various disciplines. For scholars in science and technology studies, for example, one of the central research subjects in science policy research is on which basis policy decisions are made (Bozeman and Sarewitz 2011). Further knowledge gaps exist in view of the relation of science, science policy and societal benefits. While economic impacts of science are researched extensively, the effects of science and science policy on other social spheres have been less investigated (Miller and Neff 2013). From a sustainability and development research perspective, the relation between policy, science and sustainable development is equally pointed out as a knowledge gap, next to the effects of research cooperation (Maselli et al. 2006; Stamm 2008; Mohan and Yanacopulos 2007).

The research presented here aims to add to the existing literature on both a conceptual as well as an applied level. In applying SKAD to a policy setting, the approach is conceptually reflected and further refined. To suit the specific setting of policy making, I combine SKAD with constructivist approaches to policy processes. I consider policies as a specific type of discourse with specific rules and practices of (re)production. The practices of creating policy discourse include different planes of policy making from designing new strategies and programmes, issuing calls for

proposals, to funding research projects. Viewing policy as discourse enables me to expose the interconnections between ideas and structures in policy. In doing so, it has been useful to scrutinize the relation of stabilizing structures and practices – the discursive *dispositive* – and the spaces for agency through which actors maintain, renew, change or contest a policy discourse in the practices of policy production from decisions on topics and cooperation countries to policy implementation in funded activities.

Next to reflections on the theoretical groundings of SKAD, research also offers empirically grounded insights into processes of policy making and the consequences for the discursive contents. I demonstrate that the general discourse of German science policy, centred around the idea of fostering science for German economic prosperity, influences the concept of sustainability in science policy substantially. In consequence, funding initiatives for cooperation with developing countries and emerging economies in sustainability-related research are not aimed at global sustainability. Sustainable development rather turns into a legitimizing narrative for securing German prosperity through promoting technological, economically-viable solutions. In doing so, the concept of sustainability is narrowed and depoliticized. I argue that this has consequences for the type of knowledge produced within the German science system. In most funding initiatives empirically scrutinized, the BMBF attributed a minor role to the social sciences. As part of technology-oriented projects, the social sciences were reduced to accompanying technology implementation. However, if the BMBF, as one of the main funding institutions of applied research, neglects the larger social, cultural and essentially political aspects of sustainable development, it weakens the capacities of science to critically reflect. This means that the BMBF does not enable the German science system to adequately deal with sustainability challenges in the long run.

In the case of the BMBF's science policy for sustainable development that I empirically investigated, several factors contributed to a high degree of stability of the policy discourse. Institutional structures (such as organisational shape and bureaucratic rules), redundancies in policy processes and practices of discourse actualisation as well as the BMBF's position to exclude alternative discourse made the continuation of ideas more likely than discourse change. External discourses as well as individual agency played an important role in instances of discourse actualisation leading to change. In pointing at the spaces of agency within science policy processes, I wish to contribute to the field of literature on processes of change for sustainability (Smith et al. 2010; WBGU 2011; Wiek et al. 2012; Göpel 2016).

A last contribution targets the preconditions of research for sustainable development on several levels. The empirical insights allow an abstraction in view of recommendations aimed at research projects, the BMBF as well as at interministerial cooperation. In the context of scholarly debates on new types of cooperation

(Janus et al. 2015) these might help to adjust science policy to objectives of *mutual* benefit for global sustainable development.

1.4   Analytical structure and outline of the chapters

This book is structured in the following way: After this introduction, a *literature review* (ch. 2) gives an overview about different conceptualisations of science, science policy and potential effects on society. Different conceptions of discursive elements such as *science, innovation, policy, sustainable development* as well as their interrelation are in the spotlight of the chapter. I show that multiple conceptions of the relation between science and society exist. Potentially, science policy could be aimed at any conceivable scientific, technological or societal goals. Its implemented form therefore displays underlying social norms, choices and values. Acknowledging the potential openness of goals opens up room for investigating why a certain view dominates current German science policy.

In chapter 3, I introduce the Sociology of Knowledge Approach to Discourse (SKAD) as the *conceptual basis* of my research. The chapter exposes different approaches to the analysis of policy processes and exhibits why a theoretical framework based on the discursive construction of knowledge is an adequate approach to the analysis of German science policy for cooperation with developing countries and emerging economies.

Chapter 4 then situates my research in the corresponding *methodological context*. In choosing the perspective of SKAD, my research is embedded in a constructivist perspective. Following, I make use of qualitative social research methods for obtaining empirical data, including semi-structured interviews, participant observation as well as the analysis of policy documents. The chapter informs about data collection as well as methods of analysis. Also, I reflect about my own positionality as a researcher as well as the people whose statements build the corpus of data.

The empirical chapters of the book answer research questions around the research subject of the BMBF's science policy for cooperation with developing countries and emerging economies, firmly based on the theoretical, conceptual and methodological considerations exposed in the previous chapters. Chapter 5 provides necessary *background information* to understand why the BMBF as such, and especially its policies and funding in the area of sustainability, are relevant research subjects in view of cooperation with developing countries and emerging economies. In the first section, I give an overview of the different public actors who are involved in funding research in general within Germany, and more specifically those who fund science cooperation between Germany and developing countries and emerging economies. This helps to situate the BMBF's policies, research programmes and funding initiatives in the German context. The second section

of chapter 5 then deals with the policies, strategies and funding initiatives of the BMBF and shows the historically grown importance of research cooperation between Germany and developing countries and emerging economies especially in the field of environmental and sustainability sciences, which is reflected in BMBF policy and funding.

Chapter 6 centres on the interlinkages of structures and agency in *internal decision-making processes in the BMBF* which lead to a specific policy discourse. I show that institutional structures, rules, norms, as well as previous discourse cast into strategies and programmes play a role in shaping the specific discourse on research cooperation with developing countries and emerging economies. These structural elements make up a dispositive, which enhances discursive stability. Nevertheless, it still leaves spaces of agency for the individual actors within the BMBF to influence policies for research cooperation with developing countries and emerging economies in the field of sustainability research.

As policies are not created exclusively within the boundaries of the individual BMBF working unit or (sub-)department, chapter 7 considers the *roles of different external actors* in shaping the policy discourse. Next to experts of different types, the project management agencies are important contributors to policy discourse. In addition, interaction occurs with actors from other policy fields, both within and outside of the BMBF. The chapter thus examines why the BMBF admits certain actors into the discourse coalition on science policy, while the gates are kept shut for others. Hence, the chapter highlights whose knowledge is deemed as relevant and valid for policy, and whose is not. In addition, I expose through which mechanisms and in which processes external knowledge is integrated into the policy discourse or actively excluded.

I then turn to the *contents of policy discourse* for research cooperation with developing countries and emerging economies in sustainability research. In SKAD, discourse is considered as "concrete and material" (Keller 2011c: 48). In view of the analysis of policy contents in chapters 8 and 9, this means that I base the analysis on different types of manifest discursive statements in texts and speech, including statements in policy strategies, such as the High-Tech Strategy (BMBF 2006; 2010c; 2014) , Internationalisation Strategy (BMBF 2008a; 2016b), or FONA (BMBF 2005a; 2009a; 2015e) as well statements from interviews with BMBF staff and from the BMBF's website.

Chapter 8 focuses on the *heart* of the BMBF's policy – its *core discourse*, or *leitmotif* that coins and frames all further BMBF policies, and which consists in the concept of *prosperity through science*. *Sustainability* is a further concept used in BMBF discourse, which provides an additional frame to policies – as strategies, funding initiatives as well as interview statements – as instances of discursive events – document. I reveal the development of the discursive policy orientation towards economic innovation on the one hand, and sustainable development on the other, and

expose the current discursive usage in the BMBF's policy discourse. The final part of chapter 8 is then dedicated to the BMBF's specific policy discourse for cooperation with developing countries and emerging economies – and how the overarching leitmotifs of prosperity through economy-oriented innovation and sustainable development influence the specific subdiscourse. I show which concepts the BMBF employs as rationale for funding research cooperation with developing countries and emerging economies in sustainability research, which specific aims the BMBF pursues in doing so and how these are embedded in the core discourse.

Chapter 9 is dedicated to *two exemplary BMBF funding initiatives* for cooperation with developing countries and emerging economies in sustainability research: the IWRM funding initiative and the Megacities funding initiative (BMBF 2004a; 2004b). I reconstruct the concrete objectives of the specific policy discourse – as instances of transmitting more abstract policy discourse into more concrete effects. While the IWRM funding initiative serves as an example of an economy-oriented rationale congruent to the BMBF's core discourse, the Megacities Initiative illustrates how policy makers may use spaces of agency to deviate from the main story-line and pursue objectives beyond German economic benefits. The chapter also exposes capacity development, transdisciplinarity and cooperation on eyelevel as concepts of the policy discourse which are closely related to the policy expectation of creating impacts.

After focussing on actors and contents of the discourse within German science policy for cooperation with developing countries, chapter 10 as last empirical chapter analyzes the *discourse effects*. In a first part, the dispositive used to establish and maintain a specific discourse is exposed. In the case of science policy for research cooperation with developing countries and emerging economies, the dispositive aimed at discourse effects consists of those institutional structures and practices that transmit the objectives of policy to the project level. For example, splitting funding phases into short time contracts, can be seen as a way to exercise power over the policy discourse's effects by maintaining control over resources – as a means of preventing projects to adapt policy objectives (and thus to actualize or reinterpret discourse) in the process of project implementation. In a second part of the chapter, the effects of the policy discourse as such are illuminated. I analyze how the specific orientation of policy coins the projects, how they translate this orientation into their practice and how policy discourse thereby exerts influence on the local realities of the research projects. In pointing at the policy effects, I also consider the spaces of agency that projects use to re-interpret policy, thus, to modify discourse.

Last, the conclusive chapter 11 is dedicated to a summary of the factors of *discourse stability and discourse change* as well as the *dominance of the current core discourse* of science policy as result of the various influences exposed through this book. In addition, the chapter provides a concluding analysis of the BMBF funding initia-

tives on the normative backdrop of *global sustainable development* and gives corresponding *policy recommendations* for future funding initiatives aimed at research cooperation with developing countries and emerging economies.

2 Science in the context of sustainable development

Writing about science, sustainability and development issues and their political framing is not a straightforward task: The idea of science serving an external purpose alludes to larger philosophical questions about the relation and nature of science and society. In addition, working with terms such as *science, technology, innovation, sustainability* or *development* also calls for some reflections of these concepts before one can start considering the possible interrelations between them.

Within the following sections, I will shed light on some details of the larger theoretical context of science and potential societal goals, such as sustainable development, and on the role of science policy in this context. Exhibiting the range of possible discursive perspectives on science, society and policy and their interrelation helps to get a clearer picture of dominant perspectives of science and potential effects on sustainable development. This helps to put current policy and practice into perspective and will serve as a contrasting device for the later empirical chapters of this book.

2.1 Science for a cause? Between impact and autonomy

From a positivist point of view, science can be defined as

> "1. the systematic observation of natural events and conditions in order to discover facts about them and to formulate laws and principles based on these facts. 2. the organized body of knowledge that is derived from such observations and that can be verified or tested by further investigation. 3. any specific branch of this general body of knowledge, such as biology, physics, geology, or astronomy. (For the Latin word meaning 'knowledge')." (Gillespie 1992: 1926)

In contrast to this seemingly plain definition of science as a globally valid system of knowledge, ambiguities of the term become evident quickly from a constructivist perspective. Kuhn's seminal work on scientific *paradigms* (1962) as well as Foucault's work on *epistemes* (Foucault 2005 [1966]; 1972a) show how scientific knowledge is enabled, limited, directed, interrupted and re-interpreted through specific underlying meaning schemes. Other authors focus on concurrent diverging definitions

of science. Knorr-Cetina shows that different types of knowledge production – and subsequently different institutions of knowledge production – disintegrate science into scattered disciplines with their own standards, definitions, modes and world views (Knorr-Cetina 1999). While in its current role and function science still is "the premier knowledge institution of the world" (Knorr-Cetina 1999: 1), social scientists challenge that scientific knowledge is essentially different from any other types of knowledge (Sismondo 2008). On these grounds, science as a concept resists un-equivocal definitions – like the concepts of *development* or *sustainability*.

When it comes to its role and function in relation to society, the conceptu-alisation of science reveals even further facets. Different perspectives on science diverge regarding their conceptualisation of its aims – ranging from purely fulfill-ing scientific interest to envisaged objectives outside of science itself. For a long time, science was considered as an entity independent of society. Based on a *l'art pour l'art* conception of science, Merton's norms of a disinterested, independent and pure science (Merton 1968) were the most commonly accepted code of conduct for research during the second half of the 20th century (Jasanoff 2003). In a similar vein, Polanyi argued that autonomy of science was necessary to ensure its creativity and productivity (Polanyi 2000).

However, the assumed autonomy of science from society underlying these models of science have been increasingly up for debate and have been gradually re-evaluated; the interdependence of science with other spheres of society has been emphasized (Jasanoff 2003). *Applied* sciences, those to find solutions (often in form of economically exploitable innovation) to a specific *real-world* issue and thus not purely aimed at fulfilling scientific curiosity, have become part of the accepted canon of scientific knowledge production. In addition, boundaries between ap-plied and basic science were found to become increasingly blurry and distinctions useless (Barnes 1982; Rosenberg 1991; Jasanoff 2003). In consequence, scholars began to stress the heterogeneity of scientific modes of knowledge production in their conceptions of science and society, replacing the strict dichotomy of applied and pure science through the idea of a continuum of forms of knowledge produc-tion (among others Funtowicz and Ravetz 1993; Gibbons et al. 1994; Nowotny et al. 2001).

Today, competing discourses about the relation and interaction between sci-ence and other segments of society co-exist within the scientific community – but also in science policy. The conceptualisations range from the extreme poles of *au-tonomous* science, to the contrary idea of *relevant* science (Kaldewey 2013). Debates about the nature of science even enter the public arena (see Stock and Schnei-dewind 2014).

In view of any objectives beyond science, its *usefulness*, *applicability* or *relevance* can be defined in different ways by different actors in and for different, possibly competing, social spheres: It is highly context-dependent which type of science is

considered as socially relevant (Weingart 2008). Application-oriented technological science, for example, is often directed at economic relevance or applicability, while this *commodification* of science also is strongly contested by other parts of the science community (Radder 2010).

Next to economic usability, science may pursue other societal targets. Sustainability sciences, beyond investigating sustainable development as a *research subject* often also pursue sustainability as a *normative target*. The value of science is not purely seen in science as such, but science is viewed as a means to an end, in need of a normative direction (Ziegler 1998; Smith et al. 2010; Jahn 2013). *Development* is yet another potential societal objective of science and science policy. In order to have developmental impacts, science is often conceptualized as an impact-oriented or problem-solving type of science (Rhodes and Sulston 2009). Similarly, adherers of an engaged programme of science and technology studies seek to enhance a *socially responsible* science (Sismondo 2008) or to raise the *accountability* of science towards society (Jasanoff 2003).

Different interpretations of the links between science and society and diverse conceptualisations of scientific production and their corresponding effects on society thus coexist within the scientific community as well as in science policy (Glerup and Horst 2014). In drawing attention to these different conceptions, I'd like to emphasize the socially constructed nature of science. At the same time, the coexistence and potential plurality of conceptions of the relation between science and society raises the question why certain views persist at certain points of time in specific scientific communities as well as in science policy.

2.2   Science policy and society

Scholars point to the essential role that policies play in setting a future course and for framing societal problems, solutions and standpoints. As Clay and Schaffer noted in 1984 already, "policies can make a difference. Different policies could be chosen. There is room for manoeuvre" (1984: 1). Next to the relations between science and society as such, their governance on different levels is therefore receiving increasing attention. Due to the internationalisation of research and world-wide spread of the technologies produced, international policies with their influence on scientific networks and cooperation become important next to policies focussed at the local or national level (Smith 2009; European Commission 2009; The Royal Society 2011). The policies themselves turn into a topic of interest, as they are perceived as a lever setting the conditions for potential impact on society, including development (Bucar 2010; STEPS Centre 2010).

Science policy, in a broad sense, refers to those policies directed at fostering, organizing and steering research activities. Sarewitz et al. for example define it

as "the decision process through which individuals and institutions allocate and organize the intellectual and fiscal resources that enable the conduct of scientific research" (2004: 67).

Science policy – sometimes also termed research policy, science and technology (S&T) policy, or science, technology and innovation (ST&I) policy – is a research subject in different social sciences, including specialized disciplines such as science and technology studies and science policy studies. Within these, a range of distinct perspectives can be differentiated, drawing on different social science disciplines. On the one hand, non-normative, often philosophical issues about the nature of science policy are addressed, such as the relation between science policy and other policies, or between science policy and its impacts and further effects on society. In this line, some scholars direct attention towards science policy and governance and its function towards steering the direction of science. Authors such as Nowotny et al. (2001) or Weingart (2010) reflect on the (im)possibilities of steering science, others on changing ST&I governance structures (Jansen 2010).

In another strand of literature, a focus on the systemic effects of policies prevails. From this perspective, policy or governance are analyzed in view of their function within national ST&I systems, possible effects of policy on ST&I, including complementary functions such as in view of strengthening science-industry relations in order to foster economic development, or, in case of engaged strands of Science and Technology Studies, on the interrelations of policies, ST&I and a broader public interest (among others Perry 2007; Sismondo 2008).

In current debates, science *policy* is increasingly reconsidered as *science governance*. Conceptualizing science policy as science governance broadens the concept's scope: Next to the role of bureaucratic or political actors, officially mandated by the state, the role of multiple actors, structures and discourses outside of the bureaucratic national set up is acknowledged, which are considered to influence decisions and directions of ST&I (Irwin 2008; Stirling 2008). As I am focussing on the BMBF as a main actor of science policy, I will stick to the term of *science policy*. Nevertheless, I am aware of the role of other actors – which is reflected in the empirical chapters.

Science policy in its current profile is an invention of the second half of the 20th century. Only then did governments begin their efforts to steer science through science policy, which relied on the mechanism of granting funds for research conditional on the topic (Elzinga and Jamison 1996; Stichweh 2000; Sagasti 2013). US-science advisor Vanevar Bush's report on *Science, the Endless Frontier* (1944), which lead to the establishment of the USA's National Science Foundation in 1950, can be seen as an emblematic document of science policy, influential on later science policy in stressing how science should work for societal objectives (Guston 1997; Sarewitz et al. 2004). After the Second World War, and with the upcoming Cold War, many national science funding institutions were created and investments in

science in the USA and Europe as well as in the Soviet Union arose. These were mainly directed at building up capacities in research related to strategic defence technologies such as nuclear technologies, materials research, or aerospace engineering, while solving societal problems through science, such as through medical research, also played a role (Gassler et al. 2006; Neal et al. 2008). Science policy thus is often closely linked to other policies and instrumentalized to fulfil their corresponding objectives (Bozeman and Sarewitz 2005; European Commission 2009). However, next to following political objectives, the directions of science policy have also been influenced by public debates on science, such as in case of genetic engineering (Elzinga and Jamison 1996).

Science has been funded based on different notions of its role for society. After a phase of conceptualizing it as a *motor of progress* in the mid-20th century, science policy later targeted science as a *problem solver* and *source of strategic opportunity* (Ruivo 1994). In a major shift of paradigm, science policy has been reconceptualized as *science and innovation policy*. Since the first uptake of innovation as an objective of science policy in the 1970s, the emphasis on innovation (ch. 2.4) has increased steadily (Weingart 2011). Other authors have detected similar patterns of increasing focus of science policy on economic innovation and competitive technological change in the developing world (among others Röling 2009; Conway et al. 2010; Sagasti 2013).

The short overview of historical and current directions and orientations of science policy illustrates an essential point I want to make: In general, science policy *could* direct science towards any political aim and goal and has indeed tried to promote quite different objectives throughout history. These are predominantly not scientific objectives, but science is promoted as a means of reaching an objective *beyond* science, within other parts of society (Sarewitz et al. 2004; Sarewitz and Pielke Jr. 2007). Despite the philosophical debates about the relation of science and society, with Polanyi and Merton as prominent defenders of autonomy, science policy is mainly conceptualized as a mediator between science and society and is directed at objectives beyond fostering scientific productivity as such (Miller and Neff 2013).

Science policy thus always has a normative direction, which is not predefined: Potentially, science policies could be used to contribute to all possible scientific or technological development pathways. Theoretically all dimensions of human life could be targeted, such as fostering economic development, solving societal or environmental problems or making better political decisions (Nowotny et al. 2001; Sarewitz et al. 2004). Policies, as well as the systems that they are designed to support, are open to multiple goals, as they can be framed in a multitude of ways through different "contextual assumptions, methods, forms of interpretation and values that different groups might bring to a problem, shaping how it is bounded and understood" (Leach et al. 2010: 4). Science policy thus displays the choices and

values underlying it (Leach et al. 2012). Which directions of science are pursued, which issues are successfully pushed onto the agenda is a matter of influence and power – and of a predominant discourse (ch. 3).

At present, national science policies all over the world view science mainly in terms of its relevance and applicability to other societal spheres. Science policies purely aimed at strengthening science as such are scarce (European Commission 2009). Science policy often becomes part of a larger set of policies that shall contribute to an economically defined development agenda (Evers et al. 2006; Hornidge 2011). Given the skew towards economic objectives that can be observed in existing science policies all over the world, it is little surprising that scholars have also tried to come up with explanations as well as models of how to reach different objectives. Authors such as Jasanoff (2003), Bozeman and Sarewitz (2005), Sarewitz and Pielke (2007), Stirling (2008), Leach et al. (2010), Arocena and Sutz (2012), Guston et al. (2014), Taebi et al. (2014) or van Oudheusden (2014) view science policy from a critical perspective and argue that science policy should mediate between science and society's needs and align demands in order to endorse public values – which are not necessarily congruent with economic values. In view of economically defined science policies, Bozeman et al. express their concern that "market interest for S&T sometimes overpowers our ability to think systematically about science as the engine of social change" (2011).

While some authors, such as Guston, Taebi, or van Oudsheusen, explicitly draw on the concept of "responsible research and innovation", which emerged in the early 2000s, other scholars refer to similar notions without using the term. Authors in this line of argumentation take a strong normative perspective and argue in favour of responsible ST&I and the accountability of ST&I and the accompanying policy towards the public. The authors share the idea of ST&I as socially constructed phenomenon, emphasize the role of policy and cocreation of knowledge, thus calling for new participatory governance schemes. Policy responsiveness to societal needs is a key feature of responsible ST&I.

Authors therefore propose a close interaction of diverse stakeholders in inter- and transdisciplinary decision making and agenda setting in the policy process in order to reach deliberative, participatory, responsive policies, and in consequence "a more inclusive, democratic, and equitable science–society relationship than is presently the case" (van Oudheusden 2014: 72). Participation has been theorized from different scientific angles, including development research, social sciences and political sciences, and with different normative stances. Participation describes the phenomenon that actors who are not regularly part of a decision process (in policy making as well as other social practices) take part in decision making on issues of public relevance. Participation implies that power is transferred to the participating actors (Newig 2011).

Authors from development-oriented research, such as Arocena and Sutz (2012), Stirling (2008), or Leach et al. (2010) approach science policy from a perspective of social and environmental justice – but reach a similar conclusion. Arocena and Sutz argue for the inclusion of stakeholders in decision making as well as trans-disciplinarity in research, but also emphasize that the current academic incentive and reward system does not encourage the cocreation of knowledge or development-oriented science. They conclude that further research is necessary to study which channels of influence there are to express the needs and problems of the poor and translate them into policymaking (Arocena and Sutz 2012).

Participation in practice may be motivated by different objectives. It may be aimed at increasing emancipation of the public and democratizing society and be conceptualized as a means towards balanced decisions which take into account the needs of different groups. On the other hand, it may be aimed at increasing the legitimacy of decisions and/or efficacy of actions through public acceptance (Newig et al. 2011). This promise has led to its adoption on various political levels. In the European Union, for example, participation has been inscribed in various white papers and directives in order to enhance legitimacy of its policies and to improve their implementation (Newig and Fritsch 2009; Schaal and Ritzi 2009; Newig et al. 2011). Similarly, the BMBF makes use of participatory agenda-setting processes in designing its research programmes (ch. 7).

Stirling, Scoones, Leach and others authors have developed an encompassing framework for a political ecology/economy-based approach into science and science policy, centring on the dimensions of *direction*, *diversity* and *distribution* of science, technology and innovation (Stirling 2008; Leach et al. 2010; STEPS Centre 2010). *Direction* here refers to the technical, social and political direction of innovation, including the underlying question of benefits, stakes in particular innovations, and alternatives pathways. The choices made in science and innovation – often framed by science policy – are explained to be highly political and debatable. *Distribution* therefore relates to the share of the benefits and risks of science, technology and innovation for different social groups or causes. Bozeman et al. (2011) equally propose to investigate the distributional aspects of science-based innovations. As a means to increase social benefits of innovation, STEPS Centre researchers argue in favour of policies which foster a broad *diversity* of innovations, ranging from low to high-tech to social innovation (Stirling 2009; STEPS Centre 2010; Leach et al. 2010; 2012). From a sustainability science perspective, scholars equally call for science and science policy determined through public interests and centred on major societal and environmental challenges (WBGU 2011; Schneidewind and Augenstein 2012; Schneidewind and Singer-Brodowsky 2013a).

Given the value dimension of policies, Morlacchi and Martin point to the researcher's responsibility of analyzing policy contents to lay open the normative

skew. At the same time, the authors emphasize the normative nature of the process of analysis:

> "Our task as policy scholars is not only to provide persuasive analysis that points to problems, their interpretation and possible solutions, but also to critically examine what values (and whose values) should be taken into account in doing this [...] [I]n every society at specific times certain ultimate ends (e.g. prosperity, happiness and peace) and values (e.g. freedom and democracy) result in normative rules that shape but do not determine specific actions." (Morlacchi and Martin 2009: 580)

As the empirical chapters will show, looking closely at the policies that frame science, technology and innovation means to scrutinize underlying structures and ideas, such as how decisions are made on the type and mode of science chosen for a specific purpose. Additionally, I will expose which conceptions of (sustainable) development underlie policies and what policies ultimately aim at.

2.3   Concepts of (sustainable) development

As I resort to (sustainable) development as a normative background of my analysis of science policy, the next sections of this chapter are dedicated to tracing different conceptualisations of both *development* as well as *sustainable development*. While today, even mainstream policy and public view development as a phenomenon encompassing social, political, economic as well as ecological aspects (Klochikhin 2012), this encompassing notion is indeed quite a recent turn: For a long time, in mainstream representations, *development* was limited to economic aspects, while *sustainability* was reduced to environmental concerns. In policy and practice the discourses of *development* and *environment* still are often dealt with by different communities in separated institutional structures (Sachs 2010a; Leach et al. 2012). Therefore, I scrutinize both terms separately. I will then expose different takes on science, technology, and innovation in the context of (sustainable) development, which will provide a backdrop for the empirical analysis of German science policy for cooperation with developing countries later.

2.3.1   Development

Development is a multi-faceted concept. Thomas (2000) differentiates between different denotations of the term *development*. While historical developments present one facet, another meaning denotes a vision or idea for the future, closely related to specific objectives and aspirations, which present a further meaning of the term. Last, development (cooperation) can also signify the intentional practice aimed at a specific kind of improvement. Similarly, Kothari and Minogue (2002) distinguish

between ideas, objectives and activities as interrelated elements of development as an idea. The authors agree that next to multiple development theories, there are also multiple objectives and practices of development: It is open to different, context-dependent conceptualisations. Rist (2007) argues that in most conceptualisations of development the normative aspect of positive change prevails, which often deviates from actual processes taking place on the ground.

In practice, *development* has been interpreted in different ways in different time periods and by different actors in different development paradigms (Cornwall and Brock 2005; Gore 2000; Ziai 2011). Historically, a multitude of different definitions and interpretations have succeeded and co-existed, often contradicting and contesting each other (Kothari and Minogue 2002). The openness of development as a term has enabled different actors to use the concept according to their own interests. Different conceptualisations of development therefore mirror the underlying worldviews of those in power to form the prevailing concept of development (Thomas 2000; Kothari and Minogue 2002; Cowen and Shenton 2003; Rist 2007; Cornwall and Eade 2010; Esteva 2010; Ziai 2010; 2014; 2015).

While concepts and agendas have changed over time, still there is little consensus on what exactly is to be understood by development, how it can be reached, or if it is even desirable to achieve it (Ziai 2009). On the background of the multiplicity of perspectives on development, scholars of a critical social science perspective acknowledge the discursive nature of the development agenda. Instead of searching for a shared, unambiguous definition, authors discuss the underlying issues of power, knowledge and resulting practices in international cooperation which follow from the specific way development is defined in the predominant discourse (Escobar 1992; Gardner and Lewis 2000; Gore 2000; Esteva 2010; Ziai 2010; 2015; della Faille 2011; Nederveen Pieterse 2011).

The idea of development has historical roots in the 19th century, when first intentional development thinking and practice emerged in Europe. First directed at alleviating social problems in the own country, stemming from rapid urbanisation during industrialisation, the idea of development as a state intervention was then extended to the colonies. Here, the objective was to *modernize* traditional societies by triggering economic growth and introducing modern institutions, values and norms (Crewe and Harrison 1998; Cowen and Shenton 2003).

As a discourse, embedded in institutions and practice, and thus in a dispositive sustaining the idea (ch. 3), development grew strong in parallel to the rise of capitalism after World War II. Many scholars point to US president Truman's inaugural speech (1949) as a marker of the beginning of the era of development as practice as we know it today (Rist 2007; Esteva 2010; Sachs 2010a; Ziai 2014). Even in postcolonial times, development discourse was based on the idea of modernisation: Development represented a transition to a *modern* society through economic, scientific and technological progress, which were understood to enable social and economic

upwards movement. Development discourse, modernisation and capitalist values are closely intertwined in this conceptualisation (Norgaard 1994; Crewe and Harrison 1998). The underlying assumption was a linear transition, or rather progress, from one stage of development to the next, with the western industrialized nations as examples to follow (Smith 2009). Modernisation thinking was prominent in the *take-off* model, depicting the stages of economic growth, which pictured innovation as a key factor for economic development (Rostow 1990 [1960]).

Since the mid-20th century, the discourse on development has been wildly successful. It is sustained by national governments (of developing countries, emerging economies as well as industrialized countries), in international organisations as well as by NGOs (Gore 2000; Mitlin et al. 2007) and has been converted into a binding international frame in form of the United Nations' Millennium Development Goals, followed by the Sustainable Development Goals (UNDP 2013a; UN 2015).

Despite of the overall stability of a modernisation-based development discourse, in the worldwide diffusion of the development discourse, meanings of development and resulting practices have fluctuated. Some reconceptualisations have successfully entered mainstream discourse in development policy and practice. After market-oriented, neoliberal approaches to development prevailed in the 1980s (Gore 2000; Esteva 2010), the dominant development discourse began to diversify. Instead of uniform theoretical approaches pushed by the state as main actor, different stakeholders with different concepts and approaches began to contest the notion of a single possible development path and added further dimensions of development to be tackled. Some alternative ideas, such as participatory development and ownership concepts began to influence mainstream development approaches (Cowen and Shenton 2003).

Nevertheless, the idea of modernisation continues to lie at the core of most development concepts in theory, policy and practice as a sort of *meta theory* (Kothari and Minogue 2002) and mainstream development concepts continue to be inherently linked to capitalist ideas of reducing poverty through increased economic activities and growth (Thomas 2000; Cowen and Shenton 2003; Rist 2007; Esteva 2010; Sachs 2010a). In addition, certain assumptions coined during colonialism, such as beliefs in the superiority of the metropolitan economy, technology, institutional organisation and governance, expertise and knowledge underlie even postcolonial development theories and practice (Kothari 2002; Ziai 2010). This explains why more radical reconceptualisations of development have developed into an alternative discourse rather than being taken up in mainstream development policy and practice. At the furthest pole, post-development discourse questions the underlying assumptions of development and contests its desirability. As such, it seems inherently incompatible with the current ideas and practice of mainstream

development discourse (Nederveen Pieterse 1998; Escobar 2000; Ziai 2010; Esteva 2010).

Considering nature as part of development, thus including an ecological dimension in the conceptualisation of development is a quite recent phenomenon. For a long time, development and ecological concerns seemed to be incompatible, and were dealt with in different discursive communities. In the 1970s, discourses began to interlink, finally leading to the emergence of a discourse on *sustainable development* (Sachs 2010b).

2.3.2   Sustainable development

The concept of sustainability, or sustainable development, most frequently defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987: 41), increasingly gained currency during the late 20th century. As a concept, *sustainability* stems from ideas on long-term forest management and was first mentioned by von Carlowitz in 1712. However, it did not achieve widespread usage until it was taken up in the environmental debates leading to the publication of *Our Common Future* by the World Commission on Environment and Development (WCED, the Brundtland Commission) in 1987, source of the famous quote above. The WCED turned sustainable development into its central concept, paving the road to the first United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992 (Scoones 2010). This milestone event, also termed Earth Summit, lead to the publication of key documents for the further conceptionalisation and implementation of sustainability, such as the Agenda 21, the Rio Declaration on Environment and Development, the United Nations Framework Convention on Climate Change or the United Nations Convention on Biological Diversity, among others (UN 1997).

The idea of sustainable development introduced a notion of development into worldwide policy making that included environmental aspects next to social, political and economic ones (Redclift 2005). As conceptualized in the Brundtland Commission's report, sustainability thus encompassed human needs as well as environmental ones and thereby presented an alternative to the prevailing economy and growth-oriented development model (Hopwood et al. 2005). Similarly, the Rio Declaration stressed the interdependence of social, environmental and economic aspects as three pillars of sustainability and called for an integrated development (UNCED 1992a).

While quite unanimously, the Brundtland Report as well as the Earth Summit are viewed as starting points of a sustainable development discourse on a larger political and societal scale, the conceptualisations introduced have been criticized, further developed, reinterpreted and extended. In consequence, subdiscourses of sustainable development coexist today, exposing a diversified range of stances and

approaches (for an overview, see Robinson 2004; Hopwood et al. 2005; Redclift 2005; Hugé et al. 2013).

Most concepts of sustainable development still coincide in encompassing environmental, economic and social concerns and considering the interactions between these dimensions (Keiner 2005). They differ in their interpretations and weightings, however. Hugé et al. (2013) differentiate between subdiscourses according to their emphasis on the interdependence and integration of the dimensions of sustainability; the conceptualisation of boundaries set by the environmental carrying capacities; and the process of change envisaged.

Hopwood et al. (2005) introduce a continuum of standpoints on sustainability along the level of concern in view of socio-economic equality on one axis and the level of ecological concern on the other, thereby arranging extremes such as neoliberal economics, socialism, ecosocialist/ecofeminist movements as well as ecofascism on different ends of the axis (Hopwood et al. 2005: 41). In view of the extent of changes pursued, followers of different strands of sustainability subdiscourse can be additionally categorized as supporters of the status quo, as supporters of incremental change and reform or as supporters of substantial transformation. Furthermore, approaches can be differentiated according to their take on technology as a potential substitute of natural resources (weak vs. strong sustainability debate).

Some of the most influential subdiscourses of sustainable development in current policy making – followed by institutions such as the OECD or the World Bank as well as national governments – include the subdiscourses on the *green economy* (and related green growth or green innovation), and *ecological modernisation* (Hopwood et al. 2005; Schwachula et al. 2014). These stances can be positioned at the economy-oriented end of the continuum proposed by Hopwood, relying on technological means to solve environmental concerns.

Ecological modernisation as well as green economy discourses believe in saving the environment with the economy's help, mainly through technologies such as renewable energies (Mol and Spaargaren 2000; Mol and Sonnenfeld 2000; Brand 2012). Conceptualisations of sustainability from an ecological modernisation or green economy perspective rarely address social issues such as equality or power issues (Unmüßig et al. 2012; Jessop 2012; Partzsch 2015). Similar to green economy or ecological modernisation, green innovation approaches argue for maintaining the current system while adding green innovation systems to foster the development of eco-friendly technologies (Altenburg and Pegels 2012).

Neither ecological modernisation (nor green growth or green innovation approaches) belief that current institutions, such as the state or the economic system, require fundamental changes in order to reach a sustainable future (Mol and Spaargaren 2000). This makes them quite attractive for economic and political actors who are interested in maintaining the current status quo. Not surprisingly, ideas

of eco-modernisation and green economy have turned into the dominant subdiscourse of sustainability in policy and economy (Redclift 2005; Martínez-Alier et al. 2010; Wright and Kurian 2010).

In contrast, critical scholars point at the inherent ambiguity of the concept of sustainable development in view of reconciling economic progress as well as social development while respecting the environment – which is perceived as an internal conflict of goals (Robinson 2004; Redclift 2005; Sachs 2010b; Brand 2012; Hugé et al. 2013). Therefore, sustainable development is critically perceived as the "21st Century's wicked problem" (Göpel 2016: 183).

More radical views on sustainability therefore demand system transformations towards more sufficiency instead of efficiency in production and consumption. For example, as a recent critical perspective, degrowth perspectives stress social and environmental concerns. Based on the argument that "growth is not the solution but a part of the problem" (Martínez-Alier et al. 2010: 1742), degrowth opposes green growth or ecological modernisation as unsustainable pathways. Instead, the degrowth discourse challenges the traditional social primate of the economy, thus calling for a deep systemic transformation of society as a basis of sustainable development (Martínez-Alier et al. 2010; Demaria et al. 2013; Brand 2014).

In view of the diversity of competing definitions, contemporary scholars seem to agree that there is no single, unified concept of sustainable development. No standard objectives, goals, or pathways to reach sustainable development can be agreed upon. As a discursively constructed concept, which includes a normative dimension, sustainable development is open to different interpretations, which reflect the particular discursive perspective of the interpreter (Robinson 2004; Hopwood et al. 2005; Redclift 2005; Sneddon et al. 2006; Wright and Kurian 2010; Unmüßig et al. 2012; Hugé et al. 2013).

The diversity of different discursive conceptualisations as well as the own internal ambiguity allows a broad range of societal actors to subscribe to sustainable development. This may explain its wide usage and its success as a discourse on the political as well as other societal levels. Instead of discrediting sustainable development as an empty term, some scholars therefore consider sustainable development as a boundary term, which bridges different ideas and different groups of actors, including scientists as well as policy makers and civil society (Scoones 2010). Sneddon et al. equally contend that the concept supplies "some common ground for discussion among a range of developmental and environmental actors who are frequently at odds" (2006: 259). The discursive nature of the term thus may turn into a potential if ambiguities and conflicts of interest and goals are laid open and discussed in broad participatory processes.

Other scholars however paint a direr picture. According to different scholars, the ambiguity of the term does not lead to a reconcilement of interests and conflicting goals (Hopwood et al. 2005; Robinson 2004; Wright and Kurian 2010; Hugé

et al. 2013). Instead, they perceive the ambiguity as a danger: The vagueness allows deviation from the threefold objectives of sustainable development in favour of specific interests. Sustainability as a term therefore is open to co-option. Instead of leading to change, the concept of sustainable development enables politics and economy to maintain their status quo and continuing previous practices, while still profiting from a rebranding and seemingly doing the right thing (Redclift 2005). In the last years, labelling things as sustainable has become a normatively accepted disguise for economic growth, and as such appropriated even by neoliberal politics (Jessop 2012). Similarly, green activists put forward that the term has suffered a hostile take-over:

> "A 1980s term that was formerly emancipatory and critical of the system has been absorbed by Realpolitik and the economy, as well as ruling institutions and mindsets, and associated with meanings and reform options that are acceptable to them." (Unmüßig et al. 2012: 21)

The coexisting conceptualisations of (sustainable) development document that development is best perceived as a socially constructed phenomenon. As such, it must be understood as a contested, changing, and normative concept – and it is not the aim of research to give a satisfactory definition of the term. Rather, I acknowledge that manifold discursive positions have historically evolved and continue to co-exist contemporarily in science, in civil society, in policy, in institutions of development cooperation, with different agendas and aims.

As I am specifically interested in investigating and exposing in which way the concept of sustainable development is constructed in the policies of the BMBF aimed at cooperation with developing countries and emerging economies, the next section will deal with the potential impact of science (and its political frame) on sustainable development.

2.4   Science, innovation and (sustainable) development

The idea of knowledge as a precondition of (sustainable) development has a long tradition and continues to be maintained without big controversies in current development practice and policy (Hornidge 2012). Embedded in a discourse of knowledge for development, striving for knowledge as a driver of future development has become a normative goal that many governments and institutions adhere to (Hornidge 2014a). Similarly, and although certain aspects of the concept of knowledge for development are debated in the scientific community – such as its best use (Narayanaswamy 2013); the role of local or indigenous knowledge and problems of conceptualizing it as opposite of scientific knowledge (Agrawal 1995; Sillitoe 2000;

Mosse 2001) – the development discourse in science has generally been affirmative of the role of knowledge (Hornidge 2013).

Factual types of knowledge often are transmitted through the formal educational system. Scholars generally endorse knowledge in form of literacy or other basic knowledge-related skills, and consequently push for the access to primary and secondary education (Klochikhin 2012: 48). The value attributed to knowledge is also reflected in development policies worldwide. Creating knowledge through education was one of the Millennium Development Goals (UNDP 2013a) and is one of the SDGs as well (UN 2015). The Human Development Index includes knowledge, measured through average and expected years of schooling (UNDP 2013b) and primary, secondary and tertiary education as well as capacity development on other levels are a focus of national development cooperation policy such as in Germany (BMZ 2010).

The role of science in the context of knowledge for development is more controversial and contested than that of education. While the role of education is mainly to transmit *existing* knowledge, science generally implies generating *new* knowledge. The idea of turning science, technology and innovation into a lever of a development process can be traced back to colonial times (Smith 2009). Since then, ideas of knowledge transfer and of science and technology as a panacea for development have prospered, often in modernist approaches. The World Bank's report on *Knowledge for Development* (1999) for example still followed this line of thinking (Hornidge 2014b). In current scientific literature, different perspectives on science and its impact on different aspects of human societies can be traced. Especially in view of (sustainable) development, perspectives cover a broad spectrum ranging from positive accounts to more reflexive views which stress the complexity of the interrelation between science and society, or on possible negative or unintended consequences of science.

Different scientific perspectives on the potential effects of science on development diverge in two main points, namely the scope and the scale addressed. Some concepts exclusively focus on isolated dimensions of development, such as the role of science for economic development, while other concepts look at the phenomenon from a more encompassing perspective and consider social and environmental aspects next to economic ones, thus displaying a larger conceptual scope. In view of their scale, perspectives differ regarding the level of development addressed: Regarding the potential contribution of science for development, some strands of literature focus on an overarching systemic level, such as on the transformation of societies towards sustainability (Geels 2004; Geels and Schot 2007; WBGU 2011). In contrast, other concepts rather address how science can contribute to solving concrete problem in smaller scale research projects. They are thus directed at a context-dependent, problem-specific level and often focus on the mode of knowledge creation.

2.4.1 Innovation as impact of science on the real world

If science is viewed in terms of its relevance and applicability for (sustainable) development, a crucial element is to transform scientific knowledge into impact outside of science (Sarewitz et al. 2004; Douthwaite et al. 2007). The process of creating impact, thus describing the relation between science and societal aspects, can be illuminated through the concept of *innovation*.

There are conceptual linkages between innovation and technology. In everyday language, both terms often have connotations of *high-tech* and science-based inventions. Technology however primarily denotes "the practical application of knowledge especially in a particular area"; "a capability given by the practical application of knowledge"; as well as "a manner of accomplishing a task especially using technical processes, methods, or knowledge", and "the specialized aspects of a particular field of endeavour" (Merriam Webster 2017).

Other definitions, such as the Oxford Dictionary's, stress the scientific origin of the knowledge applied (Oxford Dictionaries 2017a). Interestingly, both definitions stress the process character of putting knowledge into practice rather than characterizing technology as a material technological object. In the sociology of technology, scholars similarly stress that technology may describe a physical artefact, a process or an activity, as well as the knowledge – or know-how – about creating an artefact or a related process. These may or may not be science-based (Bijker et al. 1987).

Like technology, innovation denotes a process and/or result of creating an effect on the *real world* through knowledge. As other terms analyzed here, innovation does not have a fixed definition, but is defined in context-dependent social processes of knowledge creation. Originally, innovation was introduced as an economic concept. The Austrian economist Joseph Schumpeter coined the term in the 1930s, defining innovation as a new combination of factors that lead to a commercial or industrial application of a new product, process, market, supply source or organisational change (Schumpeter 1934; Fagerberg 2006).

Until today, innovation is predominantly interpreted as a narrow, economy-related concept, including in science policy all over the world. However, it has also been redefined in multiple ways and is now widely conceived as a social process (Jamison 1989). In non-economic conceptualisations, innovation refers to any novelty which is implemented in a specific context, or to the process of its implementation – not necessarily aimed at economic benefits (Röling 2009). Objects of innovation can then be material phenomena, such as a technology, or non-material innovations, such as a new technique, organisational or process-related changes, or social processes (Ul Hassan et al. 2011).

Potentially, science-based innovations thus may occur at have various entry points to the *real world*. Scientific results or research-based technologies may be

adopted in form of an innovative technology, product or process leading to poverty alleviation, enhanced food security, or solutions to other social, economic or environmental problems. Innovative ideas based on scientific results may change public perceptions and individual behaviour; they may influence policies and governance structures (Sumner et al. 2009).

An essential part of any innovation process is its adoption, dissemination or implementation. Only the actual uptake of an *invention* (or a new idea) in the real world converts it into an innovation (Jamison 1989). Linear theories, including the influential book on the *Diffusion of Innovations* (Rogers 1962), suggest that basic research is followed by applied research, which leads to product development, production and diffusion as a final step (Godin 2006). The idea of a linear innovation process was highly influential on past innovation policies, as well as policies and institutions of other policy fields, such as development cooperation or agricultural policies which promoted agricultural innovations via extension organisations (Chataway et al. 2006; Röling 2009).

Douthwaite et al. (2003) argue that a linear conception of innovation is closely related to a positivist research paradigm, which conceives of end-users of an innovation as passive recipients of a scientifically-tested novelty. Following from the perception that scientific knowledge a superior type of knowledge, it is thus the users' fault if an innovation is not successful. In contrast, constructivist approaches perceive innovation as a process of social interaction, learning and knowledge-generating. Research therefore does not only need to cover the investigation, but the implementation phase of an innovation as well. The users, included in the process, are part of a process of socially constructing an innovation.

While a few scholars still stick to the linear models, such as Balconi et al. (2010), most scholars both in economics as well as other disciplines now conceptualize innovation as a more complex phenomenon. In economy-targeted innovation, the idea of innovation as a complex process is now an established notion (among others Jamison 1989; Rosenberg 1991; Nelson 1995; Lundvall et al. 2002; Edquist 2006; Aghion et al. 2009). In development-oriented innovation research, linear models are equally considered as outdated. Different researchers shows that the interaction and cooperation of innovation producers and users, such as scientists and non-scientific stakeholders, is highly relevant to ensure high adoption rates: Users know best which characteristics to look for in potential innovations, and how to adapt new technologies according to their needs (Lundvall 1985; Douthwaite, Keatinge et al. 2001; Douthwaite 2002; Röling 2009; Arocena and Sutz 2012).

The conceptualisation of innovation as a non-linear and social process further extended the term's scope. Innovations are now recognized as not necessarily stemming from science. Other types of practical and non-scientific knowledge have led to major changes in practices or technologies throughout human history (Röling 2009). On the conceptual level, development-related concepts of innovation and

technology, such as *appropriate technology* (Schumacher 1973) or *grassroots innovation* (Seyfang and Smith 2007) are mainly not science-based and show that innovation may spring from different valuable sources of knowledge applied in a new context, including local or indigenous knowledge. Scholars reflecting on innovation in view of development nevertheless acknowledge the opportunities inherent to science (Rhodes and Sulston 2009; STEPS Centre 2010).

Tracing effects

With the objective of science policy to cause effects in the real world, it is hard to get around the concept of impact. Tracing and measuring impacts of policy, or research undertaken in its frame, is scientifically difficult and *not* an objective here. It nevertheless seems essential to point at the pitfalls of *impact* and at the same time explain in which sense impact turns into a matter of investigation here.

In impact-oriented research, creating effects in form of innovations for sustainable development is considered as more significant than standard measures of evaluating science. Indicators such as numbers of peer-reviewed articles, or of measuring a purely commercial value of an innovation through the number of patents produced do not represent impact adequately (Douthwaite 2002; Maselli et al. 2006; STEPS Centre 2010; Ely and Oxley 2014). Results of technological and natural science-based research are often viewed in economic terms, defined as technology transfer or economic innovation, and measured through indicators such as numbers of patents, commercialisation of a product, or the amount of third-party funding from industry. In contrast, non-technological or non-commercial forms of innovation in society are investigated less and consequently conceptualized less. No standardized criteria for measuring knowledge transfer or social impact exist yet, that could serve as a base of comparable indicators for impact across different social sciences disciplines (Froese et al. 2014).

Nevertheless, science policy makers, science funding institutions as well as researchers themselves are increasingly interested in evaluating societal values of research, next to traditional indicators of scientific excellence and of economic usability (Bornmann 2013). In the US, for example, the National Research Foundation has introduced a criterion for evaluating the broader societal value of science next to scientific excellence – albeit contested and confusing to many researchers (Sarewitz 2011).[1]

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1 The missing practice of an evaluation beyond economic benefits clearly sets impact-oriented research and science policy off from development cooperation and development policy, whose programmes have a stronger tradition of evaluation due to international agreements on aid effectiveness as well as strong pressures of accountability within donor countries. While evaluation has turned into a common practice among development cooperation agencies, researchers are reflecting about the adequacy of framing, measurement of results, and effects of evaluation on policy directions in this policy area as well (Holzapfel 2016).

While most researchers engaged in applied, problem-solving types of researchers embrace positive outcomes and effects of their doing, many reject the idea of its measurement. Douthwaite et al. suggest that positivist, i.e. linear approaches to impact fail, as impact proves to be non-linear and complex. Culture, context and other circumstances matter, as knowledge emerges in social processes. Any ex-post impact assessment would require baseline studies to compare against (Douthwaite, deHaan et al. 2001; Douthwaite 2002; Douthwaite et al. 2003). Other scholars similarly put into question if it is possible to measure impact in a scientifically sound way at all: First, science-based impact can occur on many levels in many dimensions. Science may provide concrete solutions for specific problems, such as new treatments for a disease, a new agricultural practice to improve food security, an integrated resource management strategy to guide a socio-ecological system to a more sustainable pathway, the introduction of a pro-poor policy. Next to direct impact on the social, economic or ecological environment, impacts may consist in changes of behaviour, in policies, in mobilizing civil society for a certain cause, in developing individual or institutional capacities, etc. – manifold ways of conceptualizing impact co-exist (Bozeman et al. 2003; Pregernig 2007; Sumner et al. 2009; Brewer 2011; Wiek et al. 2014).

Second, unequivocally tracing causalities is often impossible: Impact may have multiple causes, complex factors, and may be a non-linear result of research. Constructivist approaches to impact also acknowledge the role of external circumstances. Existing networks among stakeholders and policymakers, the power constellations at place may open a window of opportunity for a research-based innovation, or keep it shut (Douthwaite et al. 2007; Sumner et al. 2009; Martin 2011; Ely and Oxley 2014).

Third, impact may also occur in unforeseen and unintended ways. For example, science-based innovation leading to economic growth might aggravate inequality at the same time, medical research might not produce expected impacts on reducing infection rates, the introduction of a new crop variety might lead to abandoning more nutritious ones, etc. (Douthwaite, deHaan et al. 2001; Sarewitz et al. 2004; Smith 2009). Ely and Oxley (2014) additionally emphasize that science may take decades in producing impact, while other effects may only be temporary, or endeavours of creating impact may be in vain. Viewed from yet another perspective, the appreciation of an impact as desirable or not itself involves normative decisions and depend on societal value judgements, thus complicating impact assessment from an ethical point of view (Martin 2011; Brewer 2011).

To add a further layer of complexity, it is necessary to distinguish between effects of research and effects of the science policy that frames it. Policies do not *control* research, but only frame it through its policy objectives. Science policy thus does not cause *direct* effects – apart from shaping the science system as such – but uses research as a mediator to affect reality. The European Commission there-

fore puts into question if it is possible at all to determine causal relations between policy and effect (European Commission 2009). From a policy science perspective, scientists have also questioned the possibility of policy evaluations, doubting that evaluations of policy will produce meaningful results – due to the inherent normativity and the interest in institutional survival (Wildavsky 2007 [1979]; Jann and Wegrich 2009).

On this background, I do *not* aim for any type of impact evaluation, neither of research projects nor of science policy. Rather, I will convert the BMBF's assumptions about impact into a research subject and expose the ministry's conceptualisations of impact – and the effects these have on the projects (ch. 9, 10). Apart from scrutinizing complex causalities, it is a ground laying philosophical question if impact expectations on research are justified. Considering that an essential characteristic of science is that it is a *search* process seems to imply that knowledge-generation is an open-ended process without predetermined results.

Despite the restrictions in view of impact assessment outlined above, it is possible to outline the effects that science potentially may have on different developmental aspects. These range from intended or unintended consequences; from traceable to assumed effects; and from locally-bounded specific innovations to effects on a more systemic level.

2.4.2   Systemic impacts of science on sustainable development

Most countries, so-called developed as well as developing countries and emerging economies alike, strategize systemic impacts of science mainly in view of *economic* development, which they place in the heart of development (ch. 8). While in the academic community, the prevalence of economic growth and international competitiveness as main objectives of science policy are viewed critically (Ober and Paulick-Thiel 2015; Schaal et al. 2014), science and innovation policies are often set to contribute to economic development (Hornidge 2011; Evers et al. 2006).

Although the direct causality of science (in terms of expenditures on science, technology and innovation) triggering economic development (in terms of an increasing Gross Domestic Product) is up for debate, many international organisations and governments continue to base their science and innovation policies on this linear perception. Investments in science are believed to lead straight ahead to economic wellbeing (Hornidge 2013). International organisations promote investments in tertiary education, science and technology to build knowledge-based economies, often referring to cases of the *Asian Tiger* states, such as Korea, or BRICS countries with successful innovation systems and growth rates as models (among others Brito and Schneegans 2010; World Bank 2007; OECD 2012). Many governments have readily taken up the idea of a correlation. In their science policy, they promote knowledge society concepts, and thus emphasize the links between sci-

ence, technology, innovation and the productive sector in commercial innovation processes (Bechmann et al. 2009; Hornidge 2007; 2011; 2013).

The notion of innovation systems is the widest spread conceptualisation of how science, technology and innovation lead to economic growth, developed in the 1980s by economists Freeman, Soete and Lundvall (Freeman and Soete 1997; Lundvall et al. 2002; Fagerberg 2006). The elements commonly considered as essential for an efficient innovation process in the innovation system approach are human capacities in public and private sectors, including social as well as scientific capital; a sound institutional frame; supportive governance structures, policies, incentives, and the availability of public and private funds. These elements are dynamically interlinked in the system. They interact, influence, and condition each other in the process of generating, disseminating, and using new knowledge (Lundvall et al. 2002; UN Millennium Project 2005; Hall and Dijkman 2006; Kadura et al. 2011). From a growth-oriented, economic perspective, embedded in innovation systems science turns into a means of structural development of the economy. The economic benefits of technological innovation in developing countries are stressed, based on the rationale that general economic growth at the same time leads to poverty reduction (among others Conway et al. 2010; Lundvall et al. 2009; Chaminade et al. 2009; Klochikhin 2012).

However, past experiences have shown that growth does not necessarily go hand in hand with improved living conditions for all – it does not simply trickle down to the poor or lead to social inclusion. Purely economic approaches to innovation are therefore increasingly questioned in the development science community. Scholars such as Arocena and Sutz (2012) put forward that among other factors, innovation as driver of pro-poor economic growth would require the integration of social objectives and innovation policies: Neither innovation capacity nor economic growth are guarantees for more equality or a fairer society. In fact, innovation systems can even enhance inequalities of income or education. Other negative side-effects of innovation include rising food prices after certain innovations, such as in the case of first-generation biofuels, when cultivation of biofuel crops started to compete with food crops (Altenburg 2009; Cozzens and Kaplinsky 2009).

Still, the potential for systematic and targeted poverty reduction or social inclusion through innovation is widely neglected in most economy-related innovation approaches (Cozzens 2008a; Altenburg 2009). A smaller body of literature therefore focuses on reshaping the economic innovation process into a more inclusive endeavour. *Products for the poor* are one possible pathway of letting marginal groups benefit from innovation, while at the same time opening business opportunities for firms in the process of elaborating affordable products for the poor (George et al. 2012). An additional element of an inclusive innovation system is to create labour opportunities within the innovation process (Altenburg 2009). Tackling structural

challenges that affect developing countries, such as food security, sanitation, or public infrastructure is another dimension of pro-poor innovation. However, in most innovation systems, incentives are lacking for pro-poor innovation. In economic terms, pro-poor innovation is surrounded by a market failure situation. Issues relevant for poor or otherwise marginal social groups lack a market of affluent consumers as well as strong stakeholders who push the topic on the public and policy agenda; intellectual property rights on technologies hinder their usage in a pro-poor context. Adequate policies and support therefore are of major importance in making up for adverse market conditions. So far however, science policies are seldom geared towards a pro-poor innovation system (Cozzens 2008a; Arocena and Sutz 2010; 2012).

Like issues of social development, ecological concerns are still mainly neglected in economic innovation concepts. While ideas of green innovation systems have conceptually entered policy advice by international institutions such as the OECD (OECD 2011; 2013), the idea of transitions towards more sustainability-oriented innovation systems has not had far-reaching impact on worldwide policies (Stamm 2009). In most countries – industrialized as well as developing countries and emerging economies – economic development goals, to be reached through higher growth rates, continue to compete with ecologically defined development goals. This poses a normative dilemma especially for developing countries. Extending innovation concepts targeted at strengthening the economic dimension of development, sustainability-oriented innovation research therefore has developed approaches to reconcile economic development and sustainability (Stamm 2009; Altenburg and Pegels 2012). The models are directed at greening the economy and are above all targeted at developed societies (Markard et al. 2012). They are closely related to concepts of the *green economy.*

Innovation, social and ecological aspects of development

The different perspectives on innovation systems described above address a structural, systemic level of economic development, with different degrees of concern about social and environmental dimensions of development. Even the approaches oriented towards inclusive or green innovation systems approach innovation from a point of view *within* the market economy. They conceptualize innovation as a process that is inherently defined by economic viability. Rather than sketching alternatives to economy-driven innovation processes, they *adapt* innovation concepts with an economic focus. In contrast to these economy-related conceptualisations of innovation, a further body of critical development and sustainability research advocates non-economic conceptualisations of science, innovation and technology to reach inclusive, pro-poor development – often also including sustainable ecological perspectives.

Some of these alternative concepts of innovation take a holistic, systemic view on the phenomenon of innovation for sustainable development, detached from the economy. Next to high-tech and economically viable innovations, other types of innovations, such as low-tech, social and institutional innovations might be equally effective in finding context-adapted, socially just solutions for development challenges. Innovations may be science-based but may equally be based on local knowledge (Smith 2009; STEPS Centre 2010; Ely et al. 2010). Allowing for a broad diversity in the type of innovation minimizes the risk of technological lock-in processes and thus ensures resilience in view of global challenges (Stirling 2009; STEPS Centre 2010; Leach et al. 2010; 2012).

Characteristically, the alternative, sustainability-oriented concepts of innovation reflect comprehensively about the intentional or unintentional consequences of a certain innovation. Science and innovation may lead to positive as well as negative impacts on socio-ecological-economical systems (STEPS Centre 2010; Hornidge et al. 2011). The WBGU (2011) states that in view of any technology to be introduced as alternative to an established one, systemic impacts on the global climate, on resources, on other environmental effects as well as on economic and social consequences should be considered carefully. Seemingly local-scale, problem-oriented innovations can have impacts on the systemic level, even if these were not originally intended. During the Green Revolution, for example, focus was put on new crop varieties for better yields. However, not much attention was paid to agricultural context, practice, adoption or further consequences of introducing new varieties. Thus, positive effects on yields were produced, but the introduction of the new technologies also had far-ranging impacts on the larger social, political and environmental scale (Douthwaite 2002; Smith 2009; Conway et al. 2010).

A potential consequence with positive systemic impact on society is the further development of science- and innovation related capacities accompanying science-based activities for development. General capacity development in science as well as science management leads to the development of a functional scientific system and a critical mass of academics (Gijzen 2005; Velho 2006). In addition, even outside of academia, well-educated staff with university degrees can make better-informed decisions both in the public as well as the private sector. Scientific education is also essential to adequately decide about, deal with or to adapt future science-based innovations for the benefit of all sectors of society (Arocena and Sutz 2010).

Put more generally, a functioning science (and higher education) system in developing countries can contribute to the capacity to develop in self-determined and self-reflective ways and to use one's own potentials. A (scientifically) educated critical mass of citizens may take better-informed decisions, set and achieve own societal goals. Next to strengthening democratic processes at national level, developing countries may also benefit from increased capacities in the international

political context, such as in the UN, for example. Scientifically educated and capable citizens enable societies to reduce dependence on donor countries, to elaborate an own developing countries' approach to solving global problems (Cozzens 2008b; Conway et al. 2010; STEPS Centre 2010). It is little surprising that academic capacity development has turned into a common element of programmes for research cooperation between industrialized countries and developing countries or emerging economies. Examples include science capacity development initiatives by the German Academic Exchange Service (DAAD 2017) or within BMBF programmes for international cooperation (Borchardt et al. 2013).

2.4.3   Problem-oriented research

Next to the impact on the systemic level, science can also have a more immediate effects on a context-specific, smaller scale of sustainable development. Researchers have therefore begun to reflect about the impacts on society, on the real world, for the benefit of the problem owners. Gibbons et al. (1994) approached different types of knowledge production by establishing idealtypes of *mode 1* and *mode 2* science. In this conceptualisation, disciplinary, often non-application-oriented ways of producing knowledge in a *mode 1* type of science are differentiated from a *mode 2* science, which is characterized as interdisciplinary, context-sensitive, and conducted towards an application aim. It is characterized by heterogeneous organisational forms and leads to the creation of *socially robust knowledge* (Gibbons et al. 1994; Nowotny et al. 2001). Similar ideas of science are expressed in concepts of *post-normal science* (Funtowicz and Ravetz 1993). At the same time, ideas of non-linearity in knowledge creation also gained influence in economic innovation studies. Researchers recognized the need of opening up knowledge production towards non-scientific actors such as consumers or governments in order to produce usable results, models shifted towards concepts such as triple helix concepts or national systems of innovation (Lundvall 1985; Etzkowitz and Leydesdorff 2000; Edquist 2006).

A similar idea is expressed in the concept of transdisciplinarity, a concept originally developed by Mittelstrass and now widespread in sustainability sciences (Mittelstrass 2011). Like *mode 2* science, transdisciplinary approaches are characterized by problem-, policy-, and impact-orientation. Furthermore, all possible dimensions of a complex problem and all types of interventions, solutions or entry points for change are considered, including the technical and physical structural environment as well as the non-structural economic, sociological, institutional, political environment. In addition to the cooperation among scientific disciplines, as in interdisciplinary approaches, transdisciplinarity places even more emphasis on a *democratisation* of science (Funtowicz and Ravetz 1993) by additionally including non-academic stakeholders such as problem owners and policy makers in all stages

of research, knowledge production and problem setting. Thus, within the process of knowledge production, different types of knowledge coexist at equal footing, including traditional, local, indigenous, everyday, lay knowledge as well as scientific and expert knowledge. The process of generating new knowledge turns into a process of coproduction (among others, Cash et al. 2003; Hirsch Hadorn et al. 2006; Pohl and Hirsch Hadorn 2008; Lang et al. 2012; Wiek et al. 2012; Jahn et al. 2012; Cornell et al. 2013).

The idea of coproduction as employed in transdisciplinarity thinking is not to be confused with the idea of coproduction in science and technology studies (Jasanoff 2004). However, it is closely related to the ideas of citizen participation and cooperation between different societal groups in sustainability discourse. Since the surge of sustainable development, participation and cooperation have been conceptualized as underlying principles, functioning both as means towards sustainable societies as well as emancipatory elements (Kuhn and Heinrichs 2011; Newig et al. 2011).

Transdisciplinary as well as other participatory concepts of converging science and society are in line with constructivist thinking in the sociology of science, which perceives all forms of knowledge to be socially constructed, a notion that questions the traditional positivist scientific perception of a factual reality (Evers 2000; Hornidge 2013). From this perspective, scientific knowledge is not impartial, objective or neutral, as in the Mertonian ideal, but coined by social norms and subjective values, shaped by interests (Weingart and Lentsch 2007; Irwin 2008). If scientific knowledge is as much socially constructed as other types of knowledge, and thus not more representative of the truth as other meanings, then scientific knowledge can also be challenged by the public in view of its underlying interests, its salience, etc. It is therefore very much in line with constructivist thinking to call for more participation of civil society stakeholders in science or in science policy agenda setting (Jasanoff 2003; Irwin 2008; Sismondo 2008).

The idea of transdisciplinary knowledge creation has been taken up by science policy, which promotes it as an adequate way of problem-solving in science (Jahn et al. 2012), it is taken up by policy advice, e.g. as part of a concept of transformative science (WBGU 2011). It is also recommended to and applied within the development research community, for research aimed at impact next to publications or patents (KFPE 1998; Stöckli et al. 2012; ZEF 2014a).

Instead of an ex-post impact assessment, which many constructivist scholars reject (ch. 2.4.1), a further approach to impact is *ex-ante project design*. As impact is not a naturally given consequence of scientific activity, scholars scientifically reflect about the practice or mode of science which affect the outcomes and the success of turning results into innovations. Different approaches have developed in different scientific communities (Douthwaite, deHaan et al. 2001; Douthwaite 2002; Douthwaite et al. 2003). To increase impact of research projects beyond transdisciplinary

project design, some authors have provided additional frameworks for broadening innovation uptake paths while considering potential side-effects. Douthwaite et al. (2001, 2007) show that a constant reflection about a project's possible impact and the related pathways are essential for increasing diffusion of research results. The Follow the Technology Approach as a managing and monitoring approach, as well as the Participatory Impact Pathway Analysis (PIPA) as an ex-ante operational framework for designing impact-oriented research for development projects (Douthwaite, deHaan et al. 2001; Douthwaite et al. 2007) have resonated in international development research. PIPA has been adopted as an approach to impact on policy by the UK-based Institute for Development Studies, focusing on networks, actors, and power constellations in order to identify the pathways most promising for creating impact in form of influence on policy processes. The underlying assumptions about change, influence and impact are constantly reflected during research processes in order to adapt them in case they prove wrong (Ely and Oxley 2014). Similarly, the Follow the Technology Approach has been further developed into the Follow the Innovation Approach at ZEF, proposing a methodology for interaction with stakeholders at different levels in order to increase the chance of jointly creating promising innovations, and to open up windows of opportunities. (Ul Hassan et al. 2011; Hornidge et al. 2011).

2.4.4   International research cooperation and sustainable development

An important further element to be considered when contemplating science and its potential effects on society is the role of international cooperation. Science worldwide is increasingly carried out in international networks, as "[c]ollaboration enhances the quality of scientific research, improves the efficiency and effectiveness of that research, and is increasingly necessary, as the scale of both budgets and research challenges grow" (The Royal Society 2011: 6). Expecting potential benefits of science on economic, social and environmental development, many developing countries and emerging economies are increasingly interested in international science cooperation. Collaboration is seen as a means to link up to international state of the art research, to access knowledge and global scientific networks (KFPE 2010; Conway et al. 2010). However, there are potential downsides of international cooperation in science, often linked to a prevailing modernist paradigm.

US-President Truman's Inaugural Address (1949) is often described as the birth of development thinking. At the same time, it was a key event of publicly spreading the narrative of science and technological progress as drivers of development, which in the modernist approach paradigmatic at the time meant economic growth in a liberal market economy, with technological change as a basis of enhanced productivity. The transfer of expert knowledge and technologies from developed into

less developed countries was proposed as a standard solution for catching up (Sillitoe 2000; Anderson 2002; Smith 2009; Klochikhin 2012).

Modernisation theory and its assumptions of knowledge for development have been criticized for many years, among other reasons for being too simplistic (Chataway et al. 2006), too linear (Evers 2000), for implying an expert-lay hierarchy (Sillitoe 2000; Illi 2001), or for maintaining North-South hierarchies and technological dependence (Shamsavari 2007). Nevertheless, ideas of modernisation and catch-up still underlie many policies and institutions (Smith 2009). The World Bank's report on Knowledge for Development (1999) for example still followed the modernist view of linear knowledge transfer and of science and technology as a panacea for development (Hornidge 2014b). The differentiation between "global/local, first-world/third-world, Western/Indigenous, modern/traditional, developed/underdeveloped, big-science/small-science, nuclear/non-nuclear, and even theory/practice" (Anderson 2002: 645), closely entwined with modernism, still underlie manifold types of cooperation today, including cooperation in science. Agendas are often set by partners from the industrialized world, while partners of developing countries and emerging economies are perceived as junior partners and recipients of knowledge or providers of data. Cooperation of this type may hamper its potential benefits (Sagasti 2004; Stöckli et al. 2012). Finding a suitable mode of cooperation is therefore crucial for international research projects. Transdisciplinary interaction requires bridging knowledges across different scientific and non-scientific, practical camps, which is challenging as such. The interaction between participants from different international contexts adds a further layer of complexity to the project set-up. Whereas in development cooperation, *participation* and *ownership* have turned into internationally accepted norms for successful partnerships, which have been agreed upon internationally in the Accra Agenda of Action and the Paris Declaration of Aid Effectiveness (OECD 2008), for other types of international cooperation comparable frameworks are missing.

Development- and sustainability-oriented researchers have mainly cooperated in models based on the idea of transdisciplinarity, which entails ideas of respecting and appreciating diverse knowledges. Symmetric partnerships between researchers from developed countries and developing countries, based on mutual interest and ownership, including joint agenda setting, decision making, implementation and management are strived for, but also critically reflected about (among others KFPE 1998; Bradley 2007; Zingerli 2010; Wiesmann et al. 2011; Stöckli et al. 2012). While a normative discourse on *partnership on eyelevel* prevails among researchers and policy makers alike, some authors argue that discourses on partnership are highly political (Cornwall and Brock 2005; Mosse 2001). Terms can be filled with different meanings and employed to fulfil diverging aims, underlying inequalities do not cease to exist. In this line, some authors conclude that in science cooperation between partners from industrialized countries, develop-

ing countries and emerging economies, the partnership principles stated in policy documents and research proposals are often not transmitted into project practice. In addition to different socio-economic, institutional and epistemic backgrounds, diverging research interests and a lack of methodologies on international cooperation can lead to reproducing (neo)colonial patterns or patronage relationships as well as enhancing power imbalances (Fuest 2005; 2007; Maselli et al. 2006; Bradley 2007; Grosfoguel 2013; Zingerli 2010). It is therefore worthwhile to scrutinize what partnership means in practice in case of the BMBF-funded research projects for cooperation with developing countries and emerging economies in sustainability research (ch. 9, 10).

Next to project practice, partnership is heavily influenced through the accompanying policies. As the analysis in chapter 9 shows, the specific policies for funding international cooperation in sustainability research play an essential role in determining the projects realities and their actions. Through its international orientation, German science policy exerts influence on partner countries. National science policy, which is potentially open towards any scientific, technological or societal development goals (ch. 2.2), thereby turns into a policy of international scope. The objectives of policy for international cooperation thus turn into leveraging points for potential positive as well as negative impacts.

3   Discourse analysis in a policy setting

As outlined in chapter 2, the conceptions of science, science policy, innovation, (sustainable) development and their interlinkages are not stable. In contrast, their meaning is contested and controversially defined. It is therefore crucial to analyze closely which definitions and approaches towards science, innovation and development underlie policies that are designed to have certain kinds of impact – and why this is so. In this conceptual chapter, I will therefore introduce *policy* as a particular setting and *discourse analysis* as fundamental concept for analyzing my empirical data.

Science policy, as a specific field of public policy, can be viewed through multiple lenses and with different focal points of analysis: As in other social science research, manifold conceptual approaches exist as theoretical frames of policy in general, and science policy in particular. Policy processes have been considered from a variety of scientific perspectives, such as sociology and political sciences, anthropology, international relations, psychology, economics, or management sciences (Sutton 1999; McNie 2007).

Apart from disciplinary differences, the different approaches to policy also vary significantly in their focus and scale: Approaches centring on structures can be distinguished from those centring on actors or contents of policies, and those on macro scale can be contrasted to those applied to the meso- and micro level (Blum and Schubert 2011). In this chapter, I will give a short overview of major theoretical approaches before describing how I conceptualize my analysis.

A prominent approach to analyze policies, stemming originally from political sciences, but also used in other social sciences, is policy analysis, grounded on Lerner and Lasswell's seminal work (1951). In general, policy analysis is concerned with the internal dynamics of policy making and implementation, and less with the structural function of policy in view of society (see Hoppe 1999; Sutton 1999; Schneider and Janning 2006; F. Fischer et al. 2006; Howlett et al. 2009; Blum and Schubert 2011). Policy analysis zooms in on the field of policy making and asks which interests, objectives and motives lie behind particular fields of policy making, thereby questioning what is on the political agenda, why it is on the agenda, if

its targets are promoted in an effective way, and who is benefitting. Interests pursued by different groups of actors are often used as point of departure of analysis.

Traditionally, policy analysis has used a policy cycle model, emphasizing stages of policy making, which as an idealtype is ordered in a cycle consisting of a problem definition, agenda setting, policy formulation, implementation and evaluation, back to a problem (re)definition (Hoppe 1999; Jann and Wegrich 2006; Howlett et al. 2009). These are pictured as a sequential process based on rational decisions. Very often, the heuristics of the model are accompanied by (neo-)institutional theories to explain policy processes, often based on rational choice assumptions of actors and their interests (Nullmeier 2001). According to Shore and Wright, traditional policy analysis thus rests on "positivistic models of perfect or bounded rationality in which economic actors pursue purposeful goals, decision makers make fully informed strategic choices and analysts measure policy effects in terms of calculable costs and benefits" (2011: 6).

Critical scholars therefore argue that this linear view of the emergence and implementation of policy is too simplistic and unrealistic (Jann and Wegrich 2006; Lyall 2008; Leach et al. 2010; Shore and Wright 2011). As an opponent of the policy cycle, Keeley states that "[w]hile these approaches have some use, much experience shows that policy processes are often distinctly non-linear, inherently political and contested, and more incremental and haphazard than these models suggest" (2001: 9).

3.1   The Sociology of Knowledge Approach to Discourse for policy analysis

Next to applying a political science lens on policies, policies can also be investigated from a *sociological* perspective. Using a sociological approach to analyze policies and effects is more suitable to my research subject: The focus of analysis within this study is on the underlying ideas, beliefs and objectives of BMBF policies and programmes for cooperation with developing countries and emerging economies, the processes and actors involved and the effects of the specific conceptualisation. In contrast to political sciences approaches to policy, with my research I do not intend to address any questions in view of the political system, such as effectiveness of different forms of governance and policymaking or the role of state power in policymaking. These questions, however, centrally underlie many political science approaches (Shore and Wright 2011). Traditional political science approaches to policy often centre on the role of the state in policy making, pluralist or corporatist approaches look at collective political actors such as interest groups or organisations which shape policy (Howlett et al. 2009). More recent approaches to policy in contrast often focus on participatory approaches to policy as means of strength-

ening democracy, on transformative governance (Hoppe 1999; Hajer and Wagenaar 2003; Fischer 2006; Voß et al. 2009; Newig and Fritsch 2009; Newig 2011; WBGU 2016).

In my analysis, I will resort to the concept of *discourse* grounded in the Sociology of Knowledge Approach to Discourse (SKAD) developed by Keller (Keller 2005; 2011a; 2011b; 2011c; 2012; 2013). Discourse was coined by Foucault, who used discourse as a concept describing the inherent relations between the social construction of knowledge and power (among other publications Foucault 2005 [1966]; 1972a; 1982). Approaches to discourse analysis based on Foucault's concept exist in different social sciences, including anthropology, linguistics, history or sociology, and have also been applied in political sciences since the 1980s (Sutton 1999; Hajer 2002; Wagenaar 2011). Approaches in this line of political sciences, often termed interpretive or argumentative policy analysis, ask for knowledge, discourses, meanings, and interpretations of political actors – in contrast to the focus on interests, linearities and causalities in traditional approaches to policy. Constructivist takes on policy view objects and problems of policy not as objective facts, but as social constructs: It is recognized that social and political problems can be defined, interpreted and understood from different and competing angles (Nullmeier 2001; Hajer 2002; Hajer and Wagenaar 2003; Fischer 2006). However, scholars in this line of policy analysis, such as Fischer or Hajer, are still a minority among policy analysts (Nullmeier 2001). Habermas' concept of discourse has been more influential for studying policies, thus conceptualizing discourse in a different way; as an argumentative process that underlies political negotiations (Kerchner 2006). An example in this vein is Schmidt's discursive institutionalism which centres on the role of structures and institutions in the policy process (Schmidt 2012).

Being interested in the *what* and *why* and *who* of German science policy on a social science background, a sociological approach to analyzing policy discourse seems most adequate as a conceptual approach. The *Sociology of Knowledge Approach to Discourse* (SKAD) seems suitable, as it is aimed at providing a "genuine social science perspective on discourse interested in the social production, circulation and transformation of knowledge" (Keller 2011c: 43).

In his works, Keller provides an encompassing conceptualisation of discourse rooted in the traditions of social constructivism based on Berger and Luckmann (1966), symbolic interactionism, Foucault's initial concept of discourse (Foucault 1972a) as well as hermeneutic sociology of knowledge (Keller 2011c). In integrating the rather abstract discourse concept of Foucault and further sociological theories of the social construction of knowledge, Keller aims at turning discourse into a usable concept for empirical sociology (Keller 2005). SKAD has been applied to and tested on different research subjects. A further advantage of choosing SKAD is its level of methodological and conceptual detail. It has been continuously developed further and extended in scope and concept as a research programme (Keller 2011b).

SKAD centres on how and why knowledge is defined as valid, in which processes it emerges, how it is transmitted, how knowledge is related to power and which functions it has in society (Jäger 2001). In Keller's words:

> "Discourses may be understood as more or less successful attempts to stabilize, at least temporarily, attributions of meanings and orders of interpretation, and thereby to institutionalize a collectively binding order of knowledge in a social ensemble." (2013: 2)

Social actors construct, produce and attribute meaning, and thereby reality, through discourse, in a process of objectifying subjective realities. In line with Berger and Luckmann, Keller argues that shared knowledge emerges through social construction: processes of internalisation, typification and objectivation of knowledge which is then institutionalized, maintained and reproduced through discourses (Keller 2013).

In contrast to the everyday usage of the term discourse as an equivalent of discussion, a discourse is not just an idea that is spoken about and debated. Beyond an idea, existing in language, a discourse is institutionalized and objectified in form of social practices, communication processes, institutions as well as physical objects (Keller 2011b). The objective of discourse analysis therefore is to lay open the processes of social reality construction in institutional settings (Keller 2013). As the setting of my study shows some of the specificities inherent to policy making, I will complement SKAD with some constructivist ideas on policy processes as well as with some insights on the institutional dimensions of policy from argumentative discourse analysis (Hajer 2002; 2003a; 2006).

3.2 The Sociology of Knowledge Approach to Discourse in empirical research

In SKAD, analyzing discourses may encompass the analysis of the contents, the actors involved and their practices in discourse production, the context of the emergence of a discourse, as well as the effects of a discourse (Keller 2011b). In my analysis, I will broadly follow this proposition. The analysis of the processes of producing and establishing the policy discourse is additionally inspired by constructivist policy analysis.

3.2.1 Actors, practices and interaction in the production of policy discourse

With reference to Gidden's concept of the duality of agency and structure (Giddens 1979), Keller explains that a discourse and its structures, its *dispositive* (ch. 3.2.3) persists in and through acts of agency – in being repeatedly refreshed, reproduced,

or reformulated in social practices. Discourses thus exist through social actions and performance (Keller 2005). In SKAD, social actors are considered as "individual or collective producers of statements; those who use specific rules and resources to (re)produce and transform a discourse by means of their practice" (Keller 2013: 72).

Apart from the contents of a discourse, the analysis therefore encompasses who is a bearer of a discourse and in which social practices the actors stabilize or transform a discourse. This means that the actors, their position and role in a discursive field have to be described as well as their practices, such as the interactions between actors of different social groups and positions.

Practices, in the encompassing sense, are defined as socially conventionalized patterns of action, including the use of language. Practices can be defined as discursive, i.e. language-based, such as statements; or as non-discursive practices, i.e. symbolic, such as gestures. Discourse-related practices can furthermore be categorized as practices of discourse (re)production, in the sense that they contribute to discourse reconceptualisation, renewal or change. Keller further describes *model practices*. These are those discourse-related practices that actors engage in as model of an appropriate behaviour within a discourse. They thus are guiding action. As a further type of practice, discourse-independent practices are those action patterns which emerge in social contexts apart from the discourse examined (Keller 2011b; 2013).

For analyzing German science policy, the analysis of discourse-related *discursive practices* has been central. Written and spoken texts, such as policy documents and interviews, which contribute to stabilizing and renewing or changing the policy discourse, have been the key elements of investigation. In contrast, model practices have shown to be of less relevance in the analysis of German policy making for cooperation with developing countries and emerging economies, which can be explained by the different social groups of discourse recipients and producers (ch. 6, 7).

In constructivist insights to policy, policies are conceptualized in a way that fits the discursive approach of SKAD. From a constructivist point of view, political problems can be explained as socially constructed, just like other social phenomena (Hajer 2003a). Manifold influences shape the way in which a political problem is perceived. At the same time, political decisions are understood as hardly stemming from rational decision making based on objective arguments (Hajer 2006). The knowledge embodied in policies rather emerges in a process of discourse production and "both reflects and shapes particular institutional and political practices and ways of describing the world" (Keeley and Scoones 2003: 21). Shore and Wright add that "[l]ike the architecture and internal organisation of an institution, policies reflect the rationality and assumptions prevalent at the time of their creation" (Shore and Wright 2011: 3).

I therefore consider *policies as a type of discourse* with specific rules of formation. Policies influence and shape realities by establishing certain ways of framing problems and perceiving the world. Subsequently, policy discourses define problems, actions to be taken, and specific solutions (Cornwall and Brock 2005). Leach et al. contribute that "different narratives lead to radically different assessments of policy options. Even among different actors in the policy field, different system framings are important and often lead to very different narratives around intervention and action" (2010: 49).

A policy is not just the *outcome* of a discursive process such as a final programme, law, or text, but should be conceptualized as the *entire process* encompassing the framing of a problem, making decisions and implementing policies. Just like discourse itself, policies are "productive, performative, and continually contested. A policy finds expression through sequences of events; it creates new social and semantic spaces, new sets of relations, new political subjects and webs of meaning" (Shore and Wright 2011: 1).

In SKAD terms, the policy process can be considered as an instance of reconceptualisation of a policy discourse, a momentum of renewal or contestation of discourse (Keller 2005). This actualisation of a policy discourse thus is subject to numerous influences. At the same time, policymaking takes place in a contested social and political space, with pronounced elements of power and governance, bureaucratic practices, institutions, etc. (Shore and Wright 2011). While one could easily assume that this would lead to a dominant policy discourse shaped exclusively by those at the higher hierarchical levels, leading to top down policy making, constructive understandings of policy stress that policies emerge "across a political space that could extend from local residents to interest groups, local institutions and authorities, the media, national government and, in some cases, international agencies" (Wright and Reinhold 2011: 86). The production processes of policy discourse are not linear – neither chronologically from decision to implementation, nor top-down from policymakers to recipients. Policies are believed to be continuously altered and shaped in all stages of the process, including in their implementation.

While policies set the official frame for projects, these in turn possess agency to transform policy and act according to their own "hidden transcript" (Mosse 2004). Policy implementation practices turn into complex processes, shaped by the interaction, strategies and discourse employed by all participants involved (N. Long 1992). Following, street level actors – using a term coined by Lipsky (2010 [1980]) – are not seen as neutral implementers, as assumed in some pluralist/interest group approaches to policy. Instead, constructivist approaches believe them to actively contribute to shaping policies. The separation into a policy and an implementation sphere is perceived as obsolete, as bureaucrats such as ministerial staff or funding agencies as well as project participants "prioritize, interpret instructions, deal with

overlapping and contradictory directives, and take initiatives in areas where there might be a policy vacuum", simply choose to ignore directives (Keeley and Scoones 2003: 32).

Actors might also choose not to take decisions at all or ignore facts, thereby influencing a policy. While some scholars explain the reshaping of policies by street level staff through their attempts to make policies work, others attribute this to their struggle to adjust policies to their values, which might contradict policy goals (Hajer and Laws 2006). Based on empirical insights into policy making, different scholars on policy point out that shaping policies is a messy, complex, non-linear process in which multiple actors simultaneously influence politics during formulation phases and implementation. Policies and their results often differ from the initial objectives and their success depends on informal channels of communication, on coincidences, political windows of opportunity, on the topic's stickiness; on key persons seconding the issue, etc. In conclusion, actors on all levels as well as external factors heavily influence the policy outcomes, turning it into a non-linear and sometimes random process (Clay and Schaffer 1984; Hajer 2003b; Keeley and Scoones 2003; Scoones 2007; Hornidge 2007; Reis 2012; Mukhtarov 2014). Sometimes, the non-linear, messy nature of policy making even leads to the impossible to identify an author, beginning or cause of a specific policy (Shore and Wright 2011).[1]

In view of German science policy for cooperation with developing countries and emerging economies, it remains to be seen if the agency of policy makers as well as other actors involved in implementing policies outweighs the structural constraints of an institutionalized discourse, embedded in a dispositive and practices. A high level of agency would rather lead to change and modification of discourse, while lower level of agency and higher levels of institutionalisation would rather contribute to repetition, maintenance and self-reinforcement of the pre-existing discourse. Empirical analysis will also show if different actors in the policy process possess a level of agency comparable to those of the street level actors described by Lipsky, thus re-interpreting the policy discourse in its implementation (ch. 6, 9).

Power and knowledge

Potentials for agency are closely linked to the power both inherent in the relations between actors as well as in institutional structures. Based on Foucault, Keller and

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1 Interestingly, approaches specifically aimed at analyzing science policy and implementation are limited to rational choice-based principal-agent theory as proposed by Guston (1999), Van der Meulen (1998), Braun and Guston (2003). Principal-agent approaches rightfully stress the power imbalances within the relation between the policy level and funded projects. However, they do not shed light on the communicative process of producing meaning (Nullmeier 2001) and do not explain agenda setting processes. Principal-agent theory therefore "fails to detect the collective, but perhaps unintended, consequences of programme funding" (Shove 2003: 376).

other constructivist scholars argue that knowledge production is shaped by and shapes power mechanisms. In his works, Foucault repeatedly points at the inherent link between power and knowledge construction in discourse (Foucault 1972a; 1980a; 1982; 1991).

Taking opposition to different expressions of power as a starting point for conceptualizing power, Foucault distinguishes between sovereign, disciplinary, and governmental types of power (Foucault 1982). Power is defined as "a way in which certain actions modify others" (Foucault 1982: 788).

It encompasses the capacity of actors to structure their own and others' room of action, to enable, guide or to prevent actions, by drawing on different resources and by using different means (Ziai 2009; Wagenaar 2011). Power can thus be repressive as well as enabling and productive (Foucault 1980a). Hence, power is not exclusively the ability to force one's own will onto others, "but power is also present where individual decisions are taken voluntarily in a field of action that is structured in a specific way or where a discourse provides only certain ways of constructing social reality" (Ziai 2009: 185).

Power in Foucault's sense has an element of voluntariness, of internalisation and self-disciplining (Gordon 1991; Ziai 2009). This idea becomes important in view of the anticipatory obedience of some of the project management agencies and researchers towards the BMBF (ch. 7.4, 10.3). Power relies on the potential agency of those acted upon, i.e. their freedom to choose a certain way of acting in reaction.

Making use of power may have different objectives and may sometimes not have intentions at all. While means of exerting power range from threats of violence, to inexplicit rules and explicit laws, from incentives to control systems, power also relies on social attribution. These attributions of power are based on resources, including social and cultural capital (Foucault 1980a; 1982). Power therefore manifests in the relations between actors, in their actions – it is exercised, and it is not a fixed entity, but is *fluid* (Foucault 1980a; Gordon 1991; Ziai 2009). Nevertheless, power relations are inscribed in and reproduced by structures and practice (Hajer 2003a; Wagenaar 2011; Hametner 2013; Keller 2013).

Foucault highlighted the close links between knowledge and power. In his view, humans "are subjected to the production of truth through power and we cannot exercise power except through the production of truth" (Foucault 1980b: 93). He developed discourse as a concept to explain the linkages and defined discourse as the rules for what is *sayable*, based on its *conditions of existence* (Foucault 1991: 60). In this line, power is an inherent element of SKAD. If discourses are attempts to institutionalize knowledge – and in consequence social order (Keller 2013), the analysis of power relations consequently is essential. Power is specifically conceptualized within the actors' positions within a discourse: SKAD differentiates between speaker positions and subject positions. Both subject positions as well as speaker positions are shaped through a discourse's way of ordering reality and thus are

product of pre-existing power constellations. At the same time, speaker and subject positions also shape the further distribution of power (ch. 8, 11).

Discourses may suggest collective or individual identities, roles, practices or behaviours to its addressees, for example trough model practices (see above). These identity offers are termed *subject positions* (Keller 2011b). In offering subject positions, discourses coin reality and exert power over their addressees by shaping them. The proposed subject positions are instances of power effects (see below). Participants in a discourse internalize subject positions and thereby reproduce power structures. Power therefore always contains elements of self-positioning and positioning through others (Hametner 2013).

Speaker positions, on the contrary, are the potential spaces of actively participating in a discourse. Speaker positions are restricted, however. The exclusion from speaker positions is a mechanism of exerting power itself; but limiting available speaker positions has further power effects: In excluding some types of knowledge, while enabling the integration of others, it shapes the further ways of perceiving reality. Only under certain conditions, actors can legitimately fulfil speaker positions. Institutionalized power and resources – including discourse-independent resources such as financial, cultural or social capital and knowledge – influence whose knowledge is counted as legitimate and spread (Keller 2003; 2013). At the same time, power struggles occur between participating actors about interpreting and establishing a specific interpretation of reality (Keller 2003; 2011b; 2013). SKAD acknowledges the speakers' agency to interpret and modify their speaker position – which may lead to modifications of discourse or the emergence of alternative discourses. In the empirical analysis, this means to consider who is allowed to contribute to a discourse under which circumstances, and who is left out, which actors contribute to a repetition and which actors change a discourse (ch. 7).

In view of the interrelation between policy makers and external scientific experts, literature on science-policy interfaces[2] additionally helps to understand how

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2 Literature on science-policy interfaces is vast. Taking a pragmatic approach, one strand recognizes the political nature of knowledge in policies, but nevertheless assesses how scientific knowledge could inform and thereby improve policy decision making (Nowotny et al. 2001; Cash et al. 2003; Sarewitz and Pielke Jr. 2007; McNie 2007). From this perspective, if science is to be taken up by policy, the *right* kind of knowledge has to be provided. It thus needs to be context-adapted through a close interaction of users (policy makers) and producers (scientists) in the creation process (McNie 2007). Gibbons, Nowotny et al. conceptualize this type of knowledge as *socially robust*, co-constructed knowledge (Gibbons et al. 1994; Nowotny et al. 2001), while Cash et al. and Clark et al. point at the necessity to provide *relevant, credible,* and *legitimate* information to bridge the gap between knowledge, action, and policy (Cash et al. 2003; Clark et al. 2010). Other authors equally emphasize the role of *usable* knowledge. These conceptualisations go beyond simplistic ideas of *evidence-based policies* (Dilling and Lemos 2011; Watson 2005; Haas 2004; McNie 2007). Other authors focus on issues such as the co-construction of scientific knowledge through policy-expectations; necessary institutions, actors, or boundary organisations to make

and why certain types of knowledge become recognized as facts or truths, while others are not admitted into dominant discourse (Keeley and Scoones 2003). Traditionally, policy makers have relied on scientific expertise to inform policy decisions and assumed a linear uptake of expert knowledge based on rational decisions. However, scholars on science-policy interfaces have challenged traditional assumptions on scientific rationality and of the strict separation of knowledge production by science and its utilisation by policy makers (Hoppe 1999). The process of knowledge exchange between science and policy is seen as non-linear, and boundaries become contingent (Lyall 2008).

Leach et al. (2010) show that the value attributed to scientific evidence is a social construct itself, which serves particular objectives rather than providing objectivity. Establishing a policy by mobilizing certain facts based on science as a master frame is a tool of legitimizing, depoliticizing, and pretending objectivity (Irwin 2008). What is accepted as valid or legitimate knowledge within policy thus correlates with the policy makers values (Sarewitz and Pielke Jr. 2007; Miller 2001; Keeley and Scoones 2003). Maintaining the belief in policies as neutral outcomes of science-based processes, or in science as impartial provider of evidence (such as in concepts of evidence-based policy) fails to acknowledge the social construction of evidence and political nature of policy making (Nowotny 2007).

Discourse coalitions

Speakers use different resources and strategies to stabilize or destabilize a discourse, such as money, power, influence, reputation, etc. (Keller 2011b). Establishing a discourse coalition is a specific strategy to produce or maintain a discourse. Discourse coalitions involve different actors and form themselves around specific discourses. A discourse coalition, as similarly defined by Hajer and Keller, therefore can be defined as a community of actors that gather around a common story line, using a common speaker position, while not necessarily sharing a common background (Keller 2001; Hajer 2006).

While in political sciences, analysis is often carried out based on organisations as units of analysis (Pritzlaff and Nullmeier 2009), an important aspect of discourse coalitions is that they group together actors around similar ideas, not around their institutional background. This means that they can form across institutional borders, and different positions within organisations or within social groups are possible. Social group and discourse coalition are not identical. However, existing discourses shape speaker positions for members of a social group, who still have agency to reinterpret the discourse (Nullmeier 2001; Hajer 2006;

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knowledge exchange possible; or on the role of knowledge in policy change (among others Chilvers and Evans 2009; Jansen 2010; Guston 2001; Cash 2001; Holmes and Clark 2008).

Keller 2011b). Coalitions are built for diverse reasons. In the concept of policymaking applied here, a common idea unites a group of actors. In case of the policy discourse on science cooperation with developing countries and emerging economies, entry to the coalition is limited through the BMBF's powerful position. It includes ministerial staff, implementation agencies, as well as some external actors, while others are excluded (ch. 7).

3.2.2   Policy contents: concepts, ideas, and knowledges in policies

An empirical analysis of discourses that exclusively focuses on actors or processes of policy discourses would be incomplete: the contents, ideas and knowledge in policies themselves are an indispensable part of the analysis. According to Keller,

> "one essential goal of discourse research is indeed to answer the question of what knowledge, what objects, relationships, properties, subject positions and so on are claimed to be 'real', by what means – such as meaning schemata, storylines, moral and ethical assessments – this takes place, and what different formation rules and resources underlie these processes." (Keller 2013: 78)

In contrast to positivist approaches to policy, which often focus on interest as main motivation of actors (Nullmeier 2001), SKAD and other constructivist approaches do not perceive ideas as linear results of or instruments for pursuing a specific interest. Different motivations can lead to similar ideas. No predefined interest is assumed to motivate actors. On the contrary, interests and motivations are perceived to have complex causes which cannot be explained by plain self-interest and rational profit maximisation, as rational choice approaches might postulate (Griggs 2006; Hajer 2006). Actors might pursue institutional as well as private interests, projects and agendas, which in themselves are influenced by previous discourses (Keller 2011b). Furthermore, the fact that actors may have specific interests does not necessarily mean that these enter a discourse in a predefined form. Pursuing interests is one possible motivation, but not the only and primal explanation of discursive construction of reality. What's more, existing interests might not even influence the contents of a discourse explicitly. It is thus not always possible to trace interests by looking at the contents of a discourse. There might be hidden agendas or deviating motivations behind the verbalised contents of a discourse (Keller 2011b). I will therefore follow SKAD and focus on the ideas manifested instead of underlying interests.

In view of the contents of discourse – and this is a main contrast to other types of qualitative research on perspectives or to content analysis – discourse analysis focuses not on individual utterances, but on typical statements. This focus on manifestations of the typical, collective knowledge, once again leads back to Berger and Luckmann's seminal work on social constructivism (1966) and the underlying

typification processes which guide the individual's perception of the world as well as their actions. Statements gathered in empirical research are thus part of a body of typical patterns of thinking. As such, they do not only stand on their own as individual utterances but are representative of a type of statement (Keller 2001).

The analysis of the contents of discourse is based on the phenomenological structure of discourse that explains how a problem is constituted. The phenomenal structure of a discourse

> "includes cognitive devices like the concepts used to name an object, the relations between those concepts, the introduction of causal schemes and normative settings, the dimensions, urgencies and legitimations for action, as well as the kind of practices considered to be suitable to a particular phenomenon." (Keller 2005: [29])

Analyzing the phenomenological structure thus means to examine how certain ideas are conceptualized and which knowledge perspective is chosen. The topics included, the nature and dimensions of a problem constituted within a specific discourse, the cause-effect relations established, objectives of policy, proposed actions as well as subject positions following from it will be described based on empirical data (ch. 9). In addition, I will examine if any categories or social typifications are proposed within the discourse, as these often serve to establish and maintain a specific order of reality (Keller 2013) (ch. 10).

Constituting a specific reality through discourse necessarily means to implicitly or explicitly exclude diverging ways of perception or interpretation, while at the same time depreciating differing positions. This explains why often various competing, alternative, sometimes hidden discourses coexist around a single phenomenon. One aim of the analytical description of phenomenal structures therefore is to reconstruct different discourses in a field (Keller 2011b) – therefore I will also show alternative positions on science policy (ch. 7).

3.2.3   Effects of discourse

In addition to the discourse-related practices as well as subject positions, discourses have effects on the real world through their dispositives, which Foucault defines as strategic infrastructure to intervene in the world and to exert power (Foucault 1980c). Grounded on Foucault's original idea of discourse (1972a), Keller defines a dispositive as "institutionalized infrastructural elements and assemblages of measures (such as areas of responsibility, formal procedures, objects, technologies, sanctions, educational procedures and so on)" (Keller 2013: 71).

The dispositive can thus be described as the institutionalized infrastructure of discourse, which encompasses material objects (such as a technology), but also normative and legal elements, such as laws or regulations, formal and informal

social institutions and practices (such as bureaucratic procedures), cognitive and normative patterns etc. (Keller 2011b; 2013).

Dispositives – much like discourse-related practices, speaker positions and subject positions – have a dual function. On the one hand, a discourse is embedded in, reproduced and manifested in its dispositive, which thus stabilizes and reinforces a discourse in addition to discourse related practices (see section above). At the same time, dispositives provide specific approaches to dealing with specific issues, suggest problem solutions and guide action (Keller 2001). They are a means of power and structuring reality in the sense of knowledge politics: Through a dispositive, a discourse produces effects on the real world and intervenes in it (Keller 2011b; 2013). In consequence, discourses thereby coin a specific reality. They exert power through their institutionalized discursive practices and dispositive. These enforce, stabilize or change meanings and define what can be said, i.e. what is perceived as valid knowledge in a specific discourse. Thereby, discourses orient thinking and social practices (Bührmann and Schneider 2008). Discourses thus are (self-reinforcing) power structures with external effects.

Many discourse theorists stress that discourse shapes and influences realities, often relating to Foucault's ideas of power (see above). Ball for example argues that policies establish "'regimes of truth' through which people govern themselves and others" (1993: 14). Leach et al. similarly contend that discourses have power effects through contributing to a *conduct of conduct* in Foucault's sense, as "knowledge, institutions, power relations and people's senses of themselves may come to interlock, mutually reinforcing each other" (Leach et al. 2010: 77). If dominant, a discourse can limit the policymaker's room for action: Alternative pathways might become impossible to think of (Leach et al. 2010; Wagenaar 2011). More actor-oriented perspectives, in contrast, consider discourse as a structural element but less as a totalizing frame: Multiple interpretations of reality coexist within different subdiscourses (N. Long 1992; A. Long 1992). Whether stressing room for action or structural constraints, questions of agency or power are a central topic for discourse analysis.

According to Nullmeier (2001), discourse analysis only makes sense if it includes the analysis of power and dominance. Otherwise, the line between discourse analysis and institutional analysis or analysis of agency/structure becomes blurred. Indeed, dispositives are related to the sociological concepts of institutions or structures. However, while social institutions and structures refer to conventionalized patterns of practices, to social norms and rules, dispositives also encompass materialities. In addition, a dispositive emerges in relation to a problem or an issue, is aimed at intervention, even though dispositives rarely follow a strategic master plan (fieldnotes, discussion with R. Keller on the differentiation between dispositive and institution; 25.09.2014). What further distinguishes the analysis of discourse (and its practices, dispositive) from the analysis of social institutions (and

structure/agency) is that discourses make authoritative claims of validity, embodying Foucault's idea of knowledge and power. Hence, the analysis of discourse should include an analysis of why a certain knowledge order prevails in a specific policy field (Nullmeier 2001). In view of its power effects or influence, a discourse can be defined as dominant, if next to a specific perception of a problem, alternative views are suppressed and practices and dispositive are shaped accordingly (Keller 2011b). Nevertheless, even if a discourse becomes dominant, there might still be room for struggles over the definition of truth, the correct interpretation or implementation of a problem or a policy (Hajer 2003b). It is a question of empirical analysis to find out in relation to which practices, dispositive, resources, and power relations a discourse becomes dominant in policy or stays alternative, marginal or subliminal.

3.2.4   Beyond the borders of a discourse: Context

The institutional, historical and social context of a specific discourse play an important role as background of the production of statements and practices. Pre-existing discourses, institutions, practices, and structures are constitutive elements of explaining path dependencies and the dominance of a specific policy discourse (Keller 2013).

In order to reflect the influence of the context on the emergence of a discourse, Foucault used the concept of a *historical a priori*. The historical a priori describes those structures, practices, distributions of power as well as coincidences and other elements of (social) reality (which may or may not be discourse-related) that make up the *conditions of possibility* for a discourse (Foucault 1972a). Discourses are thus anchored in pre-existing conditions, of which actors may be unconscious of, but which provide the grounds that enables the emergence of a discourse while restricting the emergence of others.

Based on Foucault's idea, SKAD incorporates a similar idea of discourse itself as well as speakers within a discourse being entrenched in preceding context:

> "Social actors are embedded in the historical a priori of established symbolic orders and institutionalised power/knowledge-regimes. In order to enter a given discursive field they have to draw on existing subject or 'speaker' positions whose criteria of performance are beyond their control." (Keller 2005: [11])

In consequence, discourses, available speaker positions, as well as the actors involved are influenced by and predetermined through interdependencies within the discourse in question as well as through other discourses and discourse-external social conditions, available resources, etc. (Foucault 1991).

In view of the empirical focus of this book, the specific context of science policy includes the institutionalized relations between different actors, which exist independent of the discourse on science cooperation with developing countries and

emerging economies, but nevertheless heavily influence it. Their relation cannot be explained as an effect of the specific discourse on cooperation. Instead, it is an effect of a larger, encompassing political discourse. This *core discourse* lies at the heart of the BMBF, coining its overall thinking and its practices, including the discourse on science cooperation with developing countries and emerging economies (ch. 8).

At the same time, the pre-existing institutional hierarchies of power and dependence between the BMBF, funding agencies, projects as well as external actors are highly influential on discourse production. Power imbalances influence who is considered as legitimate speaker and who is not, and in consequence which type of policy discourse is maintained. Therefore, it seems relevant to describe the structural and institutional settings and relations between implemented projects, policy officers and funding agents (ch. 7).

4 Research design and methodology

4.1 Scientific model and approach

Research paradigms can be defined as "the basic belief system that guides the investigator, not only in choices of method but also in ontologically and epistemologically fundamental ways" (Guba and Lincoln 1994: 105). Data collection methods, type of data generated, data analysis and the scientific paradigm that the research is based on have to be congruent: Based on different assumptions of science and reality, each paradigm employs different methodologies and thus generates distinct data (Berg 2001). In addition, data can provide information towards different research questions, depending on the researcher's theoretical and normative background. The close interrelation between data and theory is often not discussed adequately in scientific literature (Baur 2009: 12; see also: Ritchie and Spencer 1994). For this reason, I point to my understandings in this section.

My research was embedded in a constructivist perspective, which makes it necessary to consider the positionality of the researcher and the people to be researched (Yanow 2006). Grounded in the constructivist paradigm, I made use of qualitative social research methods: I was interested in the nature of science policy for cooperation with developing countries and emerging economies as my research subject. I focused on the "meanings, concepts, definitions, characteristics, metaphors, symbols, and descriptions" (Berg 2001: 3), rather than on their statistical occurrence. In an interpretative approach, I addressed my research topic by collecting data which seemed most suitable to reveal the perceptions of the interviewees and participants (Krumm 2009).

The assumption of different constructions and perspectives on reality explains why instead of an *objective* evaluation of policies or projects, based on indicators, the focus of research lies on the discursive perceptions of the actors in the field of scientific cooperation between Germany and developing countries and emerging economies. It was not the objective to quantify effects of policies or projects on *development*, but to trace the conceptualisations and assumptions of different actors in view of terms such as *development*, *innovation* or *cooperation*, and find out in which way they influence the projects in their practices of translating policy into action.

Beyond my interest in perspectives of discourse and knowledge, turning away from measuring impact is also based on a scientific rationale: It still is considered as nearly impossible to find a scientifically sound quantitative or qualitative measure of research impact. Impact is perceived as "conditional, even serendipitous; allocating resources to it thus remains highly problematic" (Brewer 2011: 256). Extending Brewer's argument, I would put forward that it is equally problematic to operationalize it: As sustainable development as such is influenced by a plenitude of external factors, it seems problem-laden to develop valid and reliable indicators for measuring impacts that take into account the manifold dimensions of development and, what's more, to establish causalities between research, the policies framing it, projects' implementation actions and the multifaceted developmental realities – which might be determined by manifold research-independent variables (Sumner et al. 2009, see ch. 2.4.1). Instead of tracing impact, the concept of impact itself as employed by the BMBF turns into an object of investigation (ch. 9, 10).

4.2   Research design

The research process was laid out in an open design, inspired by grounded theory approaches. Research did not aim at testing a pre-existing hypothesis but at finding a plausible explanation for the empirical data (Corbin and Strauss 2008). Embedded in sociological approaches to discourse and constructivism as conceptual frame (ch. 3), which guided me in developing research questions and data collection methods, my approach to the empirical phenomenon was reconstructive or interpretive. Goal of my empirical data collection and analysis was thus to construct a theory about the research subject through interpreting data through the lens of the conceptual frame (Przyborski and Wohlrab-Sahr 2014). However, as empirical data was generated, the conceptual frame was open for continuous reassessment in view of its capacity to adequately explain the subject of research as well (Eisenhardt 1989; Mikkelsen 2005; Shah and Corley 2006). In the process of data collection, indeed it showed that the conceptual frame chosen before fieldwork did not correspond entirely to the occurring phenomena. In the research proposal, focus was on the interaction of projects and the policy sphere at a science-policy interface. As empirical research showed that the interfaces between policy and other actors were far more relevant for political decision making, the conceptual frame had to be adapted, the ideas of discourse coalitions and power were integrated within the theoretical frame and applied to the analysis of the interaction of the BMBF with different actors in generating knowledge for policy (ch. 7).

4.3   Data collection and sampling

In generating empirical data, I relied on semi-structured interviews, which were combined with participant observation and document analysis. Data on policies was collected in form of policy documents, semi-structured interviews among ministerial staff and staff of the project management agencies who were involved in the field of science policy for cooperation with developing countries and emerging economies, such as the responsible employees for the Megacities and IWRM funding initiatives. At occasions such as the FONA Forum 2013 as an instance of agenda setting and stakeholder involvement processes for formulating research funding programmes, and at other events related to funding initiatives, I carried out participant observation documented in field notes. Data on projects was collected within two case study projects, which included daily participant observation (during internships), informal and semi-structured interviews and analysis of project related documents. Semi-structured interviews with researchers of other cooperation projects with developing countries and emerging economies were source of further empirical data on projects. Semi-structured interviews with experts in the field of science for sustainability and science for development provided data on contrary or complementary perspectives on policy, projects etc.

Making use of different methods of data collection was valuable in various ways. Combining fieldwork in two cooperation projects as in-depth case studies with additional interviews of further projects helped to reach depth of data as well as a broader standing through extending data collection to further sources. Participant observation, and interviews in the case-study projects, carried out in the beginning of data collection, provided deep insights into cooperation in practice. This helped me to design the complementary interviews among further projects along those aspects identified as crucial in the case studies.

The corpus of data was built mainly through theoretical sampling, meaning they were chosen based on their expected contribution to answering my research questions rather than through random sampling. First interviewees as well as the case studies were selected based on the initial conceptual frame – it was clear that I needed to interview policy makers and project participants. Further interviewees were selected according to their expertise, institutional affiliation, position, etc. They were successively chosen based on increasing insights into the field. I tried to find interviewees of as different perspectives as possible, but also tried to find interview partners that showed similarities, according to the principle of maximum-minimum contrasting (Corbin and Strauss 2008; Przyborski and Wohlrab-Sahr 2014; Keller 2013). I used snowballing techniques for finding similar interviewees – interviewees directed me to further potential interviewees. Searching the BMBF project database (BMBF 2015b), I identified further potential interviewees within projects.

Previous insights into the research setting enabled me to find interviewees of different positions, but sometimes coincidences also helped. The final list included interviewees ranging from professional working level, such as scientific officers, post-docs, or ministerial employees (on the level of *ReferentInnen*) to higher hierarchical levels, such as heads of ministerial subdepartments (*Unterabteilungsleiter*), or directors of university departments or research institutes and professors. All interview partners were experts in their areas. In order to obtain data on all specific areas relevant for answering my research questions, interviewees chosen mainly worked in a) the BMBF itself; b) project management agencies working on behalf of the BMBF; c) universities and research institutes involved in projects for scientific cooperation with developing countries and emerging economies funded by the BMBF. A fourth group included d) other experts, such as scientific advisors to the ministry or experts from other ministries. Sometimes, access to potentially interesting data was restricted: for example, participant observation in form of an internship in the BMBF wasn't possible, some potential interview partners did not agree to being interviewed, and insights into some internal political documents of the BMBF were not granted. Next to the interviews, the study of policy therefore relied on publicly available documents such as official strategies, research programmes etc. Appendix A-1 gives an overview of the types of data collected in interviews and during fieldwork, about the types of respondents, and about the occasions of participant observation. An anonymized list of interviewees is included as Appendix A-2.

4.3.1   Selection of funding initiatives and project case studies

In order to trace how BMBF policy discourses impact the implementation of research projects, I chose two funding initiatives as exemplary funding lines, and therein two implemented projects as case studies for closer investigation in form of participant observation. Although international cooperation is funded within various programmes, programmes for the collaboration with emerging economies and developing countries have longest tradition and highest amounts of funding within the Framework Programme on Research for Sustainable Development (FONA), now in its second edition (BMBF 2009a; BMBF 2012a).

As funding initiatives on water related research have a comparatively long history within the BMBF (with predecessors such as GloWa, BMBF 2003a), the case study projects were purposefully selected among BMBF-funded projects on water related issues. The restricted access to data narrowed down the options: Originally, I had planned to include a case from Asia in the study, but no project with Asian partner countries was willing to participate. As a consequence, and instead of searching for geographical contrast, I chose two cases from Latin America: Having worked on Latin America before, my knowledge of the social, cultural, scientific

context and as well as speaking Spanish and Portuguese were strong arguments for choosing cases on the same continent.

The two projects identified in Brazil and in Peru seemed to offer comparable yet differing insights ideal for case study design (Flyvbjerg 2006). In both countries, social and ecological development lag far behind economic development (OECD 2010a; Albornoz et al. 2010), and income gaps between rich and poor are among the widest in the world (UNDP 2011). Both projects, IWAS-Agua DF in Brazil and LiWa in Peru were BMBF-funded projects on water management in city contexts. As collaborative projects, both involved German researchers as well as partners in the partner country. They had been running for a few years and faced their final phases during my research stays (IWAS-Agua DF 2012; LiWa 2012).

Beyond their structural comparability, the projects showed a number of differences which led me to expect interesting contrasts. While LiWa was funded within the Megacities funding initiative, IWAS-Agua DF was funded within IWAS, a programme drawing on the IWRM funding initiative. Both thus exemplified the implementation of different funding initiatives. A further distinction between the projects was the diverging policy frame for ST&I cooperation with Germany. For a long time, Brazil has been Germany's most important partner country for ST&I cooperation in Latin America, based on a long tradition and a ST&I cooperation agreement of 1969 (International Bureau of the BMBF 2011). Peru on the contrary, as most other developing countries and emerging economies, had not signed an ST&I agreement with Germany yet (Kiwitt-López 2011: 2). As I learned during empirical research, the existence or non-existence of an ST&I agreement was not a relevant difference in cooperation, however.

4.3.2   Data quality and generalizing findings

In order to check for data quality – qualitative validity and reliability – I relied on triangulation. Additionally, intra- and intermethod triangulation also generated some additional data which gave additional depth to the study (Jick 1979). Intramethod triangulation showed that perceptions vary across the projects, as well as among and between the policy levels. Intermethod triangulation also showed that in some cases, practice and statements diverge. Based on my constructivist perspective, the juxtaposition of things said and things done through interviews and participant observation was interesting data in view of the expectations and norms that interviewees tried to fulfil in interviews, while practice on the ground showed different realities (DeWalt and DeWalt 2011).

Basis of theory-building in qualitative approaches such as Grounded Theory is the inference from single cases to the general. This is done through systematic construction and comparison of ideal types or categories. In contrast to quantitative theory testing, which relies on numerical representativeness, qualitative re-

search thus relies on conceptual representation as theoretical basis (Przyborski and Wohlrab-Sahr 2014). I therefore collected empirical data until a saturation point was reached, and no new details or concepts came up which could have added further aspects to theory (Corbin and Strauss 2008).

Having carried out a total of 103 interviews (Appendix A-2), which showed a number of repeating statements, I thus postulate that my findings are generalizable beyond the individual interviewees for the discursive perspective within/on policy processes and project implementation in the setting studied. While some additional interviews carried out with project participants and BMBF staff in other funding initiatives within and outside of FONA suggest that findings such as concepts and types developed might possibly be transferable to further policy and implementation contexts, this assumption would not hold scientifically, and further generalisations would require further research.

4.4   Fieldwork

4.4.1   Entry into the field

In order to carry out this research, the cooperation of both the BMBF and the projects to be examined was essential – ethically as well as pragmatically. Therefore, the ministry was asked for approval and non-monetary support at an early stage, and luckily was supportive of the proposed research and open towards a scientific reflection of its policies. Heads of both relevant sub-departments of the ministry at the time of starting into data collection (2012), Maximilian Metzger of the Subdepartment for International Cooperation (Dep. 2.1) as well as Wilfried Kraus of the Subdepartment for Sustainability, Climate, Energy (Dep. 7.2) gave official permission to conduct interviews among their ministerial staff. Due to existing power hierarchies and dependencies, consent by these high-level gatekeepers was essential for the process of data collection, not only to conduct interviews among lower level ministerial staff, but also among potential interview partners in funded projects or project management agencies. In view of the projects visited as case studies, the German coordinators were additionally addressed in their role as gatekeepers.

Having worked in the International Bureau of the BMBF at the project management agency before – even continuing so during the early stages of the PhD – was a double-edged sword. Mentioning my background sometimes functioned as a door-opener, as the job seemed to prove insights into the context of BMBF work. On other occasions, however, it caused suspicion among interviewees, who suspected that my research was mingled with BMBF objectives, or even that I was researching undercover for BMBF purposes. The International Bureau, on the other hand, as agency directly working for and depending on the BMBF, seemed to fear

potentially critical research results and underlined that it was problematic to employ me in my double role as staff and researcher. On this background, I chose to straighten things out and to resign from the job in order to dedicate my full time to the PhD before starting fieldwork.

4.4.2 Interviews

As mentioned before, most data were collected through semi-structured interviews. Before the interviews, guidelines were designed containing a list of questions and topics that should be covered, in order to ensure reliability and comparability of data (Bernard 2006). However, in the beginning of fieldwork the interview guidelines were too closely linked to my research questions, too theoretical and thus too abstract and sometimes not readily understood by my interviewees. I therefore had to translate them into a language and level of practice meaningful to interviewees. The guidelines were thus adapted during the process of fieldwork, also based on new insights and according to each interview partners' expertise and insights. An example of an interview guideline is included as Appendix A-3.

Whenever possible, I sent the interview questions as well as an abstract of my research proposal to the potential interview partners via email in advance. If this wasn't possible, interviewees were informed about the objectives of research at the beginning of the interview, which mainly took place in the interviewee's work space. With the prior consent of the interviewees, most interviews were audio-recorded and transcribed later. An exemplary cover page and the transcript of the first minutes of an interview are included as Appendix A-4. Depending on the individual interview partner, I conducted the interviews in German, English, Spanish or Brazilian Portuguese. For the sake of readability, I translated all interview statements cited within this book into English. No research assistants or translators participated in the data collection process.

4.4.3 Participant observation

In order to produce dependable data out of participant observation, methods literature recommends prolonged stays in the field combined with the systematic recording of data in field diaries and fieldnotes (Cresswell 1998). Accordingly, I spent two months in each of the case study projects. In LiWa, this meant to participate in the project's everyday routines, staying at the project office for the time and following the project coordinator in his daily work, meetings, stakeholder events, visits to project sites, etc. In IWAS-Agua DF, the project set up was quite different. No project office existed, so instead of relying on informal conversations and participant observation, I collected information about the project routine through semi-structured interviews with the numerous project participants at different

work places. However, during my field stay, a Brazilian-German project week took place, including meetings and workshops as well as high-level events such as a reception at the German Embassy. On these occasions, participant observation was useful to witness the

> "discursive and non-discursive practices in discourse production, in the setting up and using of dispositifs, the practical reception/adaptation/confrontation with discourses and the analysis of the interplay between situational contexts and practices with discourses or the constitution of contexts through discourses." (Keller 2013: 102)

Participant observation therefore produced quite distinct data from interviews, as it showed how projects dealt with the dominant policy discourse and its effects in action. Participant observation additionally provided insights into interactions between policy makers, project participants and other actors during several conferences, such as agenda-setting events (Appendix A-1). On these occasions, manifold informal conversations with project participants, ministerial employees and project management agency staff occurred, which often contributed undistorted, unfiltered and uninhibited statements on the research subject. During the occasions of participant observation, I took fieldnotes of the conversations, observations, preliminary ideas of analysis, etc. Due to the mostly formal settings of participant observation I could write them down immediately in my laptop or paper notebook without causing irritation. Appendix A-5 depicts an exemplary page from my fieldnotes on paper.

4.5   Data analysis

In the approach to discourse as conceptualized in SKAD (ch. 3), statements, practices and dispositives are considered as "manifestations of the structured processing of controversial social knowledge" (Keller 2013: 85). SKAD is therefore aimed at finding the *typical*: From individual utterances, general statements about a discourse are abstracted. This means that while acknowledging the coexistence of different forms of knowledge or constructed realities, discourse analysis is not interested in reconstructing individual, subjective opinions, meaning ascriptions, or knowledge – this is a major difference to other forms of qualitative, interpretive data analysis (Keller 2011b; 2013). Therefore, the aim of data analysis was to find typical patterns, shared knowledge and interpretations of reality among the actors (Meuser and Nagel 2002). Interviews are considered as instances of discursive events, which contribute statements to a discourse. These in turn make up the body of a discourse's contents.

However, there is no standardized procedure or technique of how to get from single individual utterance to the typical statement. According to Corbin and Strauss, "[a]nalysis is, for a large part, intuitive and requires trusting the self to make the right decisions" (2008: 71). In order to maintain scientific quality, it is therefore important to explain and justify the chosen approach and document it. Grounded theory seemed as appropriate approach to data analysis which entailed a high degree of reflexivity in the process of a systematic reconstruction of the construction of reality (Keller 2013).

4.5.1   Corpus of data for fine analysis

Individual utterances mostly do not represent a complete discourse, but just a piece of it (Keller 2013). In general, fine analysis

> "cannot include all the data in the corpus. On the contrary, it must arrive at a systematically reflected and justified selection of texts or textual extracts within the corpus, i.e. it must subject the data corpus to further restrictions, and particularly in respect of the need to produce statements about the discourse as a whole." (Keller 2013: 98–99)

While the initial corpus of texts, interviews and notes on participant observation emerged mainly through theoretical sampling (see above), documents for fine analysis were selected on the basis of being typical, exemplary of other texts, other actors, other events. Statements were contrasted to reconstruct the discourse in depth (precise nuances within the discourse) and breadth (spectrum of different subdiscourses within the field) until a saturation point was reached, and no further aspects emerged to explain theory/research question (Keller 2013).

4.5.2   Analytical procedure

Coding is an analytical tool through which data is linked to concepts and theories (Corbin and Strauss 2008; Bryman and Burgess 1994). Several approaches to coding exist. While Grounded Theory develops codes exclusively based on empirical findings, I chose to follow DeWalt and DeWalt (2011) in entering into the data material with a list of known codes derived from my conceptual frame and research questions, but keeping open-minded for new, unknown categories. The list of codes was adjusted, categories were expanded or reduced, labels refined.

Contextual codes, also called structural codes in methods literature, were used to denote the underlying properties of the interviewees, such as nationality, social position, disciplinary background, etc. Contextual codes also depicted the context of statement production, such as who was intended as addressee of the text, context in which the statement was made, etc. Attaching conceptual codes allowed me

to crosslink and analyze the underlying conditions for certain types of statements later – thus to define different contextual levels for different interviews, documents or actor types (Corbin and Strauss 2008; Keller 2013).

Based on Grounded Theory, I used a few analytic strategies as entry points into analysis. On the one hand, asking questions about the content ("what is going on?") and about theory ("what is the relationship of one concept to another?"), and on the other hand making comparisons between texts in order to see similarities and differences. Using the software Atlas.ti, I developed conceptual codes to depict underlying concepts identified, such institutions, activities or ideas. Next to the broader concepts taken from the conceptual frame, in the beginning categories were developed by looking at the text itself, such as main problems, central themes, concerns. During analysis, I added further codes for recurring patterns (DeWalt and DeWalt 2011; Keller 2013). Codes were set into relation to each other, for example regarding the interaction between actors or in view of causes and effects. On this basis, I differentiated between themes or categories, elaborated properties or dimensions specific to one theme or one group and developed different subcodes which depicted nuances. The ongoing analysis was accompanied through writing memos, i.e. notes on ideas, concepts, dimensions of categories, codes, comparisons, etc. (Ritchie and Spencer 1994; Corbin and Strauss 2008; DeWalt and DeWalt 2011; Keller 2013). To exemplify coding, an extract of the list of codes is added as Appendix A-6.

4.6   Reflections on my position as a researcher

4.6.1   Objectivity and reflexivity in research

While scientific paradigms such as positivism or post-positivism stick to an image of science as objective and disinterested, scientists following constructivism or critical theory question this image and challenge the idea that scientific knowledge is truly objective and rational (Guba and Lincoln 1994). Qualitative research requires interpretation of the data – which necessarily involves the researcher who attaches meaning to data and represents results of analysis in a written form (Langer 2013). Thus, scientific knowledge is viewed as a type of knowledge among others, affected by interests, ideologies and world views of the scientists producing it (Sismondo 2008). Following, if underlying interests coin science and research, these biases should be acknowledged rather than hidden. As Cox provokingly states: If a scientific theory pretends not to have a standpoint, it is most probably an ideology (Cox 1981).

Scientific reflexivity is a concept in this vein, acknowledging biases and the own position. Coined by social thinkers such as Bourdieu or Giddens, it rose to the

agenda in the 1980s. Most reflexivity concepts share the idea that "authors should explicitly position themselves in relation to their objects of study so that one may assess researchers' knowledge claims in terms of situated aspects of their social selves and reveal their (often hidden) doxic values and assumptions" (Maton 2003: 54). There are some differences in conceptualizing reflexivity. Scholars following Bourdieu's definition continue to believe in the possibility of objective representation. For them, reflexivity depicts the reflection of the (social science) researcher on his/her own doing through sociological methods, aimed at overcoming one's own perspective, subjectivity and positionality and thereby moving towards a higher degree of objectivity. In contrast, scholars in the tradition of constructivist Science and Technology Studies stress the impossibility of objective representations by a single researcher and call for alternative perspectives on a research problem in order to contextualize and contrast different knowledges (Langenohl 2009).

Scholars also detect an inherent paradox in reflexivity: Even a reflection on the own doing is positional and partial. Potentially, there are infinite possibilities of constructing and deconstructing realities and reflecting on reflections – which bears the risk of reflections becoming a means of its own, and not leading to further insights about the research subject. Authors therefore propose to pragmatically put limits to reflections (Maton 2003; Schweder et al. 2013).

Despite all differences and paradoxes, and although little has been said about how to put reflexivity into research practice (Maton 2003; Kühner et al. 2013), reflexivity in form of problematizing the own knowledge production has turned into a norm in critical paradigms and their scientific practice and ethos (Kühner et al. 2013). Aiming at comprehensibility and transparency, researchers provide reflexive accounts on how data was collected and interpreted (Langer 2013; Hametner 2013).

In case of discourse analysis, Keller equally argues in favour of a high degree of reflexivity on the own research activity and its relation to objective truth. Discourse research is not believed to produce exclusive truths, but rather a *discourse on discourse*. In addition, the statements produced through research are part of a social science discourse, thus being enabled and constrained by current norms of research production, guided by pre-existing structures defining which type of research practice or statement production is legitimate, or who can fulfil speaker positions within discourse (Keller 2011a).

Notions of reflexivity are often based on the idea that the interaction of researcher and research field is a part of the research process, which adds to contextual data production, if not even to impacts on reality. For example, the role of the researcher and the researched can be viewed in the context of power relations affecting the field and their effects on research. Looking at the other direction, research effects on the actors within the research field become a subject of reflexivity. Being part of a discursive field as a researcher structures interaction with actors in the researched field, who reinforce or negate subject positions, attribute differ-

ent levels of power or social standing to the researcher, while the researcher may also reinforce or deconstruct these, thereby also impacting on power structures (Hametner 2013).

For my own research, this means that while it is impossible to reduce the own subjectivity to zero, my own role shall at least be made transparent through reflecting on my own doing in the field and in data analysis. This shall not lead to narcistic diary-like accounts (Maton 2003), but rather to a better understanding of the research process and the data generated, through "explicit attention to the ways in which family background, personality, education, training, and other experience might well shape who and what the researcher is able to access, as well as the ways in which he makes sense of the generated data" (Yanow 2006: 408).

The reflections not only on biases, but also on other aspects of positioning oneself in the research setting may also lead to further insights into the discursive field or the power relations at play. In this vein, it is interesting to consider how interviewees perceived me as a researcher, or to reflect on their expectations in view of the research outcomes. The ascriptions in the interaction and communication during fieldwork this type of context-specific data was produced (Bogner and Menz 2002). While some insights into my role in the research process are detailed in this chapter, reflections will also be part of the empirical chapters.

4.6.2   Interactions in the field: My own position as a researcher

Researching on policy making and project implementation in science cooperation can be described as a situation of "studying up" (Wedel et al. 2005): Actors of the researched field were mainly highly educated, holding PhD titles or higher degrees, and occupied high-level jobs and thus had a higher social and educational status. This led to a variety of challenges ranging from interaction with interviewees to ethical considerations during data analysis. Interview partners perceived and reacted to me in different ways, some treating me as a lay person foreign to the topic; some discussing with me as a co-expert; some perceiving me as potential critic or evaluator (Bogner and Menz 2002).

As knowledgeable experts, often with natural science or engineering background, some interview partners openly voiced their scepticism regarding my research question, methods, or scientific paradigm (Nullmeier et al. 2003). A reoccurring concern of the interview partners was the lack of quantitative analysis, statistical representativeness, or evaluative indicators. In addition, my aptness to do research on a topic in such a highly political context was questioned on several occasions. In the most extreme cases respondents called me naïve to believe that I could do research on such an assumingly hot topic without negative consequences for myself or suggested to leave research on the subject to advanced researchers with a permanent position independent of BMBF influence.

In many cases, potential candidates seemed to shy away from being inter-
viewed. Several authors have blamed fear of potential criticism for this reluctance
to share information. In professional settings, such as policy making, actors would
be generally uncomfortable with spreading internal information, or fear their pro-
fessional routines or identities to be deconstructed (Nullmeier et al. 2003; Mosse
2011). However, I feel that in case of my research, the reasons were of a different
nature. Although an evaluation of project activities was never among my research
activities, speaking openly about certain issues seemed to cause fears of harmful
consequences, such as not being granted future funding. Interviewees were often
sceptical and reluctant to speak openly, possibly critically, about the ministry. Thus,
even those who were critical about the existing power relations and policies were
afraid of potential negative consequences if critique would be openly outspoken.
Most interviewees therefore only agreed to be interviewed anonymously and/or
under the condition to approve their interview data before publishing. In order
to build trust, lengthy explanations about my background, my research interest,
as well as my independence – financially and conceptually – from the BMBF were
necessary to reassure that statements were not shared with the ministry.

Similar to Mosse's experience (2011), I experienced it as disturbing to be accused
of wrong views, of causing harm for the institution or putting future funding at
risk. More so, however, I was also surprised by the emotional responses. Being con-
fronted with hidden to open scepticism and rejection by some potential intervie-
wees was hard, as of course I had hoped to be faced with research participants who
would appreciate the usefulness of the research project. However, the emotional-
ity involved also revealed that I was hitting a sensitive spot in the interviewees,
and that they apparently attributed importance to the research topic (Corbin and
Strauss 2008). At the same time, the reluctance also made me very aware that the
topic was highly sensitive and data presentation had to be done in a way that does
not harm any of those who had consented to being interviewed despite of their
fears.

Which is the adequate way of reacting to reproaches and scepticism? As Mosse
(2006: 949) puts it: "An analysis that exists within a field of objections has to be
sure of itself." Being convinced that the topic was worthwhile to be investigated,
I tried to evade further criticism by being scientifically sound, methodologically
as transparent as possible, and providing reflexive accounts of research. On the
other hand, the reactions also triggered some questions about the origin of the
objections, which I consider to be the unequal power relations inherent in the rela-
tions between ministry, project management agencies, and projects. These will be
highlighted separately in the following chapters.

4.6.3   Ethical considerations

Scientific ethical codes were mainly designed in view of people studied who are less powerful than the researcher, thus in view of studying *down*. However, if "the people being studied are more powerful than the studiers, this precept [...] is problematic" (Wedel et al. 2005: 42). The authors therefore argue that in a context of powerful actors or institutions, such as government agencies, researchers should be allowed to follow journalistic ethical codes instead of scientific codes of conduct regarding their sources (Wedel et al. 2005).

This research project nevertheless followed the standard principle of ethics in research to maintain the integrity of informants and do no harm (Cresswell 1998). This meant that the objectives of research were entirely disclosed to the interviewees and participants before conducting interviews and participant observation within the case study projects (Neuman 2006).

A reflexive science should acknowledge the power inherent in data interpretation: The researcher has the power to make sense of the data (Mosse 2006; Hametner 2013). In case of studying up, this poses an ethical dilemma: As a general rule, social scientists should return their writing to their interviewees for verification. But in case of public policy and other official settings, Mosse argues that representations in research often compete with official, authorized representations of the informants (Mosse 2006; 2011). He suggests

> "that the way in which professional informants respond to ethnographic description itself generates important research insights. [...] But this does not mean that such 'objection' is a form of triangulation. Indeed, objections rarely concern simple matters of fact, but reveal divergent epistemologies and frames of reference, perhaps those of managerial and interpretative viewpoints or of policy professionals and ethnographers." (Mosse 2011: 51)

The author thereby points to a tight spot: Does the initial consent to being (anonymously) interviewed encompass the right of final interpretation and editing, and how can the researcher disconnect consent and "demand for interpretative consensus" (Mosse 2011: 51)? This is highly important, as powerful actors may resort to ethics codes in order "to evade social science scrutiny, resist critical analysis, gain control over research and protect reputations and public images of success" (Mosse 2011: 51). Thus, the question is where to draw the line between what is scientifically correct, and what is socially correct or desirable, what can be said without causing potential harm or being censored (Mosse 2006).

On this background, and to obtain room for my analysis while fulfilling my obligations towards the interviewees at the same time, I decided to anonymize interviews instead of sending in interview transcripts or analyzed data to the interviewees for authorisation. This enabled me to maintain the interpretive authority

of the data to myself, while I consider the loss of information through anonymisation as limited – and justifiable, as in discourse analysis, interview statements are considered as part of a larger body of typical statements and practices anyway (Keller 2011a).

Balancing of the necessary level of anonymity with the loss of information, I classified interview partners into four primary categories with a letter code attributed to each: a) external experts (EE), b) policy makers/administrative staff (PA), c) project management agency staff (PT), and d) project participants (PP). Based on the primary category, each interviewee was given an identification code, consisting of the two-lettered category and a unique number. References to specific interviews are given through referring to the identification code. All interviews are further listed in an anonymized overview of interviewees (Appendix A-2). In the list, further details about the interviews are given: The interviewees' broad field of expertise, their institutional background, as well as the date of the interview. In order to ensure anonymity, any references to gender were eliminated. Among the interviewees, 4 held positions on a working level (such as PhD students, working level staff with lower levels of responsibility); 59 worked on mid-level positions (managers, post-docs, research officers, heads of small units), and 37 were high-level staff (such as heads of ministerial (sub-)departments and above, directors, professors).

5   Public funding for international research cooperation in Germany

Research cooperation between Germany and developing countries or emerging economies is located at the borderline of responsibilities between science policy and development policy. Depending on the thematic field of science, other technical fields of policy, such as environmental policy, agrarian policy or health policy, may overlap thematically as well. Whereas in other countries, such as France, responsibilities for science for development issues are shared between the Ministry of Development Cooperation and the Ministry of Science (interview with EE19), in Germany the framework for research cooperation is provided mainly through science policy, which is defined by the BMBF. Development cooperation policy, in contrast, is determined through the BMZ. It is important to understand that scientific cooperation and development cooperation operate within different institutional settings, have different objectives and also focus on different target groups. As the subject of my research is research cooperation between Germany and developing countries or emerging economies, not technical development cooperation, my focus is German science policy and funding, not development policy and funding.

5.1   Research funders for cooperation with developing countries and emerging economies

5.1.1   Institutional and project-based research funding

The German constitution obliges the German state to foster science, research and tertiary education (Heinrich 2003). Thus, public funds are made available for scientific endeavours of different kinds. In 2012, the German state spent a total of EUR 23.1 billion on research (DFG 2015: 24). This public funding of science is based on institutional funding on the one hand and on competitive research funding on a project base on the other.

Public core funding – i.e. institutional funding for university-based as well as non-university affiliated research and research infrastructure – is mainly distributed through the German national state and through its federal states, the *Bundesländer* (BMBF 2014a). Public German universities receive their core funds through the *Bundesländer*.[1] In addition, the German research landscape consists of four big non-universitarian research institutions: The Max Planck Institutes, the institutes of the Leibniz Association, the Helmholtz Centres and Fraunhofer Institutes. All of them receive cofunding through the national government and *Bundesländer*, with varying shares of funding – and an increasing share of third-party funding (for a detailed overview, see GWK 2017: 38).

Furthermore, app. 40 research institutes are funded publicly in order to carry out policy-relevant research on behalf of different German federal ministries, such as the Federal Research Institute for Rural Areas, Forestry and Fisheries, the Thünen Institute, under the auspices of the Federal Ministry of Food and Agriculture (BMEL) (Thünen Institut 2014) or the German Development Institute (DIE), which provides policy advice to the BMZ and receives core funding through BMZ and the State of North-Rhine-Westphalia (Deutsches Institut für Entwicklungspolitik 2014).

Next to public core funding, project funding – both from public as well as private sources – has been playing an increasing role in Germany since the 1990s. The quota of third-party funding increased from 16% in 1998 (DFG 2012: 29) to 28% of the total funds available in 2012 (DFG 2015: 25). In project-based funding of research, both *Bundesländer* as well as the federal German government rely on the Deutsche Forschungsgemeinschaft (DFG), Germany's largest research funding institution, which functions as an intermediary in distributing competitive project-based research funds (Hinze 2010; DFG 2012). Among all public and private donors, the German Research Foundation (DFG) supplies the highest share of third-party funds: In 2012, the DFG came up for around a third of the total third-party funds. The *Bundesländer* only financed a minor share of the total third-party funds, amounting to under 2% (Statistisches Bundesamt 2015: 28). The EU's research programmes, currently Horizon 2020, are an important source of third-party funding for research projects in Germany as well (European Commission 2015). As all member state, Germany contributes funds to the budget of Horizon 2020. In return, German researchers are encouraged to apply for funding. In 2013, German researchers obtained a total of EUR 549.883 million from the 7th European Framework programme in place at the time, amounting to roughly 10.8% of the total third-party funds distributed within the German research community in 2013 (Statistisches

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1 Since 2015, a change in Article 91b of the German constitution enables the German national state to cofund public universities along the *Bundesländer* (BMBF 2015c). It remains to be seen if this affects the share between core and project-based research funding in the long term.

Bundesamt 2015: 28). In contrast to these different sources of public funding, private sources only supplied a total share around 20% (DFG 2015: 26).

The German state thus is an important source of third-party funding distributed through intermediaries such as the DFG or the EU-Commission. However, the German national state also supplies and distributes around 25% of the third-party funds available on its own (DFG 2015: 26). Different ministries are endowed with distributing research funds in Germany. Among them, the BMBF supplies the biggest share of research funding on project basis, with EUR 3,064.5 million in 2012 (BMBF 2014a: 502).

It is worthwhile to question why the BMBF distributes a large amount of third-party funds itself instead of commissioning the DFG with the task. The shared responsibilities of the *Bundesländer* and the federal government in view of higher education and research explain this fact: Until the change in Article 91b of the German constitution, the BMBF was not allowed to provide institutional funds to universities (BMBF 2015c). However, the funds distributed among the German research community via the DFG are predominantly used in research projects whose focus is defined bottom-up by the researchers themselves. The BMBF therefore only has a limited structural influence on universities. As a consequence, the ministry needs to define and fund research projects on its own in order to direct research activities towards national objectives of science policy (Stucke 2010; DFG 2012: 43).

5.1.2 German research funding for cooperation with the developing countries and emerging economies

Within the bigger picture of public third-party research funding, some funds are specifically dedicated to funding cooperation between German scientists and scientists from developing countries or emerging economies. Table 5-1 gives an overview of the main German actors in the area of funding science cooperation and their most relevant programmes for cooperation in research between Germany and developing countries and emerging economies (Programmes of the BMBF are excluded from table 5-1 and illustrated separately and in more detail in Appendix B-2).

As the table shows, various institutions support international cooperation between Germany and developing countries or emerging economies in different ways and on different levels. International research cooperation is mainly funded through mobility schemes, such as individual research scholarships abroad. Most institutions do not exclusively support research cooperation, but support the internationalisation of education as well, e.g. through enabling studies abroad or through the exchange of educational staff or engage on a more strategic level in order to enhance internationalisation. In doing so, the various institutions do not

necessarily follow the same agenda. Comparable to findings in other countries, different German actors or donors in the field of international research cooperation follow diverging objectives and act based on different motivations (Flink and Schreiterer 2009).

Among the public donors, the Federal Foreign Office (AA) seeks to promote cooperation in order to advance general foreign policy goals and to promote Germany as a research and business location with activities and funding in the frame of its *Außenwissenschaftspolitik* or Research and Academic Relations Policy. Between 2011 and 2015, the AA spent around EUR 600 million on different activities in the field of research cooperation with developing countries and emerging economies in research (18. Deutscher Bundestag 2017: 12).

Emerging economies play a central role: In a joint effort with the BMBF, the AA funds so-called German Science and Innovation Houses in Russia, Brazil, India, Egypt and the US, which shall increase the visibility of German ST&I abroad (Auswärtiges Amt 2013). In addition, the AA also funds the internationalisation of research through granting research scholarships and research awards for Germans abroad or foreigners in Germany. The AA does not handle the administration of these scholarships itself but works with the German Academic Exchange Service (DAAD) and the Alexander von Humboldt Foundation (AvH) as intermediary organisations.

Alongside other funders such as the BMBF and *Bundesländer*, the AA also supports the internationalisation of research through the DFG's international schemes. Mainly oriented at strengthening German research based on competition and excellence, the DFG grants individual research scholarships and professorships for foreign scientists in Germany and German scientists abroad. Although its standard programme of project funding is not primarily aimed at international cooperation, researchers may do so within the scheme, normally without receiving funds for project participants outside of Germany. In case of cooperation with developing countries, however, researchers may apply for additional funds for partners abroad. In addition, the DFG also cofunds international cooperation with funding institutions from other countries. Bilateral calls with developing countries are rare, but joint programmes or calls for cooperation with BRICS countries have been funded repeatedly (DFG 2012, interview with EE14).

Table 5- 1: German donors and funding bodies of international research cooperation and their main approaches

Donor/Funding body	Type of activity funded
AA	Research (and study-) scholarships via AvH and DAAD; German Science and Innovation Houses
AvH	Research scholarships and research awards for foreign scientists in Germany and German scientists abroad (financed through AA, BMBF, BMZ); specific programmes for researchers from developing countries
BMEL	Project funding and staff exchange schemes via the Federal Office for Agriculture and Nutrition (BLE)
BMZ	Individual scholarships via AvH and DAAD; Institutional funding of CGIAR centres (via GIZ); Project funding for agricultural research for development (via GIZ); Funding for higher education initiatives via GIZ, DAAD
DAAD	Different research (and study) scholarships for foreign students and scientists in Germany/German scientists abroad (financed through BMZ, BMBF, AA); specific programmes for researchers from developing countries; Programmes targeting higher education, such as the Exceed programme on cooperation and excellence in higher education, or the Pan-African University (with GIZ); Research components in the scope of large partnership programmes between Germany and developing countries/emerging economies; To a lesser extend: Programmes for project funding, such as NoPa (joint initiative with GIZ and CAPES)
DFG	Individual research scholarships and professorships for foreign scientists in Germany and German scientists abroad, no specific programmes for developing countries (financed through *Bundesländer*, BMBF, AA); Project funding: international cooperation possible in normal programme, partners outside of Germany usually not funded, but in case of cooperation with developing countries additional funds may be granted
GIZ	Institutional funding for CGIAR centres on behalf of BMZ; Project funding for agricultural research for development; Research components in development cooperation projects; Initiatives targeting higher education, such as the the Pan-African University (with DAAD); To a lesser extend programmes for research project funding, such as NoPa (with DAAD and CAPES)

Source: own elaboration based on Auswärtiges Amt 2013; Alexander von Humboldt-Foundation 2014; DAAD 2015; DFG 2012 and interviews with PA16, EE05, EE15, EE14.

The BMZ funds activities within higher education and research, including individual scholarships and university partnerships for science management with app. EUR 50 million per year (18. Deutscher Bundestag 2017: 12). Next to policy relevant research carried out on the BMZ's behalf at the DIE, the BMZ commissions research on concrete, applied topics through bilateral Funds for studies and specialists, so-called *Studien- und Fachkräftefonds*, in order to back up its development cooperation projects (interviews with PA16 and PA17). In addition, the BMZ funds research cooperation to a smaller extent. This is strategically endorsed through its 2012 *Education Strategy*, which includes research and tertiary education (BMZ 2012). However, compared to other sources of research cooperation funding – and also compared to BMZ expenditures on other activities – the BMZ funds for research activities are small (BMBF 2014a). BMZ programmes rather target infrastructural measures, capacity development in the higher education sector, which are not always easily separated from research activities. However, according to the interviewee, the BMZ's focus is rather on

> "the creation of suitable framework conditions, capacitation in tertiary education, the formation of competent researchers and research capacities, as a side product of the measures. The BMBF then builds up on this. Its calls for proposals are directed towards research capacities that already exist." (PA17)

The BMZ does not have own research funding programmes, but finances research through intermediary organisations. Both DAAD and AvH receive BMZ funds in order to grant scholarships to students and scholars from developing countries and emerging economies. An example is the BMZ-funded Georg Forster Programme of the AvH, which is exclusively aimed at providing scholarships to researchers from developing countries on topics relevant to development policy (Alexander von Humboldt-Foundation 2014).

As largest public funder of international academic exchange, the DAAD received a total operative budget of EUR 441 million in 2014, with the AA supplying 40%, the BMBF 23%, the BMZ 9% and the EU contributing 15% of the budget. However, being aimed at academic exchange on all levels of higher education, the DAAD does not primarily fund research projects as such (DAAD 2016a). Similar to the AvH, the DAAD grants individual scholarships to foster international exchange and mobility. In addition, it implements large partnership programmes between Germany and developing countries or emerging economies, including network initiatives on higher education management such as the Dialogue on Innovative Higher Education Strategies, or so-called "subject-related academic partnerships with developing countries" (DAAD 2016b). While many DAAD programmes are primarily aimed at institution building, curricula development, higher education management and strengthening research systems, some programmes have research components, such as the joint Mexican-German Master's programme on Natural Re-

sources Management and Development at the Cologne University for Applied Sciences and the Universidad Autónoma de San Luis Potosí (interview with EE15). The exceed-programme, funded by BMZ, fosters cooperation between universities and research institutions in Germany and developing countries in view of excellence in research and higher education in order to reach the MDGs or SDGs (DAAD 2017). Similarly, other programmes, such as the Ghanaian-German Centre for Development Studies and Health Research, which is implemented through the University of Ghana and the Center for Development Research (ZEF) and funded in the scope of the DAAD/AA initiative "African Excellence – Fachzentren zur Eliteförderung", are aimed at improving higher education, research capacities and enhancing future research cooperation (ZEF 2014b).

A further German institution involved in funding collaborative research activities is the Gesellschaft für Internationale Zusammenarbeit (GIZ), the BMZ's implementation agency. Through GIZ, the BMZ grants institutional funding to the international research centres of the Consultative Group on International Agricultural Research (CGIAR). In addition, the ministry funds development-oriented agricultural research projects through the Advisory Service on Agricultural Research for Development based at GIZ. Research components are also integrated in other GIZ projects of technical cooperation, but the competence centre for education within GIZ also has a specific unit on higher education and research (interviews with EE04, EE05; PA16, PA17). Whereas the GIZ rather carries out institution building projects in order to strengthen developing countries' educational and science systems, some GIZ programmes also resemble applied science projects, such as the NoPa programme. NoPa – according to its name aimed at creating "New Partnerships: Linking Academic and Technical Cooperation between Brazil and Germany" – was co-organized as a funding initiative between Germany (GIZ and DAAD) and Brazil (CAPES) between 2010 and 2018 (GIZ 2013, interviews with EE5, EE15). Funded through BMZ, the DAAD and GIZ also cooperate with the Commission of the African Union to set up the Pan African University's Institute of Water and Energy Sciences. Aiming at fostering higher education, science and technological development across Africa, the Pan African University establishes new institutes at existing research centres, aimed at educating post-graduates as well as PhD-candidates and to conducting applied research (DAAD 2016c; GIZ 2016a).

Last but not least, the Federal Ministry of Food and Agriculture (BMEL) funds a small number of international research projects and staff exchange in the area of global food security. The BMEL commissions the Federal Office for Agriculture and Nutrition with project funding (Federal Office for Agriculture and Nutrition 2015).

Among the German ministries engaged in funding international cooperation in research – without counting spending on higher education or mobility measures through intermediaries such as the DAAD – the highest amounts of funding are granted through the BMBF. Although no overall numbers of BMBF expen-

diture on research cooperation activities with developing countries or emerging economies are available, obtainable numbers at least show the large dimensions of BMBF funding. The BMBF exceeds the BMZ's EUR 36.7 million spent on research activities in 2012 (BMBF 2014a: 492) by far – BMBF expenditures for cooperation with BRICS countries alone amounted to app. EUR 47 million in 2012 (BMBF 2014a: 410).

In view of the BMBF funding for cooperation with developing countries, the only numbers available were those reported as Official Development Assistance (ODA) expenditures, which added up to EUR 112.7 million in 2012 (BMZ 2013), although quite likely this number includes activities of cooperation in education as well as in research. Other official sources state that between 2011 and 2015, the BMBF allocated EUR 206 million on cooperation with African partner countries (18. Deutscher Bundestag 2017: 13). With the BMBF as large provider of funds for research cooperation between German researchers and those in developing countries and emerging economies, it is worthwhile to take a closer look at BMBF funding.

5.2   The BMBF as funder of international research cooperation

The BMBF does not primarily aim at international policy making, but rather focuses on the German national context in its policies and funding measures (ch. 5.3). Nevertheless, international cooperation is part of its policy spectrum. Across its departments, the BMBF funds international research cooperation in the scope of different strategies, within different funding initiatives, with different partner countries, on different topics and with different objectives. It is relevant to differentiate between the origins of funding within the BMBF, which is organized into eight *departments*, or *directorate-generals* (BMBF 2014c). At the time of research, five departments dealt with crosscutting or structural issues: the departments for *Central Services*; *Strategies and Policy Issues*; *European and International Cooperation in Education and Research*; *Vocational Training and Lifelong Learning*; and *Science Systems*. In addition, three further departments were set up according to the thematic issues of *Key technologies – Research for Innovation*; *Life Sciences – Research for Health*; and *Provision for the Future – Basic and Sustainability Research* (BMBF 2014c).[2]

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2 After the federal elections in 2017, a new minister, Anja Karliczek/CDU, took over. The change in political leadership was accompanied by a few changes within the ministry. Among other changes to the organisation of the BMBF, digitalisation is now embedded as a crosscutting issue in all thematic departments (BMBF 2019b).

5.2.1   International vs. thematic departments

International research cooperation is not exclusively funded by the BMBF's Department of European and International Cooperation in Education and Research (short: International Department), but in its thematic departments as well (Appendix B-2). Indeed, as a crosscutting department, the International Department is equipped with lesser resources than the thematic departments. In 2012, the International Department's total budget for international cooperation amounted to only 0.93% of the total BMBF budget (or EUR 44.9 million, of which EUR 14.6 million were dedicated to cooperation with developing countries and emerging economies). In comparison, the Department of Basic and Sustainability Research had more than twice the budget available for the international cooperation activities in FONA (BMF 2014; Bundesregierung 2012a).

In addition to budgetary differences, the departments also differ regarding their approaches to international cooperation (ch. 6). The International Department regularly funds a large number of smaller-scale international cooperation activities in the frame of ST&I cooperation agreements, usually only covering travel costs or costs for joint workshops, not personnel or research costs. The schemes available through the International Department range from funding for exploratory activities such as the preparation of projects to bilateral mobility projects for international cooperation, which are cofunded by the respective partner country. The research topics of mobility projects are usually topics of joint interest that the BMBF and the partner country agree on in government negotiations on ST&I (International Bureau of the BMBF 2014). A list of developing countries and emerging economies which have signed cooperation agreements with the BMBF is included as Appendix B-1.

With some partner countries of particular interest, the International Department sets up joint financial funds in order to pool resources for joint calls for research projects, as in case of Egypt, for example (BMBF 2011a). The International Department further organizes joint science years, which entail activities for enhancing the visibility of bilateral cooperation, and additional funding for cooperation projects (BMBF 2014d). In view of strategic policy development, the International Department is responsible for the Strategy of the Federal Government for the Internationalisation of Science and Research (BMBF 2008a) as well as the follow-up International Cooperation Action Plan of the BMBF (BMBF 2014e), with the main responsibility lying within the Unit on Policy Issues, Internationalisation Strategy (interviews with PA07, PA09). The Unit on Cooperation with Developing Countries and Emerging Economies, Africa and the Middle East, provided strategic input on cooperation with the respective countries to the Internationalisation Strategy (interviews with PA01, PA08).

The Department of Key Technologies – Research for Innovation had not yet funded cooperation with developing countries and emerging economies at the time of research. If international cooperation is funded at all – rather focuses on cooperation with worldwide leading-edge researchers in order to strengthen "Germany's top position through international cooperation" (BMBF 2014f). Within the ministry, the Key Technology Department's lack of international cooperation activities – especially in view of cooperation with developing countries and emerging economies has been attributed to the fear of granting future competitors insights into state-of-the-art industry-oriented research and thereby losing the worldwide competitive advantage (interview with PA05).

The Department of Life Sciences – Research for Health, which despite its name also hosted the working unit on Bioeconomy at the time of empirical research (but has now shifted into the Sustainability Subdepartment, BMBF 2019b), has shown more interest in international activities in the past. Within the department, two thematic strategies additionally frame international cooperation. Under the umbrella of these strategies, initiatives for research cooperation with developing countries and emerging economies have been funded in the last years. The National Research Strategy BioEconomy 2030, a joint BMU, BMZ and BMBF strategy lead by BMBF guides funding in the area of bioeconomy research, defining global food security as one out of five research priorities (BMBF 2010a). In the frame of the Bioeconomy Strategy, the Department of Life Sciences launched GlobE, a funding initiative for German-African cooperative projects pursuing a systemic approach of global food security research, in 2011 (BMBF 2011e, interview with PA13). From 2013 onwards, a funding initiative on Bioeconomy International, coordinated with partner countries such as Argentina, Brazil or Malaysia, launched repeated calls for proposals (BMBF 2017).

In the field of health research, the first major initiative for cooperation with developing countries dates back to the early 2000s, when the BMBF started cofunding the European and Developing Countries Clinical Trials Partnerships, a programme by EU member states and EU-Commission and several countries in Sub-Saharan Africa (interview with PT08). Since 2011, international cooperation is also inscribed in the national health research strategy. Funding now takes place in the framework of the Research Funding Concept Neglected and Poverty-related Diseases (BMBF 2011b). Within this programme, several funding initiatives for German-African cooperation existed. A funding initiative for German-African Cooperative Product Development Partnerships for Prevention, Diagnosis and Treatment of Neglected and Poverty-related Diseases started in 2011 (BMBF 2011c); a funding measure for German-African Health Networks followed in 2013 (BMBF 2013h).

The Unit on Humanities, Social and Cultural Sciences, Academies, Research Museums, hidden within the Science System Department started a funding initiative on Maria Sibylla Merian International Centres for Advanced Studies in the

Humanities and Social Sciences. The calls for proposals targeted cooperation with partners from Latin America and Sub-Saharan Africa and proposed funds for establishing centres, the initiative was not coordinated with any partner countries' governments, however (BMBF 2015d; BMBF 2016a).

5.2.2   International cooperation for sustainability, climate, and energy

Among the thematic departments, the Subdepartment for Sustainability, Climate, Energy, (the *Sustainability Subdepartment*)[3] located within the Department for Basic and Sustainability Research has the longest tradition of cooperating with developing countries and emerging economies – both of cooperation on a political level as well of funding cooperative research (ch. 8.2, 8.3).

The BMBF's environmental and sustainability sciences funding programmes and initiatives date back to the 1980s. Since 2005, FONA is the main programmatic strategy in place: the Framework Programme on Research for Sustainable Development, implemented in its second edition (FONA2) from 2009-2015 and since then followed up by FONA3 (Kahn-Neetix 2014). Cooperation with developing countries and emerging economies is not limited to a specific subprogramme of FONA; these are thematically oriented. While some funding initiatives within thematic subthemes include international projects now and then[4], international research is mainly funded within the subareas of *Global Change* and *Resources and Sustainability*, which organisationally correspond to the working units with the same names (BMBF 2009a). The table included in Appendix B-2 gives an overview of the different funding initiatives originating in different departments.[5]

The importance given to the international dimension of sustainability and environmental issues shows in the high amount of expenditures for international cooperation, which amounted to 20% of the total funds of FONA, EUR 100 million per year from 2010-2014 (Fischer and Mennicken 2013). According to official ministerial budgetary plans, this included EUR 18 million for international partnerships for environment and climate protection; EUR 5.8 million for international activities in earth system research, EUR 42 million and EUR 14 million for funding on sustainable water and land management (with main focus on international activities),

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3 In the BMBF's new organisational shape, the Subdepartment has been renamed into *Subdepartment Sustainability, Provision for the Future* (BMBF 2019b).

4 In the funding initiative for Transdisciplinary Junior Research Groups in the scope of the Social-Ecological Research Programme (SÖF) within FONA, for example, a collaborative project on agrobiodiversity in South India was funded (BMBF 2013a).

5 With the BMBF's organisational adjustment in the new legislative period, the subdepartment's working units have been slightly reorganized, as well. New units, such as the Unit on Systemic Mobility /City of the Future have been established; previous units have extended their responsibilities, such as the Unit on Resources, Circular Economy, Geosciences (BMBF 2019b).

not counting expenditures on the Regional Science Service Centers in Africa (BMF 2014; Bundesregierung 2012a). In case of water related research, international cooperation plays an even bigger role:

> "For the last ten years, BMBF-funded research on water has increasingly focused on international aspects, and it is increasingly fostered. International cooperation takes place with Israel, Palestine, Jordan, China, Russia, Indonesia, Vietnam, Iran and South Africa. Internationally oriented projects now amount to 30 to 40 %." (BMBF and BMU 2008a: 20; *own translation*)

According to interviews, in 2012, the share of financial funds spent on international cooperation had further increased to 50% (interview with PA02).

5.2.3   Research funding in FONA: from calls for proposals to projects

In general, BMBF research funding is granted as project funding in the frame of research programmes in specific thematic areas. This can be attributed to the science policy-makers aspirations of directing diverse science projects into a coherent line of investigation (Shove 2003). The Sustainability Subdepartment is no exception to this general BMBF norm. In FONA, most projects are funded through funding initiatives within thematic subpriorities that combine different projects under a common umbrella. In order to strengthen coherence and exchange among the projects of a funding priority or funding initiative, the BMBF often also funds so-called accompanying projects, aimed at networking or coordinating actions, general public relation and communication as well as crosscutting analysis. For example, this is the case in the funding priorities Integrated Water Resource Management (IWRM), Integrated Land Management, or Future Megacities (BMBF 2013b; 2014g; PT-DLR 2014a). In case of IWRM and CLIENT, the accompanying project AIM (Assistance for Implementation) additionally supports projects in crosscutting issues such establishing contacts to stakeholders on political levels or to development banks, aimed at supporting the implementation of project results (BMBF 2014h).

Most projects in FONA – as in other BMBF programmes – come into being based on official calls for proposals, which the BMBF announces publicly. These calls, officially termed "announcements of regulations for funding measures", specify the topic of the funding measure, give details about the envisaged project structure and define criteria that have to be fulfilled, such as scientific excellence, country expertise, composition of the consortium and applicability of results. Project proposals undergo a competitive process of scientific review by external experts (BMBF 2009a; 2014i).

The BMBF commonly funds international projects as collaborative projects (*Verbundprojekte*), consisting of research partners in Germany and in the cooperation country. Additionally, depending on the call for proposals, the BMBF requires part-

ners from companies or other stakeholders (from governmental bodies, implementation agencies etc.) to be included in the consortium, such as in the IWRM or CLIENT calls (BMBF 2004a; 2004b; 2010b,) (ch. 10).

5.3   International funding initiatives in FONA

As other BMBF research programmes, FONA is primarily dedicated to supporting German researchers. Nevertheless, FONA has served as a framework programme for funding many initiatives aimed at supporting cooperation between Germany and developing countries and emerging economies (Appendix B-2). Whereas in chapters 6 and 7 I will present an analysis of the actors involved and processes leading to the concretisation of funding initiatives, programmes and strategies, this section shall at introduce FONA's different funding initiatives of recent years for the sake of a broad overview.

As an umbrella, FONA gathers a large variety of different funding initiatives. Apart from the topic of the individual funding initiatives, main differences between them are to be found in their structural set up, which in turn is linked to the mode of agenda setting. Older funding initiatives for international cooperation are mainly *unilateral* initiatives, such as the Megacities initiative or the IWRM initiative. As unilateral initiatives, they were designed by the BMBF according to German research interests, without consultations with the governments of cooperation countries. As a consequence, although international in their scope, they are financed solely through the BMBF and generally not cofinanced by the partner countries. The mode of agenda setting as well as funding modalities in unilateral funding initiatives have severe consequences for the research projects implemented in their scope. Effects range from practical problems, such as finding funding for researchers in the partner country, to the ethical problem of repeating old patterns of cooperation between well-paid foreign experts and local researchers as mere recipients of knowledge (ch. 7, 9).

However, newer initiatives also emerge from *bilateral* initiatives with other countries or regions. For example, CLIENT, the funding initiative for International Partnerships for Sustainable Technologies and Services for Climate Protection and the Environment (BMBF 2010b; 2015i) stems from a joint political initiative, the Dialogue for Sustainability between Germany, Brazil, Russia, India, China, South Africa (the BRICS countries) and Vietnam, which started in 2008 (BMBF 2009b; 2009c; BMBF and MCT 2010; BMBF and DST 2010; BMBF and Indian Department of Science and Technology 2011). CLIENT emerged as a follow up of the dialogue as a call coordinated between Germany and the partner countries (BMBF 2010b). Similarly, the German-African Regional Science Service Centers (RSSCs) are examples of bilateral or even multilateral funding initiatives. In their

creation, the BMBF and governments of Southern and West African countries negotiated on topics and funding before WASCAL and SASSCAL came into being in 2010 (interview with PT01).

A further point of differentiation between the funding initiatives is their different orientation of research. While Unit 723 at the time of research was dedicated to Global Change Research, Unit 724 at the time of research was responsible for Resources and Sustainability, and their funding initiatives mirror the focus.[6] Additionally, funding initiatives for international cooperation originating in the Resources Unit are generally rather oriented towards technological approaches, while funding initiatives stemming from the Global Change Unit rather target interdisciplinary research including socio-ecological approaches. Chapter 9 will elucidate these differences.

5.3.1   Funding initiative Integrated Water Resources Management (IWRM)

As an initiative originating in the Resources Unit, the IWRM call in 2004 made explicit reference to previous activities of the Resources Unit in the field of technology-oriented water resources research. These included an initiative on Decentral Water Supply and Disposal Systems, running between 2002 and 2012 (BMBF 2013c), as well as a project on Export-oriented Research and Development in the Field of Water Research that had been funded previously (BMBF 2014j). In contrast to the IWRM funding initiative, this was not a genuine international cooperation project, but exclusively sponsored German partners in order to adjust German technology to other countries' conditions to facilitate technology transfer (BMBF 2014j; 2014k; 2014l). The IWRM funding priority was thus embedded in a prior thematic focus on water resources within the BMBF. Interestingly, a further large funding initiative in water research, the GLoWa initiative, which originated in the Global Change Unit and which had started in 2000, was not mentioned in the call.

5.3.2   Funding initiative Future Megacities

Similar to the Resources Unit, the Global Change Unit put its initiatives into its own context of holistic research. African RSSCs were pictured as consequences of its prior initiatives such as GLoWa (Research on global hydrological cycles and development of integrated water management strategies at the regional level) and BIOLOG (Biodiversity and Global Change). These were early and large-scale funding initiatives for cooperation with African countries, both starting in 2000 (Appendix

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6 To avoid confusion with new numbering of the working units of the subdepartment, the unit previously termed Unit 723 will be referred to as *Global Change Unit*, while I will refer to the previous Unit 724 as *Resources Unit* in the following chapters.

B-2). As I will argue in later chapters, self-referentiality or the lack of cross-unit references can be explained through the distinct foci of the calls (technological vs. more holistic approach) and the accompanying inherent competition between the units within the ministry (ch. 7, 9).

Contrary to water management, however, urbanisation was a new field of research funding for the BMBF before the Megacities funding initiative came into being. As such, the initiative did not follow the footsteps of any prior funding initiatives. The BMBF started the initiative in 2004 with a focus on Research for Sustainable Megacities of Tomorrow, in its main funding phase refocused at energy and climate efficient structures in megacities. Within the initiative's scope, the projects targeted diverging aspects of the overall programmatic focus, ranging from water management in Lima to urban agriculture in Casablanca, from waste management in Addis Ababa to public mobility in Hefei, among others (PT-DLR 2012).

5.3.3   Project funding outside of funding initiatives

As projects in the frame of CLIENT, IWRM or Megacities and other funding initiatives exemplify, BMBF projects are generally funded within funding initiatives, which encompass several projects of a common core theme. In the original IWRM funding initiative (BMBF 2004a), projects had to define a reasonably sized, manageable basin area from certain regions specified in the call – the Mediterranean/Middle East, Central Asia, South East Asia, China or Sub-Saharan Africa. In the end, projects targeting river basins in China, Indonesia, Mongolia, Israel-Jordan-Palestine, Iran, Namibia and South Africa were selected, all of them aimed at creating holistic adapted IWRM concepts for their specific basin (Ibisch et al. 2013).

However, in some cases the BMBF also funded individual projects in line with its general funding priorities, but outside of a specific funding initiative or a specific call for proposals. Examples of individual projects that thematically fell into the scope of FONA but were not part of any specific funding initiative or priority are the German-Brazilian project on Mangrove Dynamics and Management, MADAM, funded from 1995-2005 (PT-J 2014) or the German-Brazilian Amazonian Tall Tower Observatory funded between 2010-2015 (BMBF 2014m).

Sometimes, individual projects were later blended into existing funding initiatives. For example, the BMBF funding priority on IWRM originally only consisted of eight core projects chosen after the call for proposals. However, several projects funded individually through other funding sources within the BMBF are listed within the IWRM spectrum in official IWRM publications such as the project overview elaborated by the BMBF funded IWRM accompanying project (Ibisch et al. 2013). Among the projects belonging to the IWRM funding priority, but not

originally stemming from the IWRM call, are the Vietnamese-German project WISDOM, the German-Uzbek Khorezm project, or the IWAS projects (interview with PT06). The International Water Research Alliance Saxony, *Internationale Wasserforschungsallianz Sachsen* (IWAS) in turn, was originally funded within the BMBF initiative for excellence in research and innovation in the new federal states, *Spitzenforschung und Innovation in den Neuen Ländern* (PROSIN) (BMBF 2014n). Neither international orientation nor a focus on IWRM were required in the call; but the ministry specifically encouraged the later project consortium to come up with a proposal (interview with PP30). Designed with an international focus on IWRM, IWAS then moved into the administrative and thematic responsibilities of the Resources Unit and was counted among the IWRM projects (interview with PA02).

Individual projects may also be funded without a public call for proposals. For example, as a follow-up to a pre-existing project in the Aral Sea basin, the German-Uzbek Khorezm project, was blended into the IWRM funding initiative, but had a slightly different focus and approach. Not aimed at IWRM schemes per se, it targeted environmental, social and economic problems around irrigation and water management in the Khorezm region, such as unsustainable practices, and land degradation or salinisation (ZEF 2012, interviews with PP26, PP41, PP42). Reasons for projects that come into being outside of funding initiatives are diverse. Often, these projects are funded, if on a higher political level, cooperation is desired – either in order to strengthen ties with a partner country or because a certain topic is considered as a priority within the ministry (interview with PA14).

Based on the data collected in my fieldwork, within FONA I concentrate on the Megacities initiative as well as on the IWRM funding spectrum – including IWAS – in the empirical chapters. As argued in chapter 4, the funding initiatives are structurally comparable in the sense that they were both unilateral BMBF initiatives, not cofunded by partner countries (neither in the frame of ST&I cooperation agreements, or else), but present different foci of research. Wherever other funding initiatives, such as CLIENT or the Regional Science Service Centers in Africa offer interesting contrasts for the analysis, I will also refer to them in the empirical chapters.

6 Practices of policy production between structural frames, strategies and spaces of agency

Based on the concepts exposed in chapter 3, I consider policies to be a specific type of *discourse*, and the policy setting as a specific setting of discourse production, with particular actor constellations, power relations and institutions in place that shape the specific policy discourse on cooperation with developing countries and emerging economies in sustainability research. Ideas within a specific discourse develop in parallel to a *dispositive* and *discourse-related practices*. The ideas that make up the content of a discourse thus are embedded in a structure and institutions that contribute to its stability (Keller 2013).

According to Keller, an analysis of *dispositives* in SKAD cannot essentially to be delimited from other types of institutional analysis (Keller 2001). A point of differentiation lies in the dispositive's purpose-orientation, however: In contrast to the concept of a social institution, a dispositive is meant to cause effects. These include sustaining the discourse's organisation of knowledge and reality on the one hand. In stabilizing the order of knowledge and the order of those actors involved in knowledge generation, the dispositive exerts an internal power effect on the (re)production of discourse. On the other hand, as an infrastructure of intervention, dispositives also aim at causing external effects, which will be subject of chapter 10.

The *practices* of creating new policies – including policies in practice such as new calls for proposals for research funding as well as creating policies on a more strategic level such as programmes – are instances of discourse reproduction. They involve individual choices, decisions and actions that maintain or challenge the previous discourse – in the case empirically investigated here on cooperation with developing countries and emerging economies in sustainability research. Each decision made reflects a choice in favour of a particular policy direction with its corresponding story line and conceptualisations, while discarding alternatives. In their decisions, policy makers are not completely free to pick from an unlimited stock of arguments or ideas. While actors select new topics regularly – they do not repeat calls on the same research topics over and over – they stay within the boundaries of the discourse. As a *system of dispersion*, a discourse may enable a multitude of differ-

ent ideas which unfold under the same conditions and rules of formation (Foucault 1972a).

Discourses are contingent on previous social conditions, thus depending on and further influencing social orders and knowledge (Keller 2001; Keller 2013). In the policy setting investigated empirically, I therefore consider the arguments used, decisions taken, choices made in view of the direction and scope of policies as well as the deeper rationale of science policy to be embedded in a *dispositive*. This dispositive encompasses the BMBF's organisational structure and institutional responsibilities, including their financial endowments; the practices of decision making and funding; as well as the different rules and norms institutionalized at different levels. The elements of the dispositive aimed at external effects include measures aimed at implementing policy, ranging from calls for proposals to projects implemented in line with the BMBF's policies; to controlling instances such as selection committees; the project management agencies working on the BMBF's behalf; accompanying projects, etc. (ch. 10).

Pre-existing political strategies and programmes embody structures as well as ideas of discourse and thereby potentially guide further discourse production. They are both containers of contents as well as crystallisation points of the norms and rules underlying discourse production. This turns them into highly interesting research subjects.

6.1   Structures and agency in the process of discourse actualisation in science policy

Before a funding initiative translates into an actual research project, policy actors take plenty of decisions at different stages of time and at different levels of responsibility: Actors in power of decision making define a topic and decide about a potential international focus, in some cases define a specific cooperation country or region, publish a call for proposals specifying objectives of research, conditions of funding, etc. If policy is discourse, each of these determinations can be considered as occasions of (re)producing statements, practices and dispositive of the policy discourse. In every decision taken, the prevailing discourse on research cooperation with developing countries and emerging economies may be maintained or altered. The creation of funding initiatives is thus a momentum of the social production of knowledge in policy, through which a specific way of conceptualizing international cooperation is (re)produced.

6.1.1 Formal distribution of decision-making power in the BMBF

While one could assume that policy discourses are shaped exclusively by actors at higher levels of power and that political decision making follows top down processes, constructive understandings of policy stress that policies are developed at diverse hierarchical levels (Wright and Reinhold 2011).

The way in which policies emerge in the BMBF endorses this idea empirically. Decisions about new funding initiatives are made at the level of working units (*Referate*). Heads of units determine topic, cooperation country as well as mode of research to be funded. Although the consultation and exchange with other actors is common (ch. 7), final decision-making power lies within the working units. This room for agency is officially inscribed in governmental regulations, which grant a high degree of autonomy and decision-making capacity to the individual working units in German ministries:

> "In principle, Federal Ministries break down into directorates-general [i.e. *departments*], and sections [i.e. *units*], the key unit within the structure of a Federal Ministry normally being the section, which is the initial decision-making authority in all matters assigned to it within its area of competence." (Bundesregierung 2011: Kap. 3, §7 [1])

BMBF *heads of units* (*ReferatsleiterInnen*) as well as scientific staff of the BMBF highlight this high degree of independence in decision making: "A ministry is very much organized bottom up. And a head of unit has the highest level of influence on the thematic focus." (PA07)

The individual units consequently bear the main decision-making capacity in view of funding and thematic priorities. This fact is interesting also in view of the presumably political nature of policy making: Decisions on research policies on the level of funding initiatives are not taken in the official political arena, the *Bundestag* as the German parliament. While the Bundestag officially passes high-level strategies, such as the High-Tech Strategy or the Internationalisation Strategy (ch. 8), it is merely informed about, but not included in the design of programmes and initiatives.[1] Instead, the officially non-political administrative level within the ministry takes decisions, including those on the details of the BMBF's general budget allocation through defining the content of calls for funding (Ober 2012; Ober and Paulick-Thiel 2015).

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1 This argument is based on the lack of any documents or interviews referring to FONA being passed through the parliament. In addition, searching in common internet search engines for the keywords "FONA"+"Bundestag"; "FONA"+"Kabinettsbeschluss" brought no results in contrast to a search for "High-Tech Strategy"+"Kabinettsbeschluss".

6.1.2   Strategies: enabling or restricting decisions?

Strategies are a further structural element which formally enhance agency rather than having restricting effects on the internal processes of policy production. Quite unlike the policy field of development cooperation, which is embedded in international agreements concerning partner countries and thematic priorities, the BMBF possesses a very high degree of liberty in view of its policies, the selection of partner countries and cooperation strategies (ch. 7). On this background, the BMBF's own political strategies for cooperation with developing countries and emerging economies in the field of sustainability research are the subject of analysis here, especially in view of their function for (re)producing discourse. In the common use of the word, a strategy signifies a "plan of action designed to achieve a long-term or overall aim" (Oxford Dictionaries 2017b). Based on this definition, the general purpose of the BMBF's strategies political strategies would be to guide future actions. Indeed, according to the Internationalisation Strategy itself, it is meant to be "a guide for further activities of the participating Ministries and aims to increase the inter-departmental coherence of the individual measures they are implementing on their own responsibility" (BMBF 2008a: 11).

If funding initiatives are instances of (re)producing science policy on the smallest scale, meaning on the most practical level, leading to interventions in the world in form of research projects, then programmes and strategies make up the discourse's overarching body: Funding initiatives are embedded in a nested system of political strategies and thematic programmes. These presumably outline the general direction of policy and to provide a frame for policy initiatives on a lower scale (fig. 6-1). The High-tech Strategy lies the discursive core of the BMBF and as such is discussed in detail in chapter 8. On the more concrete level of the science policy continuum, funding initiatives intend to translate the broader policy outlines into practice (ch. 9).

Figure 6- 1: Interrelation of initiatives, programmes and strategies
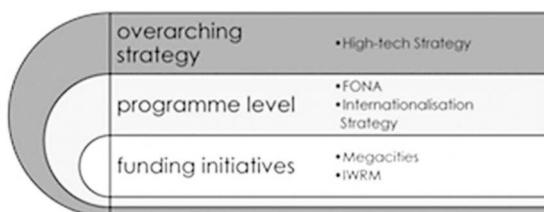
Source: Own elaboration

The BMBF issues its strategies on different levels and in different scope. Termed *Rahmenprogramm*, *framework programmes* such as FONA (BMBF 2015e) or the BioEconomy Strategy (BMBF 2010a) are meant to provide an official frame to smaller scale BMBF policies such as *funding measures* or *funding initiatives*, which, as in the case of FONA3, may be bundled within *flagship initiatives* (or funding *priorities*) which thematically group together several funding initiatives.

In most cases, programmes are based on thematic research priorities, such as sustainability-related research in the case of FONA. The scope of thematic programmes normally matches the thematic responsibilities of specific departments or subdepartments within the BMBF and extends only to the boundaries of the respective department. More encompassing or crosscutting *strategies*, in contrast, are meant to guide actions beyond a specific department. Examples for the latter are the High-tech Strategy (BMBF 2006; 2010c; 2014) or the Internationalisation Strategy (BMBF 2008a; 2016b), which even span the entire German government (ch. 8).

The decision autonomy of the heads of unit becomes even more evident when scrutinizing the relation of funding initiatives and strategies or programmes. On paper, the Internationalisation Strategy as well as FONA are the two most relevant strategical programmes for the cooperation with developing countries and emerging economies in sustainability research.

FONA

Officially, FONA is the guiding programme for the BMBF's endeavours in sustainability research, thus providing a frame for the thematic funding priorities within the Sustainability Subdepartment. FONA has been renewed and updated several times since it was issued first and is now in its third edition (BMBF 2005a; 2009a; 2015e). While FONA specifies a number of thematic fields of interest, including Global Responsibility – International Networking; Earth System and Geotechnologies; Climate and Energy, Sustainable Management and Resources and Social Development (BMBF 2009a), the programme does not explicitly determine specific areas of future funding. Funding initiatives are decided about in separate decision processes by potentially different actors.

Although most funding activities of the Sustainability Subdepartment at the time of research could be linked to the thematic scope of FONA2, the programme as such left room for deviating from its focus. As FONA2 indicated, it was a "thematically unrestricted programme framework, [and] further topics or new priorities can develop if scientific, technical or social developments require it" (BMBF 2009a: 57). Similarly, FONA3 leaves open space for changes, justified through maintaining the option to react to external developments in sustainability topics:

> "In addition to the insight from the evaluations of the ongoing and completed measures, the contents of FONA[3] will be continuously monitored to verify whether new sustainability themes and trends should be included, either in a technological or a social dimension." (BMBF 2015e: 37)

Consequently, while research projects funded within the thematic scope of sustainability generally fall into the range of topics identified in FONA, they don't necessarily have to. FONA is thus a programme that may adapt to current and actual research needs on the one hand, and to potential real-world changes on the other. From the normative point of view of making science usable for sustainable development, a research programme with inscribed flexibility is more suitable than a rigid one, as it takes into account the complex reality of sustainability as well as the learning nature of research (WBGU 2016). At the same time, the room for potential divergence inscribed in FONA in view of thematic priorities widens the space of agency of individual heads of units to shape the policy discourse (in cooperation with external actors, ch. 7); thereby further enhancing their decision-making power.

Internationalisation Strategy

Funding initiatives for international cooperation in sustainability research additionally fall into the scope of the BMBF's policies for international cooperation. As crosscutting strategies, the Internationalisation Strategy (BMBF 2008a) and the International Cooperation Action Plan (BMBF 2014o) set the overarching frame for funding international cooperation across the entire BMBF – including thematic departments such as those responsible for different areas of sustainability research. As a strategy of the entire German Government, the Internationalisation Strategy formally even targets international cooperation beyond the ministerial boundaries of the BMBF.

Yet, while the Internationalisation Strategy in fact guides and informs the endeavours and funding activities of the BMBF's International Department, whose budget is explicitly aligned with the strategy (Bundesregierung 2012a), neither the Internationalisation Strategy nor the Action Plan are binding rules for the thematic departments within BMBF or for the other ministries that officially adhere to the Internationalisation Strategy. It is not a rigid frame determining their future decisions on funding measures. The Internationalisation Strategy is designed to guide actions, but, as it states itself, "the decision on implementing the measures in the special programmes of the individual government departments is taken by those responsible for the programmes" (BMBF 2008a: 23).

In concrete terms, this means that the BMBF's International Department cannot prescribe any internationalisation efforts to be taken through the Internationalisation Strategy or Action Plan. While they guide the International Departments

own activities, the working units within the thematic departments, such as the Sustainability Subdepartment remain with the decision-making power to spend their budgetary resources according to their own priorities regarding extend, topics and partner countries of cooperation (interview with PA03). A BMBF employee of the International Department comments that "[w]e are not authorized to issue directives. We have to persuade the others. However, we have usually been successful in arousing interest in international cooperation in the long run" (PA08). Another BMBF employee adds that "[i]f a head of unit in a thematic department does not want to cooperate internationally, the Internationalisation Strategy cannot oblige him, then he doesn't. It is a very soft steering tool" (PA07).

Hence, in view of funding measures, even official intergovernmental strategies such as the Internationalisation Strategy or the Action Plan merely demonstrate aspirations, but the International Department is not in a position to impose international cooperation activities on other departments through the Internationalisation Strategy. In addition to lacking institutionalized sanctions for not following internationalisation efforts, neither strategy nor action plan provide incentives in form of additional budget assigned for international cooperation to be funded by other departments. Regarding discourse (re)production in form of funding initiatives for international cooperation in sustainability research, the heads of units' room to both reiterate or deviate from the previous direction of the policy discourse is potentially large.

The Internationalisation Strategy's lack of power in triggering cooperation reflects the distribution of power within the BMBF: The International Department cannot draw on any structural or financial resources to act upon the action of the other departments (ch. 7). Although envisioned to have effects on the entire government, the Internationalisation Strategy's power effect is limited to the International Department. The Internationalisation Strategy remains a paper tiger in view of its power of steering international action. Internationalisation is not a policy core value, but rather an add-on to thematic science policy. The lack of financial endowments and other mechanisms of enforcing international cooperation through the strategy mirrors the distribution of power within the ministry and demonstrates that crosscutting strategic action is difficult in light of a constant struggle to maintain independent decision-making power. At the same time, the lack of internal acceptance of the Internationalisation Strategy also points at the absence of an encompassing institutional identity and goals beyond departmental boundaries and beyond high-tech ideas (ch. 7).

6.1.3 Seizing spaces or following the lines?

In contrast to common understandings, I have shown in the previous section that the BMBF's strategies formally only provide a repertoire of the envisaged direction

of new initiatives. The non-prescriptive nature of the Internationalisation Strategy and FONA, as well as the lack of binding country strategies (Box 6-1; ch. 7) hypothetically provide a large space of agency for actors in the working units in the Sustainability Subdepartment as well as other thematic departments. Formally, there are little restrictions for decisions to deviate from or remain true to thematic programmes in the topics of cooperation, nor for the decision for or against international cooperation through the Internationalisation Strategy.

Box 6-1: The role of strategies for selecting cooperation countries in the International Department

In the International Department, the prioritisation of international cooperation partner countries is closely interlinked with the objectives of international cooperation as laid out in the Internationalisation Strategy. Similar to the Sustainability Subdepartment, the International Department fostered cooperation with developing countries and emerging economies rather contingently for a long time (ch. 6.3) – based on the partner's interest and as a consequence of past tradition, not based on German lines of strategy:

"We most likely cooperate with countries that are highly willing to cooperate and that approach us. If they don't, we don't like to run after them. And we consider with whom intensive cooperation existed in the past, such as with Egypt or with South Africa." (PA08)

The quote additionally illustrates that despite of a rhetoric of *cooperation on eye-level* (ch. 9), cooperation with developing countries and emerging economies is still considered as a charitable act that Germany condescendingly accepts – but is not actively striving for. In the past, cooperation with developing countries was not considered as a strategic priority for the German side. However, in the late 2000s, the International Department started to consider cooperation with developing countries and emerging economies more strategically. In view of developing countries, an interviewee explains that "[t]here was a paradigmatic change in BMBF policy when they started to systematically engage with the cooperation with developing countries in 2008. Not only cooperating with the best, where the benefits are evident, because we get something out of it, such as knowledge, resources or research infrastructures." (PT04)

The increased relevance of cooperation with developing countries and emerging economies manifested itself in rising expenditures for cooperation as well and also was reflected politically, as "[i]n the coalition agreement and in the Internationalisation Strategy there was a mandate for us to increase cooperation with developing countries and emerging economies and since then we have put massive efforts into

cooperation in education and research, also in terms of financial budget. In the last ten years, it has increased almost 100 %." (PA08)

Expenditures for cooperation with African countries alone increased even more dramatically: from EUR 11.9 million in 2005 to EUR 50.8 million in 2013 (BMBF 2014b: 2). Beyond the broad outlines of cooperation with developing countries and emerging economies within the Internationalisation Strategy and the Action Plan, no strategies on thematic priorities or partner countries exist yet: "There is no monitoring from a broader perspective, such as which regions have which strengths and what does that mean for our efforts in international cooperation" (PA09). However, at the time of research, the International Department was making first attempts to select partners among developing countries and emerging economies on a more rational basis by developing own criteria of selection, such as the stage of development of the science system (interview with PA07).

Even so, the current list of the BMBF's cooperation countries does not only mirror German willingness to cooperate but mirrors the readiness and capability of the partner countries to cooperate in science, too. The lack of any of those countries classified as least developed countries (LDCs) on the list of cooperation countries (Appendix B-2) might not only be attributed to the unwillingness of the German side to cooperate with the LDCs that shines through in interviews – but might equally be attributed to the different developmental priorities of the LDCs, which might not include cooperation in science. In most LDCs, the scientific landscape is characterized by lacking institutions, infrastructures and personnel in science as well as research funding.

While FONA is strategically followed, the Internationalisation Strategy resonates far less within the BMBF outside of the International Department. In contrast to the core ideas of German science policy as bundled in the High-tech Strategy which guide the ministry in its main discursive direction and structurally organize the entire ministry's flow of funds (ch. 5, 8), the Internationalisation Strategy is of little persuasive character and structural impact. As a consequence, in view of internationalisation policy, the approaches and levels of cooperation within the different thematic departments of the BMBF differ substantially: The Sustainability Subdepartment has a strong and rather long tradition in funding cooperation with developing countries and emerging economies. In contrast, cooperation with developing countries and emerging economies is barely funded at all in the Department of Key Technologies, while funding initiatives for cooperation have been launched in recent years in the areas of health issues or bio-economy in the Department of Life Sciences (ch. 5, Appendix B-2).

However, if the strategic frame does not necessarily guide decisions, what does? On which basis are decisions then taken? The choice of particular topics and co-

operation countries illuminates that policy-makers themselves often perceive the decisions to be based on rational and strategic choices (ch. 8, 9).

6.2   Following a beaten track: Discourse reproduction

As chapter 6.1 shows, within the thematic departments, plenty of spaces for agency exist that might enable a deviation from previous discourse or lead to a repetition of discursive assumptions in view of cooperation with developing countries and emerging economies. The head of units' autonomy as well as decision-making capacity would theoretically enable them to make far-reaching decisions about a change of directions. Nevertheless, although there is room for agency, it is not seized regularly.

While some elements of the policy discourse's dispositive, such as the rules for decision making, have an enabling function and open a space of agency, other elements of the dispositive rather restrict policy options and make repetition more likely than change. Even if they are endowed with official decision-making power, actors in the BMBF are surrounded by the infrastructural elements that stabilize discourse. Practices, norms, rules, the accepted body of knowledge embodied in strategies delimit their options.

The underlying structures of the BMBF, its organisation into thematic departments and a separate international one, endowed with financial resources according to specific distributional schemes, the laws and regulations which empower ministerial heads of unit to make decisions, as well as the contents of policy discourse embodied in policy documents may be interpreted as an institutional context or a *historical a priori*, as *conditions of possibility* (Foucault 1972a) for the specific policy discourse on cooperation with developing countries and emerging economies in sustainability research.

Foucault distinguishes between the dispositive and the historical a priori by highlighting the dispositive's strategic aims of intervening (Foucault 1980c), while Keller argues that the dispositive is equally aimed at providing an "infrastructure of discourse production" (Keller 2005: [10]). In view of the stabilizing function for discourse, dispositives are related to the notion of path dependency, which describes that established paths become more likely to be trotted on again. Once a certain direction (of a decision, organisational structure, technology) is taken, structural or discursive innovation becomes unlikely, as recursive processes positively reinforce the initial direction: Paths once taken narrow down room for alternatives and limit opportunities of action. History thus inscribes itself in the organisation and its shape. Beyond shaping options and constraints of action, historical pathways

grown into structures also shape an institution's preferences (Stucke 1993; Wilsford 1994; Van der Meulen 1998; Greener 2002; Kay 2005; Leach et al. 2010)[2].

Most institutional structures as well as practices in BMBF policy existed prior to the discourse on cooperation with developing countries and emerging economies, and additionally also pertain to further policy discourses. This would classify them as institutions of a historical a priori, which I demonstrate to be the BMBF's *core discourse* (ch. 8). However, the institutions and structures also maintain a specific order of power and knowledge that is both relevant to the core discourse as well as the discourse on cooperation with developing countries and emerging economies. They guide the production of the core discourse as well as the production of the specific discourse on cooperation with developing countries and emerging economies in sustainability research: This would classify them as a dispositive according to Keller. In view of the internal (power) effects on discourse (re)production, I will refer to the different elements as dispositive, even though the line between the two concepts of the a priori and the dispositive is blurred in case of the institutional structures, institutions, norms, rules, practices and policy ideas of the BMBF.

Being surrounded by a dispositive means that policy makers cannot freely pick out whichever argument they deem suitable in a specific situation to actualize the policy discourse. Although actors possess a degree of agency to choose a certain discursive direction over another, the dispositive delimits their options of what can be adequately chosen as a policy content at a certain point in time. Of course, actors pick up new research topics regularly – they do not repeat the same themes over and over. However, in doing so they stay within the boundaries of the discourse as a system of dispersion (Foucault 1972a).

6.2.1 Practices

To understand why BMBF policies for cooperation with developing countries and emerging economies in sustainability research generally follow previous lines of thematic policy discourse despite of the large room for agency and contingency as element of discourse, it is necessary to consider the interdependence of different strategic levels once again. As described in chapter 6.1, strategies and programmes are officially designed to function as guide of future activities. However, they often use past funding initiatives and past strategies as building blocks and thereby also

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2 From a political economy angle, path dependency can be explained by the high costs of institutional change compared to options of adjusting policies to existing institutions and structures. The concept of path dependency thus helps to understand the stability institutions and their continuity, as it stresses the impact of structures over the agency of actors to change (Stucke 1993; Wilsford 1994; Van der Meulen 1998; Greener 2002; Kay 2005; Leach et al. 2010).

have to be considered as a consequence of past ideas – as a strong element of discourse reproduction:

> "Directives from above emerge in an iterative process, by looking at what the units are doing, and then putting that together. And that's the link with strategy. Which in turn is constitutive of the elements it developed from. You see the loop. If I was commissioned to write an internationalisation strategy for the ministry, I wouldn't start by asking what makes sense and how do we get there, what do BMZ and AA say, what can we learn from a programme evaluation and then write a strategic and binding guideline. Instead, someone tours through the units asking them to write down what they are doing already. And everybody contributes perfect arguments for the own previous practice, and I have to make sense of that. That's how strategies work in the BMBF. They are less directing future actions than summaries of the status quo." (PT01)

Strategies thus have a legitimating function of pre-existing activities and repeat the status quo while guiding the future. A different interviewee similarly states regarding the emergence of FONA:

> "You look at what you're doing already. Environmental research existed beforehand, in a subdepartment that dealt with the technological questions of environmental research. Thus, a basis existed already and considered how to align that with the new requirements, so we could say: This is our contribution. And that's how FONA emerged." (PA14)

The quote pictures that the strategic orientation of the first FONA editions equally drew on activities that in their majority existed previously, which another interviewee purported about the Action Plan for International Cooperation in the International Department: "Most projects included in the Action Plan were already running. Projects stemmed from the entire ministry. The thematic departments reported those projects to us that seemed to be highly structure-forming" (PA09). Indeed, the Action Plan itself centres on so-called *beacons* of past and ongoing funding, which are considered as exemplary for the objectives and mode of future activities, as models in view of their impact, or exemplify the embeddedness into higher strategic goals (BMBF 2014e: 54).

Looking at previous funding activities in order to inspire future strategies can be considered as a routine practice of discourse re-iteration within the ministry. In addition, the phenomenon of *voluntary repetition* contributes to the stability of the policy discourse. In contrast to ideas of the policy cycle (ch. 3), which assume a circle of rational decisions based on learning and adaptation, the main policy discourse in the BMBF is not renewed in circular processes, but self-repeating: Strategies guide actions, but actions at the same time guide strategies: most funding initiatives conceptually draw on strategies as a legitimation, considering them a

safe space, instead of suggesting novel approaches – which might be rejected. Staff of the project management agencies who were involved in new funding initiatives commented on the influence of thematic programmes on funding initiatives (interview with PT07).

The ideas, objectives and motivations expressed in specific calls for funding thus mostly correspond to the thematic programme of the respective department and to the High-tech Strategy as the leitmotif of BMBF, sometimes even additionally drawing on the Internationalisation Strategy – which thereby receives a reason for existence beyond the International Department. Those BMBF departments willing to cooperate internationally can draw upon the Internationalisation Strategy as a *pool of accepted arguments* in order to plausibly legitimize their international cooperation activities. The Internationalisation Strategy thus mainly functions as a repertoire of ideas rather than as a structural dispositive for discourse production.

The call for proposals of the CLIENT initiative, for example states that it aims to contribute to fulfilling the "the Federal Government's High-Tech Strategy, the Environmental Technologies Master Plan, and the Internationalisation Strategy" (BMBF 2010b); while the call for proposals on Sustainable Land Management explicitly is put into the context of FONA, the High-tech Strategy as well as the High-tech Strategy on Climate (BMBF 2008b). In case of the calls for proposals for the IWRM and Megacities funding initiatives, neither FONA nor High-Tech Strategy are references, as both emerged before the framing strategies. Nevertheless, both were put into the context of FONA later (ch. 5, 8, 9).

If actions guide strategies and these guide actions in a self-referential manner, a continuation of old paths is more likely than change of directions. One interviewee pointedly wraps it up: "Strategies are self-fulfilling prophecies. The cart is put before the horse." (PA14) The self-referential practice of policy making thus continually narrows the space of changing the underlying discourse, as it cements the basic policy direction. Discourses are self-reinforcing phenomena, which essentially make the repetition more likely than change. As has been observed in other policy fields, established ideas in policy discourse are persisting and permeating, and actors defend them against change in order to protect the inner logic of the world view (and thereby stabilizing the own position) (Hofmann 1993).

6.2.2 Organisational identity and the role of strategies

Next to the self-referential practices of policy making, the prevalent discourse of science policy for cooperation with developing countries and emerging economies is maintained through an organisational dispositive. Responsibilities are formally distributed to specific working units, which are responsible for and therefore thematically match the strategies. As such, the foci of the working units in the Sustainability Subdepartment correspond to the thematic foci of FONA. When introduced

as a new concept, some administrative reorganisation was done in order to adjust the organisational shape with the strategy for the first edition of FONA. According to interviewees, as of the second edition of FONA, the programme was continued in a way to fit the administrative structures of the BMBF (interview with PA14). The example illustrates that programmes and strategies interlink the contents of policy with the organisational and administrative structures and staff. As actors have an interest in institutional survival (Weingart 2006), discursive change is becoming unlikely through the structural embedding.

Programmes and strategies also play a role in maintaining the institutional status quo. Partly due to the efforts to set itself off from other ministries (ch. 7), the BMBF strongly strives for a both an internally coherent as well as externally visible umbrella for its activities and initiatives. Subsuming past and previous actions within a strategy or a programme is one strategy of providing both, as illustrated in the following quote on the Internationalisation Action Plan:

> "The programme is part of a larger initiative led by Schavan, aimed at creating framework programmes in the ministry. In the Minister's view, the variety of projects in the BMBF was too large and there weren't enough concentrated, publicly visible activities. In 2008 or 2009, it was therefore decided to draft framework programmes. The International Department decided to write the Internationalisation Action Plan in order to become more prominent within the BMBF. And to operationalize and concretize the Internationalisation Strategy on a programme level." (PA09)

Strategies are therefore not neutral documents of a policy direction, but also fulfil a further political function. The efforts of blending in and harmonizing actions exemplify the ministry's desire for concentrated, focused, targeted actions, which provide visibility and legitimacy for its policy, thereby defending its boundaries and responsibilities on the political as well as administrative level. In addition to strategic umbrellas, visibility is also provided by extensive dissemination efforts for funding initiatives as well as through large scale conferences in representative locations (field notes, July 2012 – September 2013), which seem to be directed at influencing public perceptions and attributing importance through the large format. In view of the final Megacities conference in May 2013, a member of the advisory board notes that "[a] Ministry, too, needs visibility and public representation. This is related to accountability as well. EUR 50 million were spent on the programme. You have to be able to externally legitimize that" (EE06). Similarly, the ministry encourages and demands public dissemination efforts of the funded projects, such as brochures, films, posters etc. These are mainly directed at German public rather than to the public in cooperation countries (interviews with PP3, PP4). Many dissemination efforts are thus means of providing legitimacy, accountability and vis-

ibility in view of German taxpayers or political players rather than being aimed at capacity building within partner countries.

As discourse-related practices, these efforts of discourse reproduction are much more common than model practices in the context of science policy for cooperation with developing countries and emerging economies. The lack of empirically observable model practices can be easily explained by the distinct groups of actors as producers and recipients of discourse: Across groups of different actors with distinct practices – such as working routines within a ministry vs. standardized types of knowledge generation in science – model practices necessarily play a small role. Practices within the policy making sphere do not apply, and thus cannot serve as a model for practices in other social spheres.

6.3   Policy makers as change agents

Heads of unit often could, but rather don't change the discourse – policy continuation is more likely than policy change. Nevertheless, the BMBF is not a static system, as becomes evident through developments such as the introduction of new concepts like sustainability as a guiding frame for environmental research (ch. 8.2) or coming up with innovative funding initiatives such as the African RSSCs. In some cases, actors have used and even stretched the room for agency.

Considering international cooperation, the BMBF for a long time maintained the principle of "no exchange of funds".[3] BMBF staff commonly assumed that bureaucratic rules of project funding prohibited new formats of cooperation with developing countries and emerging economies, in which international partners would receive a cofunding as well. Many interviewees repeated this position without questioning it. Deeply internalized, they took this as an official rule or law and did not stop to question it. And indeed, the legal frame of research funding in Germany is rather adjusted to fund national research than at international cooperation.

Nevertheless, in some cases, the initiators of funding initiatives were willing to scrutinize the rules in order to change the discourse and its assumptions through novel approaches, innovative modes of funding etc. In the Megacities initiative, for example, international partners were funded to a certain extent, despite the general allegations that this was not possible: "The rule was 'no exchange of funds', but it wasn't realistic to follow that through" (PT07). Another interviewee states even more explicitly:

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3 The rule of *no exchange of funds* is closely related to the idea of cooperation on eyelevel (ch. 9).

"The impossibility to fund partners is not carved in stone. There is no document in the BMBF that states: In Peru we can fund that, in Egypt we can't. That's within the decision power of the units. And if a head of unit likes a project, they may decide to encompassingly fund the project partners. But in a subsequent project, another head of unit could also decide not to fund partners at all, or not fund PhD students. That is in their decision scope... that's the freedom of funding research. We don't have to stick to the DAC list and fund least developed countries but not others. That is our freedom in the thematic units." (PA03)

The room for agency was thus even larger than other BMBF employees believed. The policymakers involved in the Megacities initiatives seized the scope for decision-making and stretched the rules. In view of the African RSSCs, at their time novel in scope and approach of (co)funding infrastructure, capacity development and partners abroad, an interviewee even commented on their capacity to not only stretch, but to change the regulative structures:

"In such an innovative format as WASCAL/SASSCAL, you cannot assume that everything runs as smoothly as on the beaten track. You have to develop new ideas and convince Department Z [i.e. the Administrative Department] that the normal criteria have to be adapted. And we successfully did so." (PT01)

Despite of the common understanding, project funding rules thus could be adjusted and did not exclude certain types of cooperation, such as transferring funds abroad (interview with PA08). In funding SASSCAL and WASCAL, the BMBF finally commissioned the German development bank KfW to act as an intermediary in order to fund the projects in their envisioned scope, including infrastructure.

The African RSSCs are also a showcase of the possibility to modify the underlying discourse and its dispositive, i.e. its infrastructures. Therefore, the common statement of the BMBF that the legal frame of project funding doesn't allow funding international partners is to be seen as an expression of the need to justify the prevailing mode of cooperation – i.e. not to cofund partners:

"From my experience, rules for project funding can be bent, and in any case, they don't prescribe in detail what you may and may not do. But these new paths are complicated and time and resource consuming and relatively open-ended. It's not a standard procedure that you apply. And if someone in the ministry doesn't want to, he will say that it's not possible. If you tell them about involving the KfW in the RSSCs financial administration, they will ask if it is an exemption from the rules or a precedent case. The individual head of unit can always say that this is too much hassle, and he's not even wrong. But in general, we have to ask ourselves if the project funding instruments and rules still fit our ambitions in international cooperation." (PA09)

The bureaucratic hurdles for innovative types of funding are high, and once again it remains within the decision-making scope of the individual policy maker whether he/she wishes to take a troublesome and time-consuming route into a new direction and possibly fail in doing so – or to remain within the old, safe path. Examples such as the Megacities initiative and the RSSCs show that the legal frame – a dispositive of the traditional discourse on how cooperation should be carried out – can be adjusted to novel approaches.

6.3.1   Coincidences with consequences

According to Foucault, contingency is an element of any discourse (Foucault 1972b). The discourse on international cooperation – both in its conceptualisation as well as in the practice of funding – confirms this idea. The empirical data collected in the BMBF suggests that individual agency, often coupled with a high degree of coincidence, is a pronounced and decisive factor for decisions on cooperation.

Rather than strategic planning, coincidences contributed to enabling cooperation with certain countries and not others, in certain thematic areas and not others. This becomes very transparent in the choice of certain partner countries in the Sustainability Subdepartment (on partner countries in the International Department: Box 6-1). The selection of specific partner countries is not only subject to agency, but also to chance. Interviewees state that international cooperation often commences with political commitments arising from political visits of high-level ministerial staff to potential cooperation countries (interviews with PT02, PT03, PA01, PA05). Individual actors at higher levels play an important role, as they have the power to act as change agents, who introduce novelties in policy such as a new topic or a new cooperation country:

> "It's the people who started to act who strengthened international cooperation in environmental issues in the BMBF. If the people in charge of the Subdepartments are interested in cooperation, it will develop accordingly. If they are not, it won't. In the past, all Heads of the Sustainability Subdepartment apparently seconded international cooperation." (PA02)

Other interviewees explain how the agency and power of the individual actor also may hinder international cooperation: "It was person-related. I tried to start activities with the past head of unit, but the person was not interested. It wasn't her focus, she didn't even speak English. Thus, no international cooperation took place in that area" (PA14). As the quotes illustrate, the decision-making capacity of the head of unit, inscribed in the ministerial structures, may both enable and restrict actions. In seizing the power of making decisions, actors influence policy directions, contribute to change in discourse or to its repetition, thereby staying within known paths.

Seemingly trivial individual capacities or preferences (such as language skills) thus may influence policy directions. In this line, other interviewees pointed out that some heads of units had personal favourites among cooperation countries (interview with PT03). Coincidence thus enters policy discourse as a coincidence of preferences, which in return is enabled through the space of individual agency:

> "In my subdepartment, there were heads of unit who pursued international cooperation enthusiastically. They wanted to renew the water supply in Teheran. That was caused by coincidences. They knew somebody, like guest researchers in a research institute. Coincidences!" (PA12)

External public, political or scientific discourses often inspire novel policy initiatives – and therewith combine elements of contingency as well as rational decisions in policy making. While the occurrence of external events and discourses and the individual staff member's capacity to act as a change agent – or early adopter – is mainly contingent, the decision to introduce novel policy initiatives based on external discourses is perceived as rational, I would argue. In any case, external discourse often inspires ministerial change agents, who adopt and transmit new discursive directions into concrete policy initiatives – often supported by a corresponding discourse coalition (ch. 7). The development of the Megacities initiative is an illustration of discursive change based on external discourse events such as the publication of scientific reports on urbanisation, which inspired the funding initiative. With the funding initiative, The Global Change Unit deviated from the usual focus of the BMBF on technological development and pursuit of German interest, and instead focused on issues related to climate change and resource efficiency in Megacities, often from non-technological points of view. Interviewees traced the readjustment of focus within the Megacities initiative towards energy efficiency and climate change to external drivers, such as impacting IPCC reports or uprising public debates about climate change, which raised it on the political agenda (interviews with PT07, PA03). In case of CLIENT, political agreements on higher levels lead to the introduction of novel actors into the discourse coalition and novel funding practices. In some cases, members of the alternative discourse coalition also seem to have been able to promote change: The publication of the WBGU's 2011 report on great transformations sparked a general reconsideration of decision-making processes within the Sustainability Subdepartment, which lead to opening up agenda processes for the newest edition of FONA at least on a superficial level (interviews with EE20, EE21, EE23; ch. 7.3.3).

In other cases, the room for contingency in policy is enlarged by leaving decisions up to the research community. This is the case if a general decision on international cooperation is taken by the BMBF, but the particular call for funding does not specify partner countries – as in the IWRM call which specified regions, but not specific countries; or in the Megacities call, which specified neither region

nor countries (BMBF 2004a; 2004b). The selection of partner countries in this case therefore depended on the researchers' interests – based on a conscious transfer of decision-making power from the head of unit to the research community.[4]

It is important to bear in mind that coincidences are often starting points, discursive events, which in themselves are random, but which may have consequences as they spark the reinterpretation of a discourse. The coincidences described here – in form of personal preferences and choices, the interpretation of arguments in a certain direction – etc. – have been incorporated within the discourse's dispositive and contents, thus have succeeded in influencing it. What originates as a contingency thus may lead to institutionalisation and become part of a mindset.

6.3.2   Shaped mindsets and internalized discourse

In addition to institutional practices, norms and organisational shape, discourse also shapes the actors' mindsets, thus exerting a governmental type of power (Foucault 1980a). In this line, SKAD stresses that despite individual agency, actors are always influenced by previous discourse, which leaves imprints on their individual preferences and capacities. Discursive assumptions coin ways of acting and thinking in the ministry. Even individual choices and decision making are therefore shaped by pre-existing discourse. The prevailing mode of thinking thereby guides decisions, thus enhancing the reproduction of discourse, rather than change.

In consequence, the internalized beliefs delimit the scope of agency: Although the decision on cooperating internationally (or not) is taken by seizing the available decision-making power within the working units of the Ministry, the respective department's prevailing mindset prevents deviation (next to institutional structures and norms). Taking an opposite perspective, this means that the mind set (as well as institutions) might also be an enabling factor. If international cooperation relies on individual agency and is contingent to a certain degree, actors need to be embedded in enabling organisational structures. At the same time, they need to be able to draw on accepted legitimations within the repertoire of potential arguments – either embodied in strategies or in the mindset.

Following, while the science policy discourse in general is embedded in institutional structures and practices of discourse production that rather enhance self-reinforcement, making repetition more likely than change, spaces of adapting and changing the policy direction do exist. The decisions to extensively foster international cooperation with developing countries and emerging economies in the Sustainability Subdepartment, or to maintain a national focus in research

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4 I understand this to be a tribute to the freedom of research, which paradoxically is often referred to as a value in German science policy, while at the same time fostering applied science in specific areas aimed at specific objectives.

on information and communication technologies, are based on individual choices and the willingness to take risks – which in return are subject to coincidence as well as previous discourse, limited and enabled by the surrounding dispositive. As such, the Sustainability Subdepartment's Global Change Unit can also be pictured as an institutional niche enabling a diverging discourse on research cooperation with developing countries and emerging economies. The readiness of policy makers within the Global Change Unit to deviate from the discursive core assumptions of the BMBF in its funding initiatives (ch. 8, 9) may on the one hand be enabled through the unit's thematic focus or through the individual capacities and preferences of individuals. But I would argue that additionally, the unit offers a tradition of thinking and congruent macrostructures which increase the likeliness of deviation.

The empirical observations in this chapter therewith second the constructivist understandings of the non-rationality, non-linearity and contingency of the policy process (Scoones 2007; Shore and Wright 2011; Hajer and Laws 2006), while at the same time highlighting the complex interplay between structure and agency in SKAD.

7   Friends and foes in science policy

After reflecting on the internal structures, the room for agency and the processes of policymaking *within* the BMBF in chapter 6, this chapter tries to illuminate which actors play a role in the decision-making and agenda-setting processes next to the BMBF's heads of unit who bear the official decision-making power. Policies are not created exclusively within the boundaries of the individual BMBF working unit: In coming up with policies for research cooperation with developing countries and emerging economies, the Sustainability Subdepartment interacts with external experts, other departments of the BMBF, with project management agencies, other German ministries; and governments of partner countries. The relationships of different external actors with the Sustainability Subdepartment, their influence on decisions and their role in defining cooperation initiatives are subject of this chapter.

Two general tendencies can be observed in the interaction with different external actors: Rivalries, coined by a clear demarcation of boundaries, on the one hand, and coalition building on the other. In describing these two divergent strategies of discourse production in the BMBF' case, I examine if the notion of a discourse coalition (Keller 2001; Hajer 2006) of different speakers gathering around a specific idea – while excluding other ideas and actors – is adequately describing the discourse production processes taking place within this specific policy setting.

7.1   Defending the turf: Ministries as political entities

7.1.1   Internal power struggles and their effects on international cooperation

At a first glance, it might not seem logical to subsume further BMBF departments under external actors in policy making. However, the self-perception of the ministry is indeed centred along smaller units. As other large organisations, the BMBF is not a uniform institutional actor. This becomes clear when looking at the relation between the International Department and the Sustainability Subdepartment in designing new policies for cooperation with developing countries and emerging economies. Interestingly, the internal heterogeneity also affects the cooperation

with developing countries and emerging economies – both in policy as well as in research practice.

International cooperation as such is a crosscutting issue, with concrete policies on international cooperation – in form of funding research projects – originating both in the thematic departments as well as in the International Department (ch. 5, Appendix B-2). In official overarching documents such as the *International Cooperation Action Plan* or the *Internationalisation Strategy,* which are elaborated by the International Department, the BMBF seems to be a uniform actor with overall cooperation strategies.

However, under the surface of strategic documents, internal differences loom. In the past, the actions of the different departments were not always well coordinated. An interviewee from one of the project management agencies stated that "[t]he departments don't talk to each other. One department issues a call for international mobility; the other doesn't pick up on it" (PT03).

While examples of successful interaction between the departments exist[1], cooperation seems to be rather difficult in general. Reasons can be found in the institutional distribution of power. The BMBF is institutionally organized into departments (ch. 5). According to its official title and mandate, the International Department is responsible for coordinating and strategizing international cooperation activities. While individual international cooperation initiatives stem from different departmental sources, in view of a strategic frame, officially the International Department is in overall charge. The strategic responsibility for international issues is thus not integrated into the thematic departments but dealt with separately in the International Department.

However, the International Department does not possess any hierarchical superiority or steering capacity in view of the international activities of other departments. It is a department on the same organisational level as the other departments. Deviations from the strategic aims are therefore possible in view of international cooperation. A large room for agency and independent decision making emerges within the thematic departments as a product of the limited power of the International Department beyond its own boundaries (ch. 6). The lack of power to prescribe actions is complemented by the lack of any incentives for coordinating international cooperation actions and policies. The International Department is not endowed with specific financial resources to enable other departments to cooperate.

Instead of acting in unison, rivalries coin the relationship between the different actors within the BMBF. The efforts to stand out against the other units and departments is strong: "The heads of working units are princes who will defend

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1 Such as in case of the funding initiatives of IWRM or CLIENT, which originated in the Sustainability Subdepartment, but whose prephases were funded through the International Department.

their turfs within the larger kingdom of the ministry" (PA06).[2] As a crosscutting issue, internationalisation bears a large potential to be perceived as an illegitimate intrusion into the thematic departments sphere of action and decision making.

Interviewees from the International Department in contrast rather sought to legitimize the Department's existence through seeking cooperation within the ministry and stressed that a stronger integration of international and thematic aspects would be desirable (interviews with PA01, PA09). An interviewee from the International Department asserted that "[i]t depends on good internal cooperation with the thematic departments if activities of the International Department are expedient for the entire BMBF. But cooperation has room for improvement" (PA09).

In designing the Action Plan, the International Department therefore considered close cooperation with the thematic departments as essential to create a strategy that the entire ministry identifies with. Considering the internal competition between departments, the limited budget of the International Department and the lack of power to prescribe directions, the International Department intended to enhance *ownership* of the thematic departments through close cooperation with the thematic departments. Instead of proposing novel approaches that the thematic departments were not likely to implement, the Action Plan emerged in a process of coproduction (interviews with PA01, PA08, PA09):

> "The International Department was in the lead. It asked around in the thematic departments which activities they saw as beacons. We talked about that, there were meetings […]. It is important to integrate the thematic departments, otherwise they would tell us afterwards that they had never consented to the Plan. They were involved in the process, therefore." (PA01)

The quote illustrates the International Department's awareness of the difficulties of cooperating with the other departments and their efforts to improve the situation. Indeed, for the International Department, institutional survival *depends* on cooperation. The existence of the International Department might be endangered if in the long run its strategies, policies and services are neither used by or in line with other departments' actions. So far, the thematic departments have at least passively resisted basing cooperation efforts on those strategical efforts and agreements originating within the International Department. Keeping in mind the limited prescriptive power of strategic documents (ch. 6) as well as the internal quarrels between

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2 The quote continued: "However, all of them unite to protect the kingdom against other kingdoms, such as the BMZ." Perceiving external others as a common enemy creates internal unity. This is a social strategy of constructing collective identity often observed in traditional societies (Anderson 1991; Giesen 1999; Saurwein 1999).

the departments, it is questionable if any strategies aimed at international cooperation extending beyond the International Department, such as Internationalisation Strategy, country strategies or regional strategies[3] will successfully provide any type of guidance to the actions of thematic departments, let alone to other ministries beyond the BMBF. Without being able to make use of any power resources, such as positive or negative reinforcement mechanisms (like the ability to sanction non-cooperation through institutionalized hierarchical power or enhance cooperation through financial resources) reaching a higher level of cooperation is unlikely. Without mobilizing these resources, the International Department is not considered as a legitimate speaker within the discourse production of the Sustainability Subdepartment; their knowledge and perspective is not considered as relevant in the process of policy making.

Different departments and working units differ regarding their responsibilities as well as objectives and interests. These different approaches to international cooperation are a root cause of parallel actions instead of coordination. The International Department funds cooperation based on the Internationalisation Strategy's objectives as guiding themes, while it geographically cooperates with countries that have signed formal Science, Technology and Innovation (ST&I) Cooperation Agreements or other types of agreements with Germany (International Bureau of the BMBF 2014). A few developing countries and a larger number of emerging economies are among the partners (Appendix B-1). The ST&I agreements come into being through bilateral science and technology negotiations with the partner countries' governments and cooperation is thus largely based on mutually defined topics of interest. It is the task of the International Department to coordinate and implement these ST&I cooperation agreements with the partner countries for the BMBF, and to fund research activities in their frame (International Bureau of the BMBF 2014). In line with its core mission to enhance international cooperation, the International Department takes the internationalisation of research as starting point and primary objective of any bilateral funding activities which it issues based on ST&I agreements with partner countries.

In contrast, the thematic departments follow a different logic and way of thinking: "One perspective is that of the International Department, that of internationalizing science policy. A different perspective, not opposing, but with different highlights, is that of a thematic department" (PA14). In the thematic departments, international cooperation is possible in some funding initiatives, but not a necessary condition. Thematic departments primarily follow nationally defined thematic ob-

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3   The *Africa Strategy*, released as a first regional strategy in 2014, exemplifies the International Department's effort to provide a strategic frame to future cooperation activities with developing countries and emerging economies (BMBF 2014b).

jectives – and fund international cooperation not as an end in itself but only if deemed necessary (ch. 8, 9).

7.1.2   Ministerial rivalries

Official interfaces

In contrast to the interaction with the governments of partner countries (ch. 7.2) or other external actors (ch. 7.4), the cooperation between the BMBF and other federal German ministries is prescribed by law. Interaction is legally regulated through the Joint Rules of Procedure of the Federal Ministries, the *Gemeinsame Geschäftsordnung der Bundesministerien* (Bundesregierung 2011). These state that ministries must cooperate if their responsibilities touch, in order to ensure the coherence of actions of the Federal Government as a whole. The ministry leading a political initiative has to inform and involve any further ministries and related policy decisions can only be taken unanimously (Bundesregierung 2011: Ch. 5, section 1, § 19 [1] and [2]). In addition, the federal ministries have to ensure that they create a coherent external picture of the federal government (Bundesregierung 2011: Ch. 2, § 3 [3]).

However, while the Joint Rules of Procedure of the Federal Ministries emphasize the cooperative nature of governance, the German Constitution, the Grundgesetz, grants a high degree of autonomy and independence to each ministry. According to Article 65, "[t]he Federal Chancellor shall determine and be responsible for the general guidelines of policy. Within these limits each Federal Minister shall conduct the affairs of his department independently and on his own responsibility" (BMJV 2014).

This ministerial autonomy shines through in the implementation of joint ministerial strategies, as the Internationalisation Strategy. While on paper, the strategy encompasses the entire government, on the ground, it is up to the individual ministries to follow it. The BMBF as leader of the strategy is not in the position to prescribe actions – the strategy's character is not binding, and other ministries may choose to follow their own political frames (ch. 6). Vice versa, the BMBF is not bound to any other ministries' directives, and interviewees seemed keen on maintaining the ministry's autonomy.

Nevertheless, some mechanisms, exchange formats and interfaces aim to enhance cooperation between the autonomous ministries. In order to enable the formal exchange between ministries, interministerial committees (*Interministerieller Ausschuss*, IMA) may be established on specific topics. These boards follow highly formalized rules of procedures and formally involve a number of actors:

> "Representatives of the organisational, information and communication areas of the Federal Ministries work together on inter-departmental committees. The Federal Court of Audit, the Federal Commissioner for Data Protection and Freedom

of Information, and the Federal Commissioner for Efficiency in Public Administration sit on committees in an advisory capacity. The committees are chaired and managed by the Federal Ministry of the Interior." (Bundesregierung 2011: §20)

At the time of research, on the level of interministerial committees, no knowledge exchange or coordination of ministerial action took place in view of cooperation with developing countries and emerging economies. However, some boards on issues of special interest included international aspects, such as the interministerial board on urbanisation (IMA Stadt).

Similarly, state secretary commissions – as a high level interministerial exchange mechanism – may be convened on topics deemed of crosscutting importance. As such, a state secretary commission is installed for sustainable development (Bundesregierung 2017a), but no state secretary commission is in place for cooperation with developing countries and emerging economies.

Another official arena of exchange between different ministries and other official policy makers, such as parliamentarians, are the permanent parliamentary committees. According to its self-description, in the field of science policy, the Committee on Education, Research and Technology Assessment meets regularly to discuss "long-term strategic choices in research and education policy" (Bundestag 2017). The government facilitates these official arenas of exchange between ministries only on specific topics. No official interface, body or exchange mechanism exists to enhance interaction in view of a cross-ministerial, general approach to cooperation with developing countries and emerging economies in research and beyond. The issue at stake is neither adequately embraced within other commissions. However, while this lack of official interministerial coordination is noteworthy, it might not be critical: Interviewees from the BMBF questioned if formalized formats of exchange were productive at all and if they would lead to any cooperation beyond the exchange of information (interviews with PA07, PA03). Along these lines, it seems worthwhile to point out that interviewees did not mention any of the existing official interministerial interfaces to play a role in the definition of any policy initiatives – and thus did not act as speakers in discourse production.

Cooperation on more informal terms played a larger role in policy discourse production. For example, the BMBF's International Department organized regular round table meetings with working level staff of other ministries, of other BMBF departments as well as science organisations cooperating with certain partner countries, in order to facilitate knowledge exchange on the working level.

Interministerial cooperation in practice

The Sustainability Subdepartment's interaction with other ministries takes place in informal contacts as well. More interesting, however, is the quality of the interaction, which is coined by a strong sense of rivalry and demarcation of boundaries.

The relation of the BMBF – especially the Sustainability Subdepartment – with the BMZ is worth a closer investigation: their policies sometimes target and affect the same cooperation countries. In view of the BMZ, interviewees from the BMBF stated that "[i]n the BMBF, we are generally free to fund water research in a country like Namibia, even if that is not a BMZ priority." (PA03)

As argued in chapter 6, the BMBF did not follow a strategic approach in choosing cooperation countries in the past – cooperation has rather been subject to chance, tradition, and agency of the heads of unit based on their own preferences. In addition, international research cooperation policy is hardly bound to external agreements that regulate research cooperation practices, topics or partners. This is a major difference to the BMZ, whose country and topic priorities are embedded in international donor agreements such as the Paris Declaration on Aid Effectiveness, Accra Agenda for Action and their follow up documents (OECD 2008) or to meeting development targets such as the Millennium Development Goals and Sustainable Development Goals which have been agreed upon internationally and which set the official frame for BMZ policy and action (BMZ 2014a).[4]

In the absence of any national or international mechanism to coordinate science policy for cooperation with developing countries beyond the Internationalisation Strategy, the BMBF and BMZ state secretaries signed a cooperation agreement in 2007 (Stather and Meyer-Krahmer 2008). In the document, both ministries argued for the need to assist developing countries and emerging economies in strengthening education and science systems, which they deemed essential for social, economic and cultural development in times of global developments of knowledge-based societies. The ministries agreed to closely coordinate their policies for cooperation with developing countries and emerging economies and to evaluate potentials of new joint funding instruments (Stather and Meyer-Krahmer 2008). Although neither of the state secretaries is in office anymore, official documents such as the 2014 Africa Strategy still mentioned the agreement as a positive example of creating a joint basis of research and development policy (BMBF 2014b). Nevertheless, interviews recollected a different story about its relevance in practice: "We have a cooperation agreement with the BMZ, which is not applied. To be honest, we cooperate with the GIZ only if suitable, on project basis, e.g. in case of

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4 Framed through these international agreements and shared goals, the BMZ has limited its development cooperation priorities to seven sectors, and efforts are undertaken to coordinate these with those of other international donors (OECD 2010b). Due to donor harmonisation efforts, the BMZ's activities are restricted to those topics and countries that are internationally agreed upon – and additionally following a top down internal strategy, based on German priorities, the development needs of the partner country, and the history of cooperation. Concrete topics of development cooperation, such as poverty reduction, ensuring peace and democracy, and environmental protection, are defined through bilateral government negotiations (BMZ 2014b; BMZ 2014a).

the Tsunami early warning system" (PA11). Other interviewees even lacked knowledge about the agreement, were not sure if the cooperation agreement was still in place or did not find it of relevance for their daily work: "There is a state secretary agreement between the BMBF and the BMZ, already a few years old... but I have never seen it. I think nobody has" (PA01).

The document thus had little impact in view of strengthening collaboration. However, other interviewees argued that while the cooperation agreement did not lead to any changes in working routines, it still had a legitimating function. Staff of both ministries, who had engaged in cooperation on an informal working level already before the official cooperation agreement could now draw on the agreement to put cooperation on an official basis (interview with PA08). The agreement thereby fulfils a function comparable to the Internationalisation Strategy – it is a reservoir of arguments and instance of legitimation for actors ready to cooperate. As such, the agreement is an illustration of enabling discourse change. Here, an official document – signed by high level staff – envisages practices that deviate from current institutional practices on the working level. Without any resources to enforce the new practice of closer interministerial cooperation, its implementation is left up to the individual interpretation and agency of staff on the working level. Nevertheless, the agreement itself turns into a resource for those willing to change their practice: With state secretaries as powerful speakers within the ministerial policy discourse, their statement supporting closer cooperation backs up any practices and further official statements in the same direction.

In instances of concrete policy making within the BMBF, such as in the process of programme or funding initiative design, cooperation is often restricted to sharing information, instead of an active coordination of actions with other ministries. In SKAD terms, the different ministries positions are dismissed in the BMBF's policy discourse. The emergence of the first versions of FONA is an example of excluding other ministries from speaker positions, granting them only a position as a recipient of the discourse, as an interviewee from the BMUB recounted:

> "The BMU was not as involved in designing FONA as we would have liked to. The BMU asked for drafts repeatedly, but we were put off until the final draft for the Minister's signature was done and little possibilities for changing things existed. In earlier phases, no exchange took place." (PA15)

Similarly, neither BMUB or BMZ were routinely part of the project evaluation and selection processes in the past, which interviewees perceived as a neglect of easily accessible expertise (interviews with PA15, PA16). In view of past BMBF funding initiatives for cooperation with developing countries and emerging economies, and the lack of cooperation with other ministries in their design, an interviewee from the BMBF stated that there was no coherence between the sectoral policies (interview with PA14). The exclusion of relevant knowledge from the discourse coalition

did not only shine through in a lack of coherent policies; it also had negative consequences for the implementation of projects and their effects (ch. 10).

Causes of non-cooperation between the ministries

The general lack of policy coherence, coordination of action or of a common discursive frame as their basis raise the question about the causes that prevent cooperation instead of promoting it as foreseen in the constitution. A first cause is to be found in the organisation of work within the ministries. As elaborated in view of international cooperation (ch. 6), it largely depends on the agency of the individual working level staff if coordination with other ministries is sought. Theoretically possible in all working units, coordination of actions with other ministries is often not considered as a priority (interviews with PA14, PT07). The institutional structures and practices rather enhance non-cooperation: Due to decreasing numbers of staff and high workloads, working staff prioritize to fulfil their core tasks rather than spending time on add-on activities (interview with PA16). In order to increase cooperation, an interviewee from the BMZ therefore suggested inscribing coordination with other ministries into the work description and incentivizing it: "I it would make sense to integrate contributions to policy coherence into the ministerial target agreements – on the level of units and employees. So far, there are no guidelines for this" (PA16).

However, a second and more political explanation can be found underneath this first, practical, layer. Not including other ministries' knowledge also can be interpreted as an act of *strategic* exclusion of potential speakers from the discourse coalition on policies in the respective field. I argue that the root causes are to be seen within the different logics and perspectives on cooperation with developing countries and emerging economies that the ministries operate within. Thus, different rationales underlie BMBF and BMZ cooperation policies. More importantly, however, the autonomy of taking own decisions, choosing the own rationale and not subordinating the own field of policy to others is sacrosanct: "If the BMZ said that water is not a focus in a certain country and therefore the BMBF shouldn't fund water there either, we'd defend ourselves. We'd laugh out loud!" (PA03)

Ministries need to be understood as institutions with a strategic interest in maintaining their spheres of action and status quo (Weingart 2006). Different, often political factors may lead to organisational changes as well as changes of focus and direction. Ministries such as the BMBF therefore have to prove their legitimacy in order not to be contested and challenged in their work (Stucke 1993). However, their scope of responsibilities is socially constructed and may be challenged through other ministries. The BMBF's own historical development from a nuclear ministry to a ministry of education and research – at one point losing responsibilities for economic innovation to the BMWi – illustrates this point (ch. 8).

An unambiguous rationale for cooperation with developing countries and emerging economies would be a precondition for clearly separated responsibilities. Through measures such as the African RSSCs, which fund infrastructure abroad; through funding initiatives for international cooperation with high degrees of capacity development, such as in the Megacities programme, the BMBF enters thematic territories traditionally occupied by BMZ. In return, the BMZ also steps into BMBF territories in some of its initiatives based on research, such as NoPa or the Pan African University (GIZ 2016a; 2016b). The boundaries of institutional responsibilities seem increasingly blurred, even though interviewees explain that in theory, the BMZ takes over structural, institutional and personal capacity development, which create a basis for BMBF research funding on same eyelevel (interview with PA16). If funding initiatives are similar, however, the rationale of funding turns into the only distinctive feature between BMBF and BMZ actions (ch. 9).

This explains why ministries fear overlapping responsibilities, try to define clear territorial boundaries and enter into rivalries in case of issues that are ambiguous in their scope (Weingart and Taubert 2006). Legitimating the own actions is rather achieved through building an own distinct profile. In this context, the BMBF's strategy of maintaining the own institution's status quo seems to rely on non-cooperation and not including the BMZ or other ministries in its discourse coalition on research cooperation with developing countries and emerging economies. Routinely including the other ministries in the policy making process – as accepted speakers in the policy discourse – is avoided out of fear that the coordination of policies might lead to shifted responsibilities, to a bigger work load to coordinate actions, and above all out of fear of losing the own institution's uniqueness and visibility.

The strategy of legitimating the own existence, which ensures the BMBF' institutional survival, is thus not to cooperate with others and create coherent policies, but to be distinct and create an own profile. Attempts to consolidate and extend the own policy area lead to a competition for responsibilities and topics that are likely to meet public interest – a strategy used by others as well: "There are struggles over territories that the ministries would like to represent publicly. For example, the BMZ wasn't pleased when Schavan boasted of environmental topics." (PA15)

Cooperation, in this respect, would mean to direct less attention to the own institution, and, as the interviewee concludes: "Sharing the sun with others is never easy." (PA15)

BMBF employees give similar explanations for the lack of policy coordination on higher level, stating that "[t]here are few consultations on a political strategic level. That is actually a huge deficiency. The lack depends on the fact that each ministry and each minister want to distinguish themselves" (PA08). An external expert, involved in the Megacities programme advisory board, concludes:

"That's classic ministerial thinking... they could legitimize themselves through co-operation. But then you put yourself to the test, and you'd have to prove what you are better at, and where you could complement each other. I am sure that the BMBF manages a lot of things better than the BMZ – and vice versa. But it is eas-ier to stick to the institutional divisions as on paper than to reflect about the own capacities, what one's specific role could be. Thereby you would enter terrains you don't feel secure on." (EE06)

In more recent funding initiatives, a change in practices can be noticed, however – both in view of cooperating with other German ministries as well as in view of coop-eration with the partner countries' governments. For GlobE (BMBF 2011e) the BMBF and the BMZ cooperated in setting up the programme with distributed responsibil-ities. While GlobE still did not combine *instruments* of development cooperation and research funding, at least the financial funding was co-organized; the BMBF funds the German research partners, the BMZ funds the international CGIAR centres in-volved in the funding initiative (interviews with PA13, EE06). Here, an underlying reason of including the BMZ into the policy-making coalition probably was their access and available funding for the renowned CGIAR centres, which are conceived of as important research institutions in the thematic area of the call.

7.2 Cooperation countries: From objects of policy to partners in policy making

The countries that the BMBF funds research projects in and with present an inter-esting case. They are neither friends nor rivals: Rather, changes in the discourse on the modes of cooperation (ch. 9.4) convert them into speakers that the BMBF cannot exclude from policy production anymore. Thus, while they used to be ne-glected actors, they are now turning into partners within the production of policy discourse. In the past, the Sustainability Subdepartment did not necessarily co-ordinate their policy initiatives with the respective partner countries in bilateral agreements. This is mirrored in the BMBF's public strategic documents, which give little room to the needs and demands of the partner countries – or how these are going to be jointly negotiated. Instead of determining partnerships jointly on the policy level, the selection of cooperation countries was left to the researchers ap-plying for funding in IWRM and Megacities research. While in case of the call for proposals of the IWRM funding initiative, a few world regions were specified by the ministry, in case of the Megacities initiative, no partner countries were defined through the call for proposals at all (BMBF 2004a; 2004b). Based on the researchers' choices, in the Megacities initiative, research projects in/with Ethiopia and Iran – countries without cooperation agreements – were funded next to projects from

Peru, Morocco, China, India, South Africa and Vietnam, which have cooperation agreements with the BMBF (PT-DLR 2012). The BMBF did not seize its decision power over cooperation countries – thus allowing coincidences of the researchers' preferences to influence the policy direction, thereby introducing an element of coincidence. Next to diverse researchers' preferences, a further fact enhanced the wide spectrum of partner countries. In contrast to other policy fields of international cooperation, such as development cooperation, no external regulations delimit the range of potential partner countries in research cooperation.

In some cases, the thematic starting point of the Sustainability Subdepartment's unilateral funding initiatives even lead to the paradox situation that it funded cooperation with and in a partner country that officially *had* an ST&I cooperation agreement with Germany, but the research project took place outside of the frame of the agreement – as in the case of IWAS Brazil, for example. The practice of leaving the selection of partner countries up to the researchers, paired with the lack of cooperation between the BMBF departments thus led to the implementation of research cooperation projects in official partner countries which were not endorsed by the partner country's government or formally backed up and framed through the valid ST&I cooperation agreement (interview with EE08). The absence of partner country representatives from the discourse coalition within the agenda-setting process of older BMBF funding initiatives, such as IWRM or Megacities, thereby defied strategic action of the BMBF as a whole, as it often undermined the role of ST&I agreements set up and followed by the International Department.

So why did the Sustainability Department consent to – even promote – this loss of steering power, leading to a lack policy coherence within the ministry? Interviewees in the Sustainability Subdepartment justified funding unilateral initiatives in cooperation with developing countries and emerging economies by *freedom of research*, which included the choice of partner countries. At the same time, leaving the research country up to the researchers' choice also likely had practical reasons: A prescreening of all potential partner countries for a topic, let alone negotiations with these partner countries' governments about potential cofunding before a call for proposals, would have led to large-scale administrative efforts.

Beyond all arguments based on research ethics or bureaucratic reasoning, the ministerial practice of leaving the choice of partner countries open to researchers clearly embodies the perception of partner countries as research *subjects* rather than as *partners* on eyelevel (ch. 9). Excluding partner countries from discourse production severely neglected the partner countries' governments' rightful interest in influence on agenda setting – as well as the potential benefits that might arise from joint policy making.

In addition, the practice of funding unilateral initiatives, the lack of the involvement of the partner countries' government in decision making and the absence of

coordination with the International Department in many cases led to negative impacts in view of the implementation of the funded projects in practice. Researchers in the partner country did not receive matched funding and lacked political back up in the partner country, which had further negative consequences (ch. 9, 10). The lack of cooperation on the policy level was perceived as problematic both by researchers involved in cooperation projects as well as by partner country officials and is actually counter-intuitive to the impact that the ministry envisaged as a result of the projects (fieldnotes LiWa and IWAS Brazil, 01.08.2012 to 30.11.2012; interviews with EE08, EE13).

Interviewees from the BMZ, more sensitive to partnership issues after decades of debate on concepts such as ownership in development cooperation, emphasized the importance of joint agenda setting and noticed a change in more recent BMBF practice:

> "We don't issue programmes to be implemented in developing countries that are not induced by decisive actors there. So, in the end we do not act without concertation, we don't create unilateral programmes or define topics. We involve the relevant voices in the partner countries in the programme design beforehand. That's a BMZ principle which we advertise in all other ministries, including the BMBF. We perceive the BMBF to be on track in its more recent programmes." (PA16)

While the BMBF's recent determination to cooperate *on eyelevel* and create impact abroad already was foreshadowed in the discourse underlying the IWRM or Megacities initiative (ch. 9), not involving the partner countries' governments in the design of the IWRM or Megacities initiatives still contrasts with the ambitions. In SKAD terms, the practices and the dispositive of the discourse on cooperation with developing countries and emerging economies had not yet adjusted to the changing contents.

In more recent funding initiatives of the Sustainability Subdepartment as well as other thematic departments, a change in the practices of policy making can be observed. The examples of more recent funding initiatives thereby illustrate how a change on the level of discourse *contents* – the shared assumptions on the way in which cooperation should take place, the generally accepted ideas of modes of cooperation, stemming from discourses beyond science policy (ch. 9) – causes a change in practices as well as an inclusion of new actors. As such, the African RSSCs or CLIENT were defined in cooperation with the partner countries – who were thus included as speakers in the policy discourse (BMBF 2010b; 2015i; interview with PT01).

The example of CLIENT, a funding initiative for International Partnerships for Sustainable Technologies and Services for Climate Protection and the Environment (BMBF 2010b; 2015i) demonstrates that often discourse-external events lead to discursive change. In case of CLIENT, political initiatives at a larger scale seem to

have opened up the potential spaces for further speakers: During the G8 summit in Heiligendamm in 2007, the eight leading industrial nations agreed to establish a closer dialogue with developing countries and emerging economies, especially in view of climate change – not only on the political level, but in research as well (Bundesregierung 2009b). In order to strengthen science policy cooperation and to coordinate research agendas between Germany and BRICS countries on sustainability issues, the BMBF initiated a Dialogue for Sustainability in 2008 as a follow up. In the frame of the Dialogue for Sustainability, scientists identified topics of mutual interest in several conferences, which later turned into the basis of CLIENT as a joint research initiative between Germany, the BRICS states and Vietnam (BMBF 2009b; 2009c; BMBF and MCT 2010; BMBF and DST South Africa 2010; BMBF and DST India 2011).

In CLIENT as well as the African Regional Science Service Centers SASSCAL and WASCAL, the BMBF engaged in a dialogue and negotiation process with the partner countries' governments from the beginning. The process involved repeated meetings and long consensus building sessions (interview with PT01). In the more recent initiatives for cooperative research, the partner countries thus turned into speakers within the discourse on policy making for international cooperation in the Sustainability Subdepartment, occupying a valid speaker position and contributing their ideas on topic and mode of cooperation.

While in the case of CLIENT, partner countries cofunded the research partners in the respective partner country (interview with PA6), in the case of the RSSCs, opening a speaker's slot for partner countries cannot be attributed to their financial resources – the BMBF remained the principal provider of funding in the first phase of establishing the centres (interview with PT01). Whereas in case of CLIENT, the financial resources of the partners thus likely played a role, in view of the African RSSCs reasons for changing the circle of actors included in agenda setting (and thus in discourse production) may rather be explained by the changed framing and new importance attributed to cooperation. The political commitment on a high international level – thus external circumstances – as well a previous discursive change towards *cooperation on eyelevel* within the ministry (ch. 9) influenced who was considered as a valid speaker in the discourse coalition. The change in the discourse's contents led to a change of actors and practices, a phenomenon interesting in view of discourse production and coalitions.

The changes in the underlying ideas and in the practice of policy making in cases such as the RSSCs and CLIENT bear a potential of turning into institutionalized practice and dispositive – thus of standardly including partner countries in policy decisions. The Sustainability Subdepartment increasingly acknowledges the importance of coordinating their international activities with the respective partner countries: In this vein, FONA3 emphasizes that international cooperation in its frame shall be based on joint interest as one of the guiding principles, and explic-

itly states that cooperation shall take place in the frame of ST&I agreements (BMBF 2015e). The development to include partner countries in the production of policy discourse might ironically also lead to internal ministerial rearrangements: Opening up towards partner countries in agenda setting might pave the way to an enhanced cooperation between the departments – as the International Department's knowledge about cooperation as well as responsibilities for international cooperation agreements turn into useful knowledge for the Sustainability Subdepartment. This might potentially create a speaker position for the International Department in the policy creation. At the same time, the development also theoretically might lead to the abolishment of the International Department: Some interviewees have argued that the expertise on internationalisation might be better utilized if it were integrated into the thematic departments by dissolving the separate International Department and incorporating the staff and its expertise within the thematic ones (interviews with PA09, PA14).

7.3 Discourse coalitions

In contrast to the actors standardly *excluded* from the discourse production in policy making, other actors are routinely *included*. According to Keller, discourse coalitions may emerge as a coincidence if social actors support the same ideas or storylines. However, they may also be a (conscious) strategy of discourse reproduction (Keller 2013). Discourse coalitions – jointly supporting a specific discourse – contribute to *stabilizing* a discourse's meaning: More speaker positions are occupied by actors who share the same idea and argue in the same way. In case of policy making for research cooperation with developing countries and emerging economies, I argue that forming a discourse coalition has further functions. While the coalition stabilizes the discourse on the one hand and the consultation of experts adds legitimacy to policy decisions, there are also discourse-external effects that influence the specific actor constellation. The BMBF is in a position to gate-keep: While taking on board actors who stabilize the BMBF's discourse and add legitimacy, at the same time the ministry maintains its power over the further discourse production, its direction as well as the distribution of resources. Power thus is a central element in the case of coalition building scrutinized here. However, as often, reality is complex – as the distribution of power between the ministry and the project management agencies illustrates. Next to the project management agencies, the BMBF builds a coalition with different external experts as representatives of the research community – both on the institutional as well as individual level. In the last years, an inclusion of further actors can be observed.

7.3.1   Project management agencies:
The BMBF's right hands with own signatures

As shown in their name, the project management agencies' task is the technical and administrative management of BMBF funded projects. In addition, the project management agencies are involved in setting up new programmes and funding initiatives of the BMBF, while at later stages also taking over the administration of incoming proposals, distribution of project funds as well as monitoring the selected projects on a content level (interviews with PT07, PT03, PT02). They thus play an important role within the policy making process next to the BMBF as such.

In view of the production of policy discourse, the project management agencies have a rather conservative role, in the sense of stabilizing previous policy directions by repeating rather than redirecting the course of a policy. Due to their dependency, within the discourse coalition they are not in a (speaker) position to openly challenge and change the underlying motivations or general direction of the policy discourse. They rather act as a reinforcer to the BMBF's position.

In order to understand their role, it is important to consider the institutional relation between the ministry and the project management agencies in detail. The BMBF contracts the project management agencies in order to relieve the ministerial staff from the high administrative efforts arising from the increasing level of project funding within the BMBF funding portfolio (ch. 5). Different project management agencies, mainly based at research organisations, have worked for the BMBF since the 1970s (Stucke 1993).[5] In 2010, 372 employees worked on research issues within the BMBF, compared to 685 employees in the different project management agencies (17. Deutscher Bundestag 2011a).

International projects, such as those funded within the Sustainability Subdepartment, are administered through different project management agencies, depending on their thematic focus. In case of the Megacities programme, the Department for Global Change, Climate and Environment Protection and Social-Ecological Research of PT-DLR was responsible for evaluating and administrating projects, while next to them, VDI/VDE-IT was a main actor in designing the concept (interviews with PT07, PT09). PT-KA and PT-J shared the responsibilities of administrating the IWRM funding initiative as well as IWRM-related initiatives

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5 Among them the Project Management Agency at the German Aerospace Center DLR (Projektträger beim Deutschen Zentrum für Luft- und Raumfahrt, PT-DLR); the Project Management Agency at the Research Center Jülich (Projektträger Jülich, PT-J); the Project Management Agency at the Karlsruhe Institute of Technology (Projektträger Karlsruhe, PT-KA); the Association of German Engineers/Association for Electrical, Electronic & Information Technologies (Verein Deutscher Ingenieure/Verband der Elektrotechnik Elektronik Informationstechnik, VDI/VDE-IT); and others (BMBF 2014p).

such as IWAS, after the International Bureau of the BMBF, part of PT-DLR, had administered the prephase of the projects (interview with PA02).

The BMBF and the project management agencies interact very closely. The ministry commissions the project management agencies with specific tasks. In doing so, the boundaries of the ministry and the project management agencies sometimes become blurry, with the ministry – as well as funded projects – perceiving the agencies as an extension to themselves. For example, during fieldwork BMBF staff often directed me towards the respective project management agencies in order to obtain insights into funding programmes, instead of answering interview questions themselves (fieldnotes, June 2013).

The nature of the close relation between different science ministries and their project management agencies has been explained through principal-agent models in the past (among others Braun 1993; Van der Meulen 1998; Braun and Guston 2003). In his analysis of the relation between the different project management agencies and the BMBF's predecessor, the Federal Ministry of Research and Technology (BMFT), Braun (1993) characterized their interrelation not only as a principal-agent relationship, but even as a master-servant relationship:

> "The BMFT not only possesses the power to control the activities of project funding agencies, it has also kept the right to decide on all issues in research policy making. Project funding agencies may not fund any research project without the consent and signature of the BMFT. It is, moreover, the Ministry which chooses the program development and establishes or abolishes project funding agencies in a particular area." (Braun 1993: 150)

On the superficial level, this is still characteristic of the relation of the subsequent BMBF and its project management agencies 25 years later: Formally, the ministry does not transfer any decision-making power to the project management agencies, which have a merely executive function. Power imbalances thus shape the relation between the ministry and the project management agencies. However, this is just one side of the coin, which thus should be flipped to consider the other side as well.

Until 2011, the institutional relationship between Ministry and project management agencies was very stable: The BMBF extended their contracts with the same project management agencies, who are of independent legal status, without major changes in the relation. Project management agencies worked for the ministry as if they were governmental agencies. However, the growing number of staff working on behalf of the BMBF in the project management agencies, as well as the lack of public procurement procedures to officially mandate them led to public debates about their relation. Pointing to their informal power over the BMBF, parliamentarian Hagemann called the project management agencies a "shadow ministry" (17. Deutscher Bundestag 2011b); and the Expert Commission on Research on Innovation, appointed by the German Government, accused the tight institutional net

of ministries, project management agencies and research institutes of making re-orientation of innovation policy impossible (Expertenkommission Forschung und Innovation 2010). In consequence, the procurement procedure was revised; since 2012, the project management agencies have to compete over project management agency tasks in open public tenders (17. Deutscher Bundestag 2011a).

Despite this change on the contract level, the project management agencies' power continues to lie within their scope of tasks. It still holds true what Stucke described in 1993: Project management agencies, while officially and formally less powerful than the BMBF, manage to informally guide the ministry. In delegating tasks to the project management agencies, the ministry loses steering power, as the project management agencies have the power to channel information and thereby shape preferences and decisions of the ministry. In addition, the ministry often recruits staff from the project management agencies and historically was strongly influenced by pre-existing institutions that later became project management agencies (interview with PA12).

Empirical material shows that Stucke's findings still can be observed today. The ministry entrusts the project management agencies with monitoring current research developments and staying in close contact to the scientific community. This is especially relevant as initial inspirational sparks for new funding initiatives mainly originate outside of the ministry – from hot topics in the scientific community. In the Megacities funding initiative, for example, the impulse for considering urbanisation as a topic of funding for the Global Change Unit stemmed from a paper on global megatrends issued by the German National Committee for Global Change Research (NKGCF) in 2002, which listed megacities as a topic and which the responsible project management agency drew the ministry's attention to (interview with PT07). As in this example, the project management agencies often act as intermediators between the scientific community and the ministry in view of future funding programmes and strategies: "In the thematic departments, funding is rather bottom up. Through the project management agencies, they are close to the research community and receive feedback, and on this basis single cooperation endeavours take place." (PA09) An employee of one of the project management agencies added that "[i]t is our task to observe the research landscape in view of new topics. And to keep track of what is important and be able to answer to the BMBF's inquiries" (PT03).

Considering constructivist literature on science-policy interfaces, objective transmission of scientific facts through the project management agencies is unlikely. While the knowledge provided by the project management agencies has to *appear* valid, accurate, neutral, and produced without interests in order to be taken up by policymakers, there *is* an inherent value dimension to knowledge (Dilling and Lemos 2011; Watson 2005; Haas 2004; McNie 2007). The argumentation of researchers on science-policy interfaces can be extended to include

knowledge brokers such as the project management agencies: While the belief in the rationality and objectivity of science itself has been contested, the transmission of knowledge from science to policy via the project management agencies additionally involves a process of selection and communication, which is coined by interests and worldviews (Hoppe 1999; Weingart and Lentsch 2007; Irwin 2008; Nowotny 2007).

Through their tasks of monitoring external developments in the scientific community, the project management agencies thus may informally guide new programmes in a direction according to their worldviews, interest and preference. In addition to identifying relevant topics for future funding initiatives and strategies, the project management agencies additionally identify further experts from the scientific community as external advisors for the BMBF (interview with PA04). Preselecting experts further extends their influence on the directions of policy.

Despite this informal power, project management agencies will not likely deviate far from known policy paths. On the one hand, this has structural reasons: The project management agencies' organisational set up as well as focus of topic generally mirror BMBF structures and priorities. The focus of the specific project management agencies corresponds to the specific departments or units of the ministry. General directions of past BMBF policy, which are institutionally embedded in the organisational structure of the ministry, lead to selecting and shaping the project management agencies that work on its behalf. Nevertheless, the organisational history and culture of the individual project management agencies result in a specific handwriting:

> "The project management agencies play a big role in formulating programmes. And it depends on the way they role – if it's the VDI or DLR, engineers or also social scientists or with a humanities background. That strongly influences the programmes. These forest related things in FONA, where Jülich was the project management agency…you definitely notice that. Each one is different." (EE18)

However, a technology-oriented working unit of the BMBF rather commissions a technology-oriented project management agency than a project management agency focused on socio-ecological perspectives. In the past, different project management agencies worked for the BMBF's Resources Unit, responsible for resources and sustainability, including the project management agency at the DLR (section on Global Change, Climate and Environmental Protection). However, the Resources Unit did not mandate PT-DLR again after the change in procurement law. Having a socio-ecological tendency, the respective section of DLR continued to work only for the Global Change Unit with a similar approach. Tasks for the Resources Unit were continued by the technology-oriented project management agencies such as PT-J and PT-KA (fieldnotes on FONA-forum, 9-11.9. 2013). To maintain the working

relation, the project management agencies thus cannot deviate too far from the respective working unit's discourse.

As any organisation, the project management agencies have an interest in their own institutional survival. Proposing a change of the policy discourse and deviating from the given direction might endanger their position: new policy orientations might require new funding structures and different competences, which might not necessarily fit to the current project management agencies (interview with PA14). The changes in the procurement procedure in 2011 add to the project management agencies' vulnerability and financial dependence on the ministry – as they can lose their contract in a next round of calls if the ministry disagrees with their work. At the same time, this results in even higher stability of the policy discourse: The financial dependence on the BMBF inhibits criticism of past policy directions and leads to a type of *anticipatory obedience*. The project management agencies therefore likely monitor and preselect topics within the focus given by BMBF. For institutional stability, it is safer to repeat accepted notions and concepts rather than daring to come up with novelties, which inherently would criticize old ways of doing things by proposing something new.

From the point of view of funded projects, the project management agencies seemed like a prolonged arm of the BMBF rather than like an independent institution. According to an interviewee, the project management agencies' ways of acting strongly mirrored the current policy direction (interview with PP4). On the other hand, projects also acknowledged the project management agencies' room for interpretation. In view of the quest for visibility, an interviewee involved in an accompanying project stated that "I am sometimes not sure where the demand of visible findings in the BMBF stems from. If the project management agency just assumes that the BMBF wants it that way" (PP27).

Put in SKAD terms, the project management agencies maintain, repeat and renew a given discourse rather than changing its contents and therefore are a safe partner within the BMBF's discourse coalition. In providing ideas and topics for new funding initiatives, they rather resort to approved models of the past in order to preserve their institutional relation. Thereby, they indeed exert a high degree of power over policy making and agenda setting, without being in a speaker position in power to change the underlying motivations or directions of the BMBF.[6]

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6 The institutionalized relations between the actors involved in policies for cooperation with developing countries and emerging economies cannot be explained as an effect or dispositive of the discourse on cooperation with developing countries and emerging economies, as they existed previously to its emergence. Nevertheless, they further shape the discourse – as institutions belonging to the dispositive the BMBF's core discourse.

7.3.2 Gatekeeping vs opening doors:
The BMBF and external experts in policy making

Next to the project management agencies, which were generally involved in shaping new funding initiatives from the very beginning, the BMBF also sought advice from external experts – mainly members of the scientific community – regarding the directions of new funding initiatives, programmes, as well as strategies: "In new funding priorities, we do seek consultancy. Expert rounds take place, industrial associations are listened to. Obviously, we don't know everything." (PA05)

In many cases, the process of seeking advice from external experts remained opaque. In general, the BMBF did not lay open which procedures took place behind the scene to choose experts, or which experts were selected for which reason (interviews with PA02, PP30). The process of consulting advisors was not subject to formal rules or a standardized procedure in the past, either: "A framework programme develops through dialogue. The bioeconomy programme was strongly developed by an external round of experts, including other ministries. In FONA, we worked a lot on our own. We talked to smart people, but there was no formal involvement." (PA07)

A researcher who had been consulted as an expert in agenda-setting processes within FONA shared similar insights stating that "[t]here are no rules. In some departments, expert talks take place, as they seem fit, and also with those experts that seem fit. Thus, without clear-cut definition what ‚actor from practice' really means" (EE18).

As the quotes illustrate, it was up to the respective BMBF responsible to decide whom to consult at which stage of developing a funding initiative. While in some funding initiatives, so-called *Fachgespräche*, i.e. expert discussions, took place before defining a funding initiative (interview with EE18), in other funding initiatives, a small group of experts designed a first draft which was then discussed with a larger circle (interview with PA02). In case of the Future Megacities funding initiative, an official advisory panel accompanied the selection process of the funded projects as well as their implementation. Due to the programme's focus on applied research in and with developing countries and emerging economies, aimed at creating impact, the advisory board included scientists and practitioners, such as experts from GIZ, as well (interview with EE06). In case of IWAS, the BMBF appointed an advisory board after the project had started (interview with EE17).

In contrast to those experts who were regularly included in consultation processes of one kind, the doors to the discourse coalition remained closed to other members of the scientific community and other societal actors. Interviewees reported about the random in- or exclusion of civil society actors in agenda setting for different funding programmes, such as FONA or the BioEconomy 2030 programme (interviews with EE18, EE11). Similarly, I had previously assumed that

in order to represent scientific views, the Scientific Advisory Council on Global Change (WBGU), co-established by the BMBF and the BMUB, would be systematically included in designing or accompanying funding initiatives. This was not the case, however (Box 7-1).

Box 7-1: Alternative discourse on science policy processes

Within a discursive field, different actors may compete "for the constitution or definition of a phenomenon" (Keller 2013: 72). In the past, shaping the dominant policy discourse took place in restricted circles open to only selected actors, as I argue in this chapter. Actors speaking from positions within this alternative discourse are often not included in the policy makers' discourse coalition; or are invited to participate, but are not able to obtain speaker positions which contribute to discursive change. The variety of actors in the alternative discourse coalition contest the discursive direction of policy – such as its focus on economically viable technological solution paths (ch. 8), as well as the practices that stabilize the dominant discourse – and thus criticize the way how policies come into being, who is involved in the process based on which democratic legitimation. While these are contents of the alternative discourse, they inherently deal with the processes of the discourse production in policy making and maintain a critique and counter stance to the latter – and are therefore presented and analyzed here rather than in chapter 8.

Contestation occurs in different discourse arenas: it has turned into a subject of critical scientific as well as public discourse. As some interviewees argue, policy makers are more likely to be influenced by larger public debates leading to changed public opinions, rather than through attempts to exert direct influence in personal contact (interviews with EE21, EE 22).

Within the German context, an alternative discourse coalition gathers around critical positions of science policy making, policy interfaces or modes of research. Actors include institutions like the WBGU as well as individual researchers, members of science funding institutions, members of civil society organisations as well as politicians from oppositional parties. Being organized in several institutionalized networks, such as Ecornet, Forschungswende or NaWis (NaWis 2011; Vereinigung Deutscher Wissenschaftler 2012; Jahn and Kraemer 2013), their mode of organisation seems to correspond to the idea of a discourse coalition. In contrast to the policy making coalition, the function here seems to bundle similar ideas and make them more visible in public and policymaking.

Their critical ideas on the status quo of the process of science policy making are often centred on the idea of a transformation towards sustainability. It is argued that the participation of diverse stakeholders in policy processes is an essential element of a transformation process, as well as transdisciplinarity as a guiding principle for

stakeholder involvement and interdisciplinarity in research projects (ch. 9). Instead of lobbying for concrete new topics of research or research funding, speakers of the alternative discourse coalition thus rather propose a procedural change. Opening up the agenda-setting process, making it more transparent and including a diversity of actors is considered as a means of safeguarding societal relevance as well as ensuring that public money is spent on public goods (Jahn and Schuldt-Baumgart 2013; Schneidewind and Singer-Brodowsky 2013a; Ober 2013).

Key events in discourse production and dissemination include the publication of the flagship report of the WBGU on *The Great Transformation* (WBGU 2011), which was influential on a number of following scientific articles and public positions (Grunwald 2015; Haum and Pilardeaux 2014). Researchers, research organisations as well as civil society organisations took up the debate on the concept of transformative science and its consequences for policy production.

Civil society organisations began to reflect on science and science policy in position papers of. For example, the Friends of the Earth Germany (Bund für Umwelt und Naturschutz, BUND) published a position paper on sustainable science in 2012, including their demands on more inclusive agenda processes (BUND 2012). In a similar line, civil society organisations such as Greenpeace, Germanwatch, BUND and others signed a joint memorandum on their demands in view of a sustainable science and science policy (Forschungswende 2013). In order to open up the policy discourse to broader stakes, the community argued that it would be essential to open up expert panels, advisory boards, programme committees etc. to other societal groups, whose interests are currently neglected, while other privileged actors gain disproportionate influence (Ober 2014).

Next to the researchers or research institutes contributing to the alternative discourse from a mainly socio-ecological perspective, such as those organized in Ecornet or Nawis or the members of the WBGU, even scientific institutions that traditionally do not position themselves in the context took over speaker positions in the emerging alternative discourse. The German Council of Science and Humanities (Wissenschaftsrat) issued a position paper on science policy in the context of grand societal challenges, demanding that future grand challenges should be identified in open discussions without predetermined conclusions, which should be open to a plurality of actors and positions (Wissenschaftsrat 2015).

The alternative discourse of science policy and participatory processes entered the political arena, the Bundestag, as well, brought forward through members of left and green parties. After a BMBF-initiated science year targeting research for sustainable development in 2012 (BMBF 2012b), Green Party members of parliament suggested to implement transparency as binding principles in public research funding as well as to improve participation in decisions relevant for research in two official requests to the parliament (17. Deutscher Bundestag 2012c; 17. Deutscher Bundestag

2012a). A year later, Parliamentarian members of the Linke voiced similar requests in parliament: To redirect science policy towards the inclusion of social innovations in view of grand challenges; and to increase transparency and participation of civil society and other interest groups in research agenda setting. However, these recommendations were turned downed by the Parliamentarian Commission on Education, Research and Technological Impact Assessment (17. Deutscher Bundestag 2013a; 17. Deutscher Bundestag 2013b).

The alternative discourse and its positions in view of participation in policy making and research caused counter reactions among members of the scientific community anchored in more traditional discourse positions. Strohschneider, president of the DFG and thus of a funding institution that funds research based on excellence and not on potential application, expressed concerns that boundaries between science and policy were vanishing (Strohschneider 2014).

The WBGU and its members do not belong to the group of experts consulted. An interviewee reflected:

"You take on board people when you need advice and if they happen to argue in the lines that the BMBF wants to represent politically at that moment. From the political perspective, it would therefore not make sense to institutionalize the process. You want to remain flexible. So, you can say you have a great Advisory Council. But you only actively include it into policy making when you feel the need for it." (EE20)

From the BMBF's perspective, the non-standardisation of advisory groups was caused by the desire to keeps things simple: "There are no standard rules who is included, because you would increase the bureaucratic procedure." (PA04) For the ministerial employees, this was thus not a drawback but an asset, as they saw themselves as organizers of multi-actor consultations for new funding initiatives:

"Within the consultancy groups, you need a mix. They are controversial among them. We have included associations such as the one for waste water, the DWA, and the one for drinking water, DVWG, which display the range of positions of their members. And who inhibit that single opinions are out forward too strongly. That's the art of mixing in the editorial team and the expert group. That's our task, and it works out well. Afterwards, there are always some people complaining, they would not have been listed too and we should have done things differently. But by and large, it works out well." (PA02)

BMBF employees thus perceived themselves in the role of neutral facilitators of an agenda process that becomes objective through the inclusion of different positions, as illustrated by the quote above. In interviews, BMBF employees repeatedly

asserted to achieve unbiased decisions on new funding initiatives by including a range of different stakeholders and experts in the process (interviews with PA02, PA05, PA11, PA14).[7]

However, interviewees involved in the policy process as external experts had a more critical perception. One interviewee reflected on the impartiality of the BMBF as a facilitator of the discussion and its neutrality:

> "The units have their 20 points of contact in the science system. Actors who were already relevant in the previous programmes. With these, there are background talks, communication, I know that from SÖF. They invite 10 experts who they have known before. You discuss what they want to do. Add some ideas and publish that. That's a closed in-circle, and it actually guards the resources of those involved. The scientists involved have an interest in keeping the cycle of decision making interesting for the ministry, to advise, to offer ideas. It's a win-win situation which stabilizes the whole thing." (EE22)

The "win-win situation" mentioned in the quote derives from the fact that after being part of the agenda-setting process, experts may apply for funding within the same call. In times of growing dependency on third party funding, this fact hampers impartiality in the consulting process (interview with PP30). At the same time, the quote also illustrates that parts of the scientific community benefit from the current set up and direction of science policy. Once admitted into the in-circle and therefore regularly included in agenda setting, experts have an interest in maintaining the status quo of agenda setting: "If they arrange expert talks…well as a scientist you have your research interests and you hope for a subsequent call for proposals that fits. That's the same for everyone, and you cannot prevent that." (EE18)

Another interviewee stated that he was even involved in formulating the call for proposal's wording as such (interview with PP10). Being knowledgeable about the very details of a future call and having potential influence on its direction is a clear advantage for applying successfully to the call later. Interviewees from within the BMBF did not consider this as a potential conflict of interest: "You find out quickly if an advisor has self-interests. The community is not big. You have a good overview who has stakes at which point. And not everybody with a self-interest is a bad consultant. You have to consider that." (PA05)

I argue that the BMBF's indifference in view of the positionality of the experts consulted is based on their capacity to preselect experts, while being included in formulating calls for proposals is advantageous for the researchers consulted.

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7 This indicates a growing sensitivity to the issue of participation in policy making in times of rising external criticism of intransparent agenda setting and privileging a certain policy direction (Box 7-1).

From the discourse perspective, the lack of binding common rules of procedure leads to an authoritative position of the BMBF as central speaker in discourse production. In the past, the responsible BMBF staff and the project management agencies working on their behalf decided from case to case whose advice was sought, whose knowledge was integrated into policies and which alternatives were left out. The BMBF thus possesses a high degree of power to invite or exclude experts as speakers in the policy discourse. The BMBF's power did not begin or end with finding a balance of interests of the experts included. The ministry's power instead lay in its gate-keeping (or door-opening) position, which started with the selection of experts to take part in the process. As one interviewee put it, pointing to the power of policymakers in the agenda-setting process: "If you want to include suitable experts, you take those which potentially work in that line. You might ask if that is correct in view of transparency. But then, actually, you shouldn't do consultancy processes anyway." (EE18)

Even though the BMBF is not formally obliged to do so, it is beneficial for the BMBF to seek for a discourse coalition with external experts within the process of producing new policies and funding initiatives: The experts have a legitimizing function. Especially in a policy field like science policy, which is aimed at fostering further knowledge production as a policy outcome, the legitimacy of policies and funding increases if experts from the scientific community back them up. In this vein, consulting experts is a way of legitimizing policies and miming objectivity (Irwin 2008; Leach et al. 2010). Discussion rounds with experts, advisory commissions and representatives of civil society provide a justification to policies in public: The inclusion of certain actors is a technique of creating evidence-based policies. At the same time, involving external actors in the policy process may also turn into a strategy of providing legitimacy to policy initiatives within the BMBF as such (in backing up decisions that deviate from previous policy discourse, as in case of the African Science Service Centers). As a strategy, drawing on external experts' knowledge is analogous to drawing on science-based arguments to back up value-based decisions, as constructivist literature on policies argues (ch. 6).

7.3.3   Science–society–policy interfaces: On the road to participatory policy making?

In the last years, international as well as German debates – as in the alternative discourse coalition (Box 7-1), concepts of policy making are shifting towards a participatory, deliberative approaches. As the Sustainability Subdepartment itself promotes participatory modes of research, such as transdisciplinarity, this does not go unnoticed in the BMBF. Attempts to broaden the discourse coalition through more deliberative forms of agenda setting illustrate this point. The BMBF's Sustainability Subdepartment has turned more sensitive to the issue of participation

and transparency in agenda setting in the last years – at least on the surface.[8] The process of designing the FONA as a research programme illustrates how a changing discourse on policy design contributes to changes in policy practice: Whereas the input for the first two editions of FONA still came from a limited number of experts with an insider view, with the third edition of FONA, the BMBF however changed the processes and aimed to increase participation of civil society and other actors (interviews with PA11, PA15). In interviews as well as in public talks, high level ministerial staff emphasized the importance of participatory processes and pointed out the new transparent and participatory mode of programme design (Huthmacher 2013). The BMBF thereby follows an international trend of scientific governance moving towards transparency, dialogue, and public engagement (Irwin 2008).[9]

Does the agenda process leading up to the latest FONA, as programmatic frame of sustainability research thus illustrate an instance of opening a discourse coalition to a broader public? For the newest edition of FONA, issued in 2015, the responsible BMBF Subdepartment organized a public agenda-setting process, consisting of several conferences open to the public – including scientists, industry representatives as well as civil society organisations – the so-called FONA-Fora (BMBF 2015g). The Forum in 2013 was aimed at a joined agenda process, according to its programme:

> "The BMBF invites […] representatives from science, business and civil society to discuss future tasks and challenges of sustainability research in six sessions. This is the kick off of an agenda process, which culminates in the publication of a further developed framework programme (working title FONA3) in 2015. We expect a discussion beyond purely scientific questions and topics. Embedded in the High-tech Strategy as well as national and European sustainability strategies, FONA aims to support sustainable developments within society. To do so, thinking outside of the box of science and research is necessary. Only that way, research findings will lead to innovations and solutions that are accepted by the people." (BMBF 2013d: 4, *own translation*)

This long quote illustrates that the BMBF is familiar with the discourse on transparency and participation that it promotes itself in its programmes as transdis-

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8 The Sustainability Subdepartment's funding priority on Social-Ecological Research (Sozial-ökologische Forschung, SÖF), regular part of FONA and funded since the year 2000, was among the first BMBF funding frameworks to emerge in a public agenda setting process (BMBF 2015f).

9 The BMBF has started to reflect on issues such as transparency in agenda setting, participation in research, or new innovation pathways in other departments as well. Questions around the direction of innovation have moved into the spotlight of an initiative on the meta level of ,Innovation and Technology Analysis', funded by the Strategy Department (BMBF 2014q), and even in the High-tech Strategy now encourages citizen participation as one of "five core elements of a completely consistent innovation policy" (Bundesregierung 2014: 13).

ciplinarity. However, a clash between paper and practice became apparent in my participant observation of the event – a dynamic that Irwin has described for similar agenda-setting processes in science policy (Irwin 2008).

The BMBF did not wish to institutionalize the participation of any type of social group in the Forum but left the process open to any actors from science, industry to civil society (interview with PA11). Despite the intention of broad inclusion, the FONA forum 2013 was not attended by a balanced audience. The fact that out of 480 participants, around 430 were involved in the German science and science funding system suggests that a prior strategic stakeholder identification might have been lacking.[10] While scholars argue that in political participation processes, the round of participants should represent all legitimate stakeholders sufficiently (Newig 2011), there is little consensus regarding the responsibility, i.e. if it is task of the process organizer or of the public to ensure the representation of legitimate stakeholders in the participatory process. Self-exclusion leading to non-participation must also be considered as a factor. Reasons may range from not having time or financial resources to participate, feeling incapable to contribute, or feeling uncomfortable in a social setting coined by policy experts and scientists (Cornwall 2008). In addition, civil society organisations may not have been aware of the potential impact of science policy on their field of action, therefore not considering participation necessary. In this line, interviewees stated that previous awareness raising and capacity development among potential stakeholders in view of their stakes in science policy would be necessary to increase participation (interviews with EE10, EE11). Cornwall similarly concludes that

> "While opening spaces for dialogue through invitation is necessary, it is by no means sufficient to ensure effective participation. Much depends on how people take up and make use of what is on offer, as well as on supportive processes that can help build capacity, nurture voice and enable people to empower themselves." (Cornwall 2008: 275)

In addition to unbalanced types of participants, other factors hindered an open participatory process. Some discursive core ideas – were pre-established as given facts, thereby narrowing down the options and potential outcomes. As such, the agenda process was explicitly aligned with the High-tech Strategy (BMBF 2013d:

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10 An analysis of the list of participants shows that from 480 participants listed, only around 50 belonged to city councils, enterprises or consulting firms and thus were not directly involved in research or science policy. Civil society organisations were not represented well, environmental NGOs didn't participate at all. Different project management agencies, including VDI/VDE-IT, PTJ and PT-DLR, were represented through 75 participants, while about 40 participants came from the policy making sphere, including 20 BMBF employees from the Sustainability Subdepartment and 20 participants from other ministries and their agencies, mainly from the BMU and UBA – but none of the BMZ.

4); the conference panels and workshops were not thematically open but aligned with previously defined objectives. This excluded the possibility to challenge the overall direction of the new edition of FONA as such. As Jasanoff argues, "[p]ublic participation that is constrained by established formal discourses, such as risk assessment, may not admit novel viewpoints, radical critiques, or considerations lying outside the taken-for-granted framing of the problem" (Jasanoff 2003: 237). While according to its programme, the FONA forum aimed at identifying central research questions or adequate innovations for sustainable development (BMBF 2013d), the forum itself did not provide the room necessary to think outside the preset discursive frame. Similarly, participants called for reflections on the meta level of sustainability research, such as the appropriateness of research questions and the suitable framing of problems during the forum, thus questioning the overall definition of sustainability in the BMBF's discourse.

However, instead of providing the space for a thorough scientific analysis of the direction of sustainability research within the new edition of FONA, for the BMBF it seemed enough to touch on these issues in ad hoc discussions (fieldnotes on FONA forum, 9.-11.9. 2013). The underlying discourse thus led to a specific structure of the forum, whose logic and assumptions were not to be changed. Structurally, the agenda therefore remained in hands of the BMBF, the participatory process was merely an add-on to agenda setting, but no crucial element (Cornwall 2008; Irwin 2008). Among the participants, including the public was perceived as tokenism, serving a legitimisation of earlier activities and ideas rather than as an opportunity of discourse change (fieldnotes on FONA forum, 9.-11.9. 2013).[11]

In the final version of FONA, the BMBF states that research priorities were developed jointly with representatives of science, economy, policy and civil society. In contrast to this impression of a coproduction of policy relevant knowledge, the actual level of public influence was neither discussed during the forum, published on the FONA website, nor communicated in a follow up process with participants (BMBF 2015g and fieldnotes on FONA Forum, 9.-11.9. 2013). However, in an interview it became clear that final decisions remained in the ministry: "From the sum of different opinions voiced you paint your picture. What remains and what is extremely important for us, is that we decide about the structure of the programme ourselves within the BMBF." (PA11)

While superficially changing the process, the BMBF was not willing to transfer power – and the participants did not request of the ministry to do so. With knowledge and power being closely interlinked, it is not surprising that the format of the event structurally enhanced the previous line of policy and thereby contributed to a

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11 Participants of civil society organisations expressed the same disappointment in view of other participatory processes such as in the Forschungsforum Energiewende (Ober and Paulick-Thiel 2015)

reification and stabilisation of the past policy discourse. Even though upfront, the forum was intended to gather different perspectives through including a range of actors in decision-making, thereby reaching a higher degree of objectivity (interview with PA11), the doors to the discourse coalition remained locked. According to Arnstein's classic "ladder of participation", public consultations as observed here thereby mainly serve to maintain the status quo of the institution in power (Arnstein 1969). In addition, the BMBF also secured its power over the direction of the policy discourse through the separation of different policy levels. The public fora did not address any concrete funding initiatives. Even though the FONA fora theoretically enabled deviating discursive directions, the BMBF could rely on a safety net which ensured discourse continuation.

7.4   Power in discourse production

As analyzed in the previous sections, the interaction with different groups of actors has different functions for producing policies and stabilizing discourse in the BMBF. In addition, the interaction is coined by and further coins the distribution of power among the actors involved.

Non-cooperation in policy processes characterizes the relation between the Sustainability Subdepartment and those actors which potentially endanger its institutional position– or are perceived to do so. Access to the policy discourse coalition and related speaker positions remain inaccessible to these actors. In the past, other ministries as well as the BMBF's International Department have been excluded from formulating policy initiatives as well as strategic documents such as previous versions of FONA. On the other hand, certain actors are invited to join the coalition. It is worthwhile to shed some light on the discourse coalition as such, pointing out the underlying benefits of each party in joining the discourse coalition, thereby also reflecting on the concept of the discourse coalition as such.

As spelled out in more detail in chapter 3, a discourse coalition is composed of actors whose "statements can be attributed to the same discourse" (Keller 2013: 73). This definition certainly applies to the policy making context of the BMBF and explains why a certain policy direction is taken, continued and prevailing. The admission of speakers and discourse contents in a coalition follows the potential speakers' symbolic, social, financial or cultural capital (Keller 2011b).

While SKAD generally stresses the interlinkage of knowledge and power in discourse, stating that discourse structures are power structures (Keller 2011b), there is a theoretical blind spot in the definition of discourse coalitions which becomes apparent in the case of policy making considered here. In the description of discourse coalitions, no reference is made to any potential power imbalances within discourse coalitions. Which coalition member decides about the admission? Who decides

which knowledge is relevant? In the power constellation as present in the case of policy making for research cooperation with developing countries and emerging economies, as a head of the discourse coalition, the BMBF is the sole actor in power to admit or neglect other speakers and thereby discourse contents. At the same time, the BMBF is in power to take policy decisions; and further in power to distribute financial resources. The term of a discourse *coalition* might therefore be somewhat misleading, as it rather implies a horizontal relation between its members, veto power and consensus. While among other members of the discourse coalition struggles about definitions are likely to occur, the ministerial position within the coalition grants it the power over decisions and definitions at all stages.

In case of the circle of actors admitted into the BMBF policy process, this power relation is revealed in the selection of speakers into the coalition. Selection – by the BMBF as head of the circle – is not primarily based on the speakers' capital. I argue that it is rather based on the discourse's external effects. Thus, actors gather around a common story line while additionally, all members of the community have in common to benefit from maintaining their (institutional and personal) position and related power. While being able to draw on certain resources is a precondition for speaker selection – such as the scientific credentials of the scientific experts consulted – the BMBF admits speakers primarily based on their previous conformity with the discursive direction. The ministry even strengthens institutions which follow the same direction in order to later draw on the external expertise provided through it, as the example of the German Water Partnership (GWP) in Box 7-2 shows.

Box 7-2: The case of the German Water Partnership as example of constructing expertise and gatekeeping the discourse coalition

The institutionalisation of the German Water Partnership (GWP) epitomizes the relation of experts and policymakers in BMBF agenda setting and illustrates the social construction of expertise in policy making: The GWP is a tool of legitimizing policy decisions based on evidence that exactly suits the BMBF's previous discursive direction. As "central coordination and contact office of the German water sector serving foreign partners and clients" (German Water Partnership 2015), the GWP was established by BMBF and BMU in 2008. Its creation aimed to foster international technology transfer and export of water technologies from Germany by branding a common umbrella for diverse activities.

At the same time, the GWP was meant to provide policy advice to the BMBF:

"The Federal Government will develop the future concept of positioning Germany in the international water sector together with the GWP. The GWP will also serve as a strategic forum for future activities in the lead market water for BMU and BMBF. The

BMBF's concept development in view of a new demand-oriented approach to science policy will be discussed with the GWP and contribute to the future research strategy of the BMBF." (BMBF and BMU 2008a: 21–22, *own translation*)

With the GWP, the ministry thus fostered an institution in line with its objectives, financially supported the organisation and aimed to seek the same organisation's advice in designing later funding initiatives. This exemplifies how a specific direction of science policy discourse, in this case fostering technology-oriented water research – takes on a self-reinforcing dynamic on its own. The GWP fulfils a double function for the ministry. Through providing an encompassing institutional and discursive frame for different actors of the German water business as well as researchers, the BMBF strengthened the discourse coalition on technology- and export-oriented water research. At the same time, the GWP serves as external instance of legitimating policies through proving external evidence to back up policies. The GWP is both a speaker within the discourse coalition as well as part of the dispositive which structures and maintains the policy discourse.

Observing the power of the BMBF over admitting and selecting other speakers in policy making processes relativizes findings within constructivist science-policy interface literature, which argues that the direction of science policy emerges in social interaction with external actors and depends on who is involved, and which interests prevail (Ely et al. 2010; Leach et al. 2012). While I do not want to neglect interests or needs of external actors involved in the process, the case investigated here especially highlights that policy makers themselves are no neutral entities but follow specific discursive lines.

I argue that the route to an economy- and technology-oriented science policy discourse, which becomes manifest in high level strategies such as the High-Tech Strategy as well as in policy initiatives such as IWRM (ch. 8, 9), is taken long before external experts are included in the process. In this sense, external actors reinforce and actualize a pre-existing accepted discourse, rather than *introducing* it. Thus, as exemplified in case of the GWP as well as in the selection of other experts, it is not their access to a resourceful position that leads to their inclusion in the discourse coalition on policy making, but their support of the established discourse's direction.

As such, the strand of discourse in policy for cooperation with developing countries and emerging economies as manifest in the IWRM initiative – strengthening German science and business while solving problems (ch. 9) – did not necessarily emerge because external advisors as members of the discourse coalition managed to lobby for their interests and influence policy makers. In acting as a gatekeeper to the discourse coalition, the BMBF ensures that previous policy discourse is *stabilized*. The selection of experts that fit in to the prevailing mindset thereby con-

tributes to a reiteration of a pre-existing discourse, instead of a change of direction. The BMBF's powerful position to actively neglect or enable entrance to its *circle of kings* of a discourse coalition of different actors stretches the boundaries of the concept of discourse coalitions. While it thus might not be an idealtype discourse *coalition*, the instance of BMBF policy making can be interpreted as an illustration of the relation of power, discourse and knowledge. Arguing with Keller (2011) that discourse structures are power structures, the discourse coalition here is not only an instrument of maintaining power over the discursive direction, but of safeguarding the own institutional status quo. The BMBF manages to maintain its power in relation to the other actors involved not only in view of the discourse's contents – by re-enacting its own discursive assumptions ("Deutungsmacht") – but also in view of its institutional power.

This view does not necessarily contradict the position held in critical science policy literature, that external experts such as industry representatives are a powerful influence on agenda setting (such as Ober 2014) or that current directions of policy are the result of actor networks, as expressed by Sarewitz and Pielke who argue that the alignment of industry needs and policy "is not a result of serendipity, but of the development of networks that allow close and ongoing communication among the multiple sectors involved in technological innovation" (Sarewitz and Pielke Jr. 2007: 7). My argument rather shifts the focus to a different notion. Industry representatives as well as other experts involved in policy processes certainly try to influence the specific direction of science policy – as for example has been noted about the GWP, which interviewees have titled a lobby (interview with PP22).

However, in the specific instance of German science policy making, the ministry's power to include or exclude speakers in the coalition of agenda setting is decisive for maintaining or changing the direction of policy. As a further safeguard, external actors are only granted advisory roles, but no official decision-making power. As Hornidge (2007) argues in view of enquete commissions as advisors to the German federal government, the ministry maintains the final say about any policy programmes and initiatives.

7.5   A self-reinforcing equilibrium in science policy

While the apparent imbalance in the distribution of power between the ministry, project management agencies and the research community is notable, it is equally remarkable that only few researchers of those excluded from the discourse coalition openly contest the direction of policy or the underlying policy processes. For the BMBF itself as well as those members of the science community directly involved in the discourse community, the advantage of maintaining the current state of the

art in decision-making and institutional set up is obvious. The acceptance of the status quo by the rest of the research community, or at least their lacking resistance, might be attributed to two reasons.

On the one hand, despite of the unequal power distribution, meeting the interests of the research community indirectly plays a large role for the policy makers. While the ministry is in a powerful position to shape science policy, it is not independent of other social actors. The research community is not a servant to the BMBF as its master. Their relation is rather an interplay of checks and balances: There needs to be a congruence of discursive ideas of policy makers and scientists in order to create an equilibrium (ch. 10.3). The ministry needs to ensure that the policies meet the demands of the potential applicants from the scientific community. Not doing so might lead to unsuccessful funding initiatives in terms of application numbers or quality of research proposals. Unsuccessful policies (measured in not spending the foreseen budget) in turn may lead to budget cuts in the next financial period or to a political reorientation (Ober 2014).

The relation between the BMBF and the researchers is not as hierarchical as it may seem at first sight. It may rather be described as an *interdependency* than as a top down hierarchy. If the BMBF deviates too far from the interests of the research community or narrows down the scope of agency within funding initiatives too much, the equilibrium of supply and demand of research funds would collapse. It is therefore not surprising that the BMBF consults selected external actors in the process of designing new funding initiatives or strategic programmes. The needs of the target group for a future funding initiative are embedded within the policies by consulting relevant experts (interviews with PA02, PA11).

Beyond individual funding initiatives, the BMBF's general direction of policy discourse is shaped long before discussions about new policies begin: The BMBF's science policy discourse does not emerge out of the blue but reflects accepted norms and ideas. A broader social consensus in society, including the research community, precedes the policy discourse and its institutions, practices as well as the ideas (ch. 8). It is therefore safe to assume that a large part of the science community subscribes to the current direction of science policy. The BMBF's status and decision-making power depend on the acceptance of the current status quo of large parts of the research community.

On the other hand, and whether employed as a conscious strategy or not, the present institutional arrangement, including the unequal distribution of power, stabilizes the current policy discourse, excludes alternative discourse and thus leads to a repetition of discursive contents and the conservation of the status quo. Open contestation and criticism are curbed by the fact that employees of the project management agencies as well as those members of the research community interested in BMBF funding depend on the BMBF financially, either in form of current and future third-party funding or through job contracts.

Observations of the FONA-Forum in 2013 illustrate the research community's reluctance to contest policies openly. Participants felt insecure how the BMBF staff would react if they openly criticized directions of policy. In informal conversations, during breaks, they dared to share criticism about the main discourse on sustainability science policy. In the public events, however, participants did not challenge the overall direction of FONA, thereby giving even more room to actors and opinions in line with the proposed direction. The perceived dependencies on the ministry led to self-censorship (fieldnotes on FONA Forum, 09.-11.09.13).

In a longer term, this has narrowing effects for the direction of policy. With the ministry being in power over the policy direction and the allocation of funding and on the background of the institutional dependence of actors such as the project management agencies and the scientific experts consulted, discourse coalitions turn into a self-re-enacting system. In the policy setting as such, actors included within the discourse coalition are unlikely to act as change agents, as all of them benefit from the current status quo. Being involved in the coalition grants insights into knowledge on future funding (in case of scientific experts and other stakeholders) and is key to further employment (in case of the project management agencies).

Under the constellations as such, even in so-called open agenda processes such as the FONA Fora, the general direction of the policy discourse is stabilized, while at the same time stabilizing the institutional status quo of all actors involved in speaker positions. The order of knowledge and the order of the external actors involved in knowledge generation is repeated rather than challenged.

Nevertheless, the BMBF's policy discourse is *not* a rigid frame. Niches exist for internal change agents to use spaces of agency within the ministry (ch. 6). Discursive change of the official policy discourse then is not inspired by direct confrontation with bearers of alternative discursive stances but is rather mediated through individual change agents within the ministry – who act as *early adopters* of an innovative policy idea, introduce new discourses and dare to institutionalize these in new strategies, programmes or funding initiatives, often in niches at first. Examples include the sustainability concept (ch. 8) or newer policy initiatives for international cooperation in the Sustainability Subdepartment, like the Megacities Initiatives or the African RSSCs, which deviated from the general orientation of science policy and produced shifts in the underlying rationale (ch. 6). At the same time, the process of transmitting policy objectives to the real world via funded research projects bears further opportunities of adapting and reinterpreting the policy discourse according to alternative discourse ideas under the radar of official instances of policy discourse actualisation. Projects funded in both the Megacities as well as the IWRM funding initiatives used the rooms for agency in adapting policy expectations. While one the one hand, these instances of actualizing the main policy discourse may be portrayed as a subversion, on the other hand, the room for

deviation from the main discourse on a smaller scale also contributes to its stability (ch. 10.3).

8   The heart of German science policy – and its green lungs

According to SKAD, the *context* of a specific discourse plays an important role as background of the production of statements and practices (Keller 2013). In view of the specific policy discourse on cooperation with developing countries and emerging economies in sustainability research, taking the context into account means to analyze it in its relation to other policy discourses within the BMBF. These can be explained as a *historical a priori*, the *conditions of possibility* (Foucault 1972a) for the specific discourse on cooperation with developing countries and emerging economies, and in turn can be set into relation to broadly accepted public discourses. In this chapter I therefore present what I perceive as *legitimating* concepts of science policy in general. I argue that the concept of *economic prosperity through innovation* functions as an overarching frame, guiding discourse or core belief of the BMBF, which is embedded in a dispositive, thus turning into the ministry's institutional and structural backbone. This *leitmotif* of science policy provides the deeper motivation and rationale for the ministry's thematic and crosscutting ideas and strategies, including sustainability research as well as cooperation with developing countries and emerging economies. The discourse on sustainability serves as an additional overall frame of specific policy fields of the BMBF. The uptake of the sustainability within science policy exemplifies how external public discourses may trigger new developments in policy making, on the one hand. On the other hand, it also illustrates how external discourses are adapted and reinterpreted to suit the own needs. In the last section of this chapter, I show how the BMBF's core discourse is related to the specific discourse on cooperation with developing countries and emerging economies. Chapter 8 thus provides a backdrop for chapter 9, which centres on Megacities and IWRM funding initiatives as concretisation of the BMBF's policy discourse. Both chapters deal with different, but related elements of policy *contents*. In establishing different categories, or types of discourse elements, I resort to the ideas of a phenomenological analysis as suggested by Keller (2005; 2013).

8.1   The heart and soul of science policy

8.1.1   Primal motivations and historical a priori

In order to understand why a discourse evolves into one direction and not the other, hence, to explain why it is what it is, it is crucial to consider the larger context, i.e. the surrounding discourses in which it is produced and reproduced (Hajer 2003a; Keeley and Scoones 2003; Keller 2013). Transferred to the case of BMBF science policy for cooperation with developing countries and emerging economies in sustainability research, this means scrutinizing the institutional structures of the BMBF as a dispositive, as well as the larger political context and historical background of the BMBF as a context. Both dispositive and context are highly relevant to understand the current organisation, direction and political discourse.

I argue that the concept of *economic prosperity for Germany* is the *leitmotif* and core of the BMBF's policies. In a self-description, the ministry argues that "[e]ducation and research are the foundations for our future. The promotion of education, science and research by the Federal Ministry of Education and Research represents an important contribution to securing our country's prosperity." (BMBF 2015a)

The BMBF accordingly conceptualizes research as a means to reach this objective. Technology, applied research and innovation turn into *modal concepts* to achieve the goal of prosperity. This objective lies at the heart of the BMBF since its initial days, when the predecessors of the ministry started to fund applied research by arguing that it was economically relevant for the reconstruction of post-World War Germany (Lengwiler 2010). Consequently, a focus on applied research funding as well as on technological research permeates most BMBF programmes. In the last decades, *innovation* has been added to this row of modal concepts which the BMBF relies on as a means of reaching its primary objectives.

The BMBF's dominant focus on technological innovation and applied research is deeply embedded in the ministry's DNA. As an interviewee spelled out, "[y]ou have to keep in mind the BMBF's role and history. It is a Nuclear Ministry! Then space, water, big stuff" (PA12). Although characteristic for its current orientation, the ministry's concentration on applied research evolved somewhat contingently. In the new governmental set up after the Second World War, the German federal government was left with only few competencies of science and education policy; both science as well as education were responsibility of the *Bundesländer* in the newly established democracy. In order not to lose all stakes in science and education, the federal government seized the niche of funding applied research, which had been left empty by other actors (Lengwiler 2010). In focussing on applied research, the ministry thus made a virtue out of a necessity.

The BMBF of today emerged from several predecessors with different names and slightly different organisational set ups and responsibilities. The first in a row

of ministerial ancestors was the Federal Ministry of Atomic Issues (*Bundesministerium für Atomfragen*), which was founded in 1955 in order to promote the civil use of nuclear power. In 1962, this ministry was renamed as Federal Ministry of Scientific Research (*Bundesministerium für wissenschaftliche Forschung*). Its scope was extended to cover general science funding, aerospace technologies, and large-scale research such as military research and nuclear power. This direction of science policy was legitimized by drawing on discourses of economic wellbeing and closing a technological gap between Germany and the US. As of the late 1960s, German national science policy began to pursue an internationally competitive and specifically German research profile. The funding portfolio therefore diversified, now including areas of innovative high technologies, such as biotechnology or information and communication technologies. In parallel, legitimized by drawing on a discourse of contributing to a higher quality of life through research, research areas such as environmental or health research and a first programme for applied social research were introduced as funding priorities. In 1969, the Federal Ministry of Scientific Research was renamed again, from now on titled Federal Ministry of Education and Science (*Bundesministerium für Bildung und Wissenschaft*). In parallel, the Federal Ministry of Research and Technology (*Bundesministerium für Forschung und Technologie*) was founded in 1972 to promote basic and applied research and technological development in fields such as aerospace technologies, transport, environment and energy, information and communication technologies, biotechnology and health research. Due to the economic depression and energy crisis in the mid-1970s, science policy objectives shifted towards ensuring energy supply and economic innovation through key technologies. Meanwhile, and not surprisingly, the two ministries competed in view of their competencies and responsibilities before they merged into a joint Federal Ministry of Education and Research in 1994 (Stucke 1993; Lengwiler 2010; BMBF and Indian Department of Science and Technology 2011; BMBF 2014r).

The overview of the historical background is given to make a specific point: The core discourse of the current ministry, its leitmotif, as well as the corresponding institutional shape with its strong thematic departments (ch. 5, 7) mirrors the traditional institutional focus on applied sciences, technologies and large-scale science infrastructures. These have persisted as the BMBF's core despite of changing political leadership.

Remaining within traditional pathways is typical for a political ministry: Policy often makes use of historically grown arguments and discursive patterns. Current discourses are often influenced by pre-existing historical ones which contain knowledge of how similar phenomena were dealt with in the past (Hajer 1993; 2003a). The history of BMBF topics clearly backs up Hajer's argument, as the ministry's prevailing focus on technological development is deeply rooted in its tradition. At the same time, this general leitmotif of the BMBF is also strongly institu-

tionalized in its current shape and permeates specialized science policy discourses. This is true for the direction of policies for sustainability research as well as for co-operation with developing countries and emerging economies.

Nevertheless, the uptake of new discourses, as in case of *sustainability*, shows that the core discourse does not coin BMBF thinking and action in a totalizing way. Chapter 8.2 unravels how the public discourse on sustainability slowly trickled into the BMBF, underwent a process of reinterpretation and turned into the main concept for guiding actions of the Sustainability Subdepartment.

8.1.2   Innovation at the centre of science policy

While the leitmotif of economic prosperity through research, technology and innovation inspires the entirety of the BMBF's policies, they are most palpable in the High-tech Strategy, which encapsulates this leitmotif and serves as a container of related ideas. The High-tech Strategy condenses BMBF core thinking and epitomizes the overarching frame of the BMBF's policies. Designed under BMBF lead, the High-tech Strategy is a strategic frame for the entire German government (BMBF 2014c). The initial strategy, termed *Igniting Ideas. High-tech Strategy for Germany* was issued in 2006, with updates following in 2010 (*Ideas. Innovation. Prosperity. High-Tech Strategy 2020 for Germany*) and 2014 (*New High-tech Strategy. Innovations for Germany*) (BMBF 2006; 2010c; Bundesregierung 2014). In all its editions, the High-tech Strategy at its core has been directed at "strengthening Germany's competitiveness as an economic centre" (Bundesregierung 2014: 20). In order to reach this goal, a line of causality is established between funding research and innovation and economic wellbeing. In consequence, the strategy is aimed at fostering types of innovations that are beneficial for the economy based on the argument that "innovative solutions are the factors that drive our prosperity and support our quality of life. They strengthen Germany's position as a leading industrial and exporting nation. And they make it possible to find creative answers to the urgent challenges of our time" (Bundesregierung 2014: 3). The same equation of research, innovation and wellbeing is prominently exhibited in the past High-tech Strategy's title of Ideas. Innovation. Prosperity (BMBF 2010c).

The strategy is thus aimed at promoting innovative technical solutions, as these are considered as a driver of economic growth. In addition to strengthening the German economy and its competitiveness on a global scale, the strategy shall also help to solve national and global challenges. To do so, in its different versions, the High-tech Strategy defines a number of key priorities of innovation, among them

health and nutrition, mobility, energy and climate, communication, and security.[1] The strategy aims to strengthen innovation capacities in the different thematic areas through crosscutting actions and measures across all federal ministries: It wants to contribute to a positive "innovation climate" (BMBF 2010c: 9) for companies, thereby improving the overall conditions of innovation through a bundle of measures ranging from legal to financial frameworks; it strives for a competitive innovation-based industry and encourages stronger interactions between industry and academia as well as between basic and applied research, for example through supporting cluster initiatives.

The High-tech Strategy illustrates that the BMBF does not derive its main purpose and mandate from stressing the value of science as such, but from the links established between science and economic wellbeing. In doing so, the BMBF draws on external discourses that are widely accepted in today's society, such as the capitalist, growth-oriented market system.

The core discourse of science policy thus is based on establishing a causality between technology, applied research, innovation and economic growth, which in turn is portrayed to equal overall German well-being, which is reduced to economic aspects. The ministry thereby chooses a legitimation *beyond* research. This legitimation underlies its general direction and mandate (BMBF 2013e). I argue that this idea is perceived as so strong that it provides the ministry's *raison d'etre*. What could be considered as a basic mandate of a science ministry – to foster science – is thereby put into the broader context of *economic prosperity,* which links research to the underlying ideas of an economy-driven capitalist society. While the principle of a market economy is not prescribed in the German constitution, it is a vastly accepted social norm (Papier 2007) and as such rather taken as a fact than as a social construct. Drawing on this permeating public discourse, the BMBF thus conceptualizes science, research and innovation in view of their economic function, measuring its value in terms of rentability and commercial usability (Hornidge 2007). I argue that other concepts central to BMBF policies, such as *innovation* and *sustainability*, are conceptualized in a way congruent to this leitmotif. As chapter 8.3 will show, these core values, although not originally intended to provide a frame for international cooperation, nevertheless also influence it substantially.

While first concepts of innovation surged in the early 20th century (ch. 2), it was not pivotal for science, technology or other economy-targeted policies until the 1970s. Until then, German (economic) policies had focused on large industries, which were considered to have the largest potential for economic development,

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1 In the newest version of the High-tech Strategy, the innovative workplace is introduced as an additional topic and communication with / participation of civil society actors in innovation processes and policy definition is encouraged (Bundesregierung 2014).

creating jobs and overcoming regional structural weaknesses. Increasing productivity of existing industrial branches through improving existing technology lay at the core of policies. The focus on technological innovation surged with the economic crisis of the 1970s, which was perceived as a structural problem. As such, the OECD detected a technological gap in Europe as an underlying cause of economic problems. Thus, as of the mid-1970s, technological process and product innovation was promoted as a source of economic prosperity in times of economic restructuration. Policies began to target the development of new markets instead of increasing productivity in old branches. Instead of large industries, SME (small and medium enterprises) were focussed in view of their economic innovation potential. To foster innovation, policies were to enhance the transfer of innovative technologies from public research to business. In doing so, knowledge was conceptualized as a factor of economic productivity next to human labour and economic capital (Hofmann 1993).

Today, innovation is the silver bullet of reaching the objectives of German science policy:

> "Innovations are the key to growth, employment, prosperity and quality of life. [...] innovations, small and large, can change the world for the benefit of people. Scientific breakthroughs and innovative solutions create opportunities to harmoniously combine a) dynamic economic growth and social cohesion and b) efforts to protect natural resources and to respect the carrying capacity of ecosystems." (Bundesregierung 2014: 9)

While innovation has been conceptualized from different angles in different contexts, including social or non-economic types of innovation (ch. 2.4), the BMBF understands innovations as "new or significantly improved products or services that have been introduced to the market (product innovations) and new or improved production or delivery methods (process innovations)" (BMBF 2016c). The BMBF's innovation concept is narrowly focused on commercial products, services and economically usable processes. In the ministry's conceptualisation, there seem to be no alternatives to this type of innovation as a way forward to reaching economic prosperity (Stirling 2008; 2009). Given the status that the BMBF commonly attributes to innovation, the term seems to have turned from an originally modal concept, a means of reaching a larger objective, into an objective of its own. Innovation has been so often conceptualized as a way towards wellbeing, that the term itself has started to represent a desirable objective.

Different types of innovation, such as low-tech innovation or social innovation, which are not based on economically viable innovations, are not put up for discussion. The latest High-tech Strategy mentions to use an "expanded concept of innovation that includes not only technological innovation but also social innovation – and that includes society as a central player" (Bundesregierung 2014:

4). However, social innovation is rather pictured as a *part* of economic innovation, which contributes to its economic success, rather than as an *alternative* or *additional* innovation concept:

> "Innovations result from the interplay between societal demand, scientific development and technological possibilities. If Germany's innovation strength is to be increased, both government and entrepreneurs need to invest in research, and all parties involved in innovation activities need to help shape innovation processes. The society needs to become involved in these areas even more extensively than has been the case to date. Only when all stakeholders participate can desirable and accepted technologies and internet content be integrated within everyday life. With such participation, research findings can enter more rapidly into the practical sphere and be effective there – i.e. ideas can quickly turn into innovations. The key to intensifying participation by all stakeholders – including the science and industry sectors and the general public – is to transparently document and present research and innovation funding. Transparency facilitates dialogue, promotes balanced consideration of opportunities and challenges and fosters openness to new things." (Bundesregierung 2014: 44)

The long quote illustrates that the role foreseen for social innovation is to support economic innovation. In the BMBF's view, social innovation equals stakeholder participation in the innovation process, which ensures the uptake of (technical) innovations in society. Thus, this conceptualisation of innovation heavily relies on the economic benefit of the producer of an innovation. While the innovation as such may potentially contribute to improving any area of life, the pathway of impact is per BMBF definition market-based. The quote also is an example of the appropriation of external discourses and terms into science policy. Terms and discourses such as social innovation, stakeholder participation or sustainable growth, which originally coined alternative discourses, are taken up and integrated into BMBF discourse. In this appropriation, a reshaping takes place. Using terms that superficially accommodate critics enlarges the room for a continuation of practices in line with the ministerial leitmotif below the surface.

8.1.3   Hightech and innovation discourse as ordering concept

The discourse of science, technology and innovation directed at economic benefits that underlies the High-tech Strategy is highly influential across all BMBF departments. Next to shaping thinking and the policy orientation, it is also embedded structurally. The core discourse is thus institutionally anchored in a strong dispositive. Except for those departments that are dealing with the structure of the German science system, the entire BMBF's funding activities in the thematic departments as well as the International Department are aligned with the High-tech

Strategy's objectives. While the High-tech Strategy does not have specific funds in form of specific funding programmes assigned to its implementation, the impact of the economic innovation discourse is actually much deeper: The entire ministry is organized according to the objectives of the High-tech Strategy on a crosscutting structural level. Most – if not all – existing funding activities are subsumed under the High-tech Strategy's umbrella. Accordingly, the overall BMBF funding is aimed at fulfilling the High-tech Strategy's objectives; this can be traced in the official governmental budgetary planning for the BMBF, which is ordered according to the High-tech Strategy and organizes all different funding activities in its frame (Bundesregierung 2012a). As funding initiatives emerge within the organisational structure of departments and working units of the ministry (ch. 6), the overall BMBF discourse thereby permeates into all thematic as well as crosscutting science policy discourses such as those on cooperation and sustainability.

In addition to the structural impact on the organisation of funding, the discourse underlying the High-tech Strategy possesses ideational authority within the BMBF. The core thinking presets the potential pathways that further policies can potentially follow, thus functioning as a historical a priori which both enables as well as delimits the development of subdiscourses in science policy. This becomes clear in its impact on further funding strategies and their underlying ideas. Although the BMBF's leitmotif is most plainly and transparently exhibited in statements on the general direction of science policy, such as in the High-tech Strategy, it nevertheless pervades all further specialized discourses of science policy, such as those bundled in thematic and crosscutting strategies.

8.2   The green lungs: Sustainability as a new discourse in science policy

The perpetuation of a science policy based on technological and applied research targeting economic wellbeing illustrates the point of self-reinforcing ideas and structures in discourse. In contrast, new concepts may still be taken up. This exemplifies that the interplay between the discourse's idea and the structures that carry it, its dispositive, does not necessarily lead to a lock-in or an unchangeable system. The introduction of sustainability as a novel concept in science policy demonstrates this point. As a discursive frame of policy for cooperation with developing countries and emerging economies, sustainability is gaining increasing importance.

8.2.1   Environmental research as a starting point

The BMBF's conception of sustainability still is strongly based on the environmental dimension, which surged as a new topic in science policy in the 1980s, in close connection to the discursive context of its time. While the predecessors of the BMBF

had started to include environmental research in their portfolios sporadically in the late 1960s, as off the 1970s and 1980s public debates were increasingly coined by environmental consciousness, culminating in public reflections of discourses such as on *Waldsterben*, acid rain, and risks of nuclear power (Weingart 2006). Environmental problems and their reflection in the uprising public environmental discourse led to institutional changes at larger scale within the German government. As such, the Federal Environmental Agency (*Umweltbundesamt*) was founded in 1974. The environment increasingly turned into a political issue, which lead to the creation of the German Green Party in 1980, bundling several grass roots initiatives and alternative political groupings. Finally, as a first ministry for environmental issues, the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU) came into being in 1986 in order to politically cope with the nuclear disaster which had occurred in Chernobyl, Ukraine, in the same year (Weingart 2006).

Mirroring the public and political discourse, the BMFT, ministry responsible for research at the time, slowly extended its scope of research funding to a broader spectrum of environmental concerns (PA12). While the first research funding initiatives for environmental protection were disconnected and incoherent (Weingart 2006), the support became more strategic when BMFT funding was aligned to a national strategy on environmental research and environmental technology development in 1984 (BMFT 1990).

New global ecological developments found their way into science policy via public discourse. While anthropogenic influence on the earth system had been dealt with scientifically since the 1970s, it only entered the public arena in the early 1980s, with related conceptualisations such as the depletion of the ozone layer, the greenhouse effect, and climate change. Increasingly recognizing the scope and importance of the problem, the Intergovernmental Panel on Climate Change (IPCC) was funded in 1988 (Weingart 2006), while nationally, the BMFT issued a research programme for ozone research in the same year (BMFT 1988). A funding priority on the greenhouse effect followed in 1989 (BMFT 1989). Expenditures on climate related research of the BMFT dramatically increased from 3.6 million Deutsche Mark (equivalent to app. EUR 1.8 million) in 1982 to 220 million Deutsche Mark (equivalent to app. EUR 110 million) in 1991 (Weingart 2006: 277).

Next to climate research, the Programme for Environmental Research and Environmental Technologies 1989-94 (BMFT 1990) sought to foster environmental research on human impacts on the environment, environmental stress, and remediation of environmental damages. This was legitimized by the picturing responsible environmental policy as a part of (infra-)structural policies of the future (BMFT

1990).[2] Starting in the mid-1990s, with the Research Programme for the Environment, the focus began to change from maintenance and remediation research towards preventive environmental research (BMBF and BMU 2008a), a fact that can be linked to the emerging global sustainability discourse.

8.2.2   Sustainability enters science policy

In the 1990s, the concept of sustainable development entered science policy as a novel idea, which interlinked aspects of environmental, social and economic development within a systemic approach (ch. 2). In view of its impact on science, the Agenda 21 following the UNCED conference in Rio in 1992, was especially relevant for a shift towards a concept a preventive science for sustainable development. The Agenda 21 emphasized the "role and the use of the sciences in supporting the prudent management of the environment and development for the daily survival and future development of humanity" (UNCED 1992b 35.1). At the same time, it stressed the importance of scientific inputs as a basis of political decision-making on issues of sustainable development (UNCED 1992b: 31.1).

Next to the surging international discourse on sustainability manifesting itself in the Agenda 21 as well as other international treaties following the Earth Summit, sustainability discourse began to institutionalize itself in strategies on the European and national level. The European Commission issued an influential white paper on Growth, Competitiveness and Employment in 1993, which included a section on a new, sustainable, development model (European Commission 1993). A former BMBF staff pointed at the importance of this paper for science policy: "This gave us a push, because it spelled out what sustainable development meant for science policy, namely the pursuit of an alternative development path. That's what it is about! It started in 1993, and from then on spread out a little bit." (PA12)

The BMBF's forerunner, the BMFT, followed the European Union's footsteps and took up sustainability as a policy concept. As of the early 1990s, the ministry specifically related to sustainability in its research programmes. The Forschungsrahmenkonzeption Globale Umweltveränderungen 1992-1995 (BMFT 1992) referred to sustainable development as defined in the Brundtland report as a guiding concept, stressed the socio-ecological aspects of environmental problems and their global dimensions. In consequence, first interdisciplinary funding priorities like SHIFT ("Studies of Human Impact on Forests and Floodplains in the Tropics") emerged for cooperation with Latin American countries (BMFT 1992).

After the national elections in 1998, change in political leadership from the conservative Christian Democratic Party (CDU) to the Social Democrats (SPD) further

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2 The programme was rather focussed on dealing with pollution through technological research, and, as later programmes, asked for a market-based application of the results though SMEs.

strengthened sustainability as a politically relevant discourse across political scales. On the national German level, a governmental commission was set up in order to discuss sustainability and the protection of people and environment, the Enquete-Kommission des Deutschen Bundestages "Schutz des Menschen und der Umwelt" (13. Deutscher Bundestag 1998). In 2001, the European Union issued a sustainability strategy; Germany followed with a national sustainability strategy in 2002, drawing on international treaties following the UNCED Rio process (Bundesregierung 2012b).

With instances of national and international recognition and institutionalisation, the international public and policy discourse on sustainability became powerful enough to motivate even the previously conservative political parties to use the political opportunities and become part of the discourse coalition on sustainability – jumping on the sustainability bandwagon (interview with PA14). In the early 2000s, the minister then in charge of science and education, Edelgard Bulmahn (SPD), established a working group for sustainability research within the ministry. The group started discussions on a research programme for sustainability, which later became FONA (interviews with PA04, PA14). By issuing FONA in 2005, the BMBF turned into a visible speaker within the discourse community on sustainability, while at the same time responding to demands for action arising from both international as well as national conventions and strategies in which the rising discourse of sustainability had cumulated. As such, FONA became part of the national sustainability strategy of the German government, which obliged different governmental departments to contribute (interviews with PA04, PA12, PA14).

SKAD explains the relation between discourse and its dispositive as a mutual influence of ideas and corresponding structures, which are self-reinforcing. The emergence of environmental research as a topic of science policy and the subsequent development of FONA, framed as by sustainability discourse, exemplify how a new (sub)discourse establishes itself and later on is reproduced through dispositive and practices. Since the introduction of the sustainability concept into BMBF funding and the first edition of FONA, institutional structures have been built in the responsible Sustainability Subdepartment: a dispositive with FONA as corresponding programme, and administrative structures that guide further developments:

> "If you compare FONA2 and the organisational structure of the ministry, you notice quickly that it is a continuation of the previous programme. No paradigm change occurred based on insights during the first five years. The programme is a continuation of the status quo of the first programme period. Five or six units were responsible for FONA, had their own insights and developed an own handwriting. FONA2 adds up what the five existing units of the subdepartments were doing." (PA14)

In conclusion, the uptake of sustainability as a concept within the BMBF and more specifically with FONA as an accompanying funding programme was inspired by the external discourse on sustainability. A combination of multiple factors helped the new sustainability discourse in becoming the dominant paradigm in environmental research funding, culminating in the emergence of FONA: The rise of sustainability as a concept in international public debates; changing public perceptions and rising demands for political action which were taken up by policy makers; a change in political leadership within the BMBF. In centring funding on sustainability as a *leitmotif*, the Sustainability Subdepartment drew on a politically opportune idea which had already begun to institutionalize itself in public discourse as well as in international politics, such as in corresponding international agreements and in public discourse. As an encompassing concept, sustainability also provided a coherent frame for previously scattered BMBF activities, which was an added benefit in view of legitimation and external visibility (interview with PA04).

Nevertheless, interviewees also emphasize the important role of individual actors. Both external actors as well as actors from within the BMBF acted as change agents. As supporters of the sustainability discourse, they were able to form a discourse coalition on sustainability and thereby act as game changers: "In that phase of Brundtland and Rio there were some young people in the government who thought in that direction. Within a whole movement, individual people are important to move topics." (PA12) The quote enhances the notion of the duality of structure and agency underlying discourse as conceptualized in SKAD. Without the bearers of a discourse who have agency and act as change agents, a new discourse will hardly be successful in institutionalizing itself.

8.2.3   Sustainability in FONA: Reinterpretations of a concept along economic criteria

In contrast to the BMBF's leitmotif of high-tech and innovation, the idea of sustainability is not an influential idea throughout the BMBF. While it serves as an overarching concept for the funding activities of the Sustainability Subdepartment, sustainability cannot be considered as a comparable core value or guiding discourse of overall BMBF policies.

The BMBF's economy-oriented core discourse influences the ministry's conception of sustainability. It thus is a strong stimulus for the actualisation and reinterpretation of the sustainability discourse. As such, ideas incorporated in the High-tech Strategy are integrated in FONA. Since its first version in 2005, FONA portrayed "sustainability as an economic and innovation factor" (BMBF 2005a: 6). While the first edition of FONA (2005) evolved in parallel to and independent of the first High-tech Strategy (2006) (interview with PA14), as of its second edition FONA was explicitly set into relation with the High-tech Strategy's goals. The BMBF

claimed that FONA "implements the High-Tech Strategy in the field of 'Climate Protection/Energy'" (BMBF 2009a: 5–6).

The overall orientation of the BMBF towards technological development and economic growth thus turned into the fundament of the ministry's endeavours even in fields such as sustainability. The congruence of FONA and the High-Tech Strategy's objectives is not surprising from a SKAD standpoint. The core values of the BMBF trickle into all specialized science policy discourses.

There is no standard definition of sustainability or sustainable development – and no standard or commonly accepted way of achieving it. As in any discourse, different definitions coexist, covering a range of more radical concepts calling for radical changes in economic and social systems, towards ones that do not question current ways of consumption etc quote. It is a matter of power and of resources which definition is successfully established in policies and public (ch. 2.3; Voß et al. 2006; Voß 2013). In FONA, a politically suitable definition of sustainability developed. In SKAD terms, the discourse on sustainability was renewed and adapted within the BMBF in order to fit its leitmotif. Members of the working group that developed the first concepts for FONA point out that the initial draft of FONA and its underlying concept of sustainability had been much more radical in scope and that pursuing its objectives would have required institutional changes at a larger scale:

> "The result of the working group was that in order to reach a sustainable future for mankind and the earth, science, policy and funding would need to be redirected towards finding solutions quickly. However, this would have meant to reorganize the BMBF and redirect its policy as well. The report was never really considered and disappeared from the agenda." (PA14)

Pursuing a different discursive direction by developing policies for solution-oriented, non-technological research could have served to distinguish the BMBF from the Federal Ministry of Economic Affairs and Energy (BMWi), to which the BMBF lost its official responsibility for technology in 1998 (BMWi 2015). However, the BMBF did not let go of its general direction of an innovation-driven science policy oriented towards economic well-being, embedded in a dispositive of organisational shape, practices and prevalent ideas. The alternative discourse, built on the argumentation of orienting science policy towards the socio-ecological objectives of sustainable development, was not successful in establishing itself as the main objective of science policy, as interviewees remember (interview with PA14).[3]

Instead of undergoing the risk of an institutional re-orientation, the BMBF adapted the sustainability concept in order to suit its core discourse. Taking up, adjusting and interpreting the sustainability concept according to the own needs

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3 However, the ideas remained alive within alternative discourse coalitions (ch. 7, Box 7-1).

was politically useful in different ways. Sustainability provided a coherent umbrella for previously isolated bits and pieces of funding in the field of environmental sciences. Rather than bringing radical conceptual changes, the sustainability discourse thereby provided a new frame for old problems. Striving for sustainability as an overarching concept legitimized funding and made activities more visible, while at the same time, the general direction of policy and funding did not have to change substantially in order to fulfil national and international obligations towards sustainability (interviews with PA04, PA12, PA14).

The High-tech Strategy and its underlying discourse of a science policy aimed at fostering an innovation and technology-driven German economy remain pivotal for the policy discourse on sustainability expressed in FONA. Economic wellbeing and growth through technology development are put into the centre of the BMBF's sustainability concept:

> "The concept of sustainable development is becoming an increasingly important economic factor. The High-Tech Strategy for Germany initiated by the Federal Government meets the global challenges. Protection of climate and resources has priority. Here, decisive key issues of the future are identified which lay the foundation for a competitive knowledge society." (BMBF 2009a: 5)

Aspects of sustainable development, such as climate protection, are thus not considered as a value as such, but as an instrument towards economic prosperity. As such, it is not surprising that the New High-tech Strategy (Bundesregierung 2014) explicitly includes Sustainable Economy and Energy as a priority field of action. A similar idea is expressed in the next statement, taken from the BMBF website:

> "With FONA, the national sustainability strategy and the new High-tech Strategy are put into practice. The objective is to strengthen Germany's position as a technological leader in the areas of climate protection and adaptation to climate change, sustainable resources management, and innovative environmental and energy technologies." (BMBF 2016d, *own translation*)

The quote illustrates that not only sustainability as such, but its potentials for German economic development are major motivations of FONA.

In contrast to the BMBF's conception, many scholars argue that sustainability in all its dimensions is not to be achieved without questioning the supremacy of economic growth, and thus perceive the combination of sustainability and economy-oriented innovation thinking as a paradox (ch. 2.3.2; among others Unmüßig et al. 2012; Martínez-Alier et al. 2010; Brand 2012; Göpel 2016). Based on similar arguments, within the German sustainability research community, researchers positioned themselves critically in view of future research topics for sustainability research and questioned the BMBF's stance on economic growth and sustainability (Grießhammer et al. 2012). The Sustainability Subdepartment seems to be aware

of the criticism but maintains its discourse on green growth, coupling economic growth and sustainability:

> "It is correct that applied research is closely oriented towards economically viable innovations. In my opinion it is wrong to criticize the focus on technological research, however. Rather, the economy-relevant topics should be directed towards sustainability. We have to prioritize transformation research in this area. We will only reach the guiding principle of sustainable prosperity with the economy, not by setting boundaries to it. That's why we feel so strongly about the connection of sustainability issues with economic innovation. We need the humanities for that, but civil society as well." (Huthmacher 2013, *own translation*)

The idea of a green economy is sustained as a basic assumption and objective throughout the most recent edition of FONA as well:

> „By fostering a closer collaboration between science and industry, FONA3 aims to support the Federal Government's recently declared objective in the HighTech Strategy of a green economy, which seeks to sever the link between economic growth and the use of resources." (BMBF 2015b: 7)

While FONA3 proposes to scientifically reflect on notions such as societal wellbeing, and thereby acknowledges the room for interpretation, the possibility of green growth and along with it the objective of FONA as such is not put up for debate or scientific analysis. *Qualitative growth* is introduced as a new related concept in order to explain how to reconcile economy and sustainability: "The goal of a green economy is the transition to sustainable business management, with practices that conserve natural resources and mitigate negative environmental effects, thereby facilitating qualitative growth." (BMBF 2015e: 10) The definition does not go into the details of what exactly *quality* signifies in view of growth, which per definition is a quantitative concept. Head of department Huthmacher, in a parliamentarian expert debate, made use of a similar line of argumentation: "A few words about the concept of sustainability. Maybe our definition is not state of the art. Qualitative prosperity and growth is now at the center of our self-perception, and it is part of and fed back to the High-tech Strategy." (17. Deutscher Bundestag 2012b)

Unfortunately, Huthmacher did not elaborate upon the concept of *qualitative growth* in this instance of discourse actualisation, either. It remains open how qualitative growth is to be achieved and how to distinguish it from quantitative growth. I'd like to argue that the introduction of well-sounding concepts such as qualitative growth is a strategy of discourse reproduction and legitimation. It preserves the BMBF's course of policies and actions in withdrawing from direct critique. *Empty signifiers* accomplish to pacify critics, while maintaining the status quo behind the façade.

8.3   Translating the discursive leitmotif into discourses of international cooperation and sustainability

As has become clear in chapter 8.1, the core ideas of German science policy, which crystallize in the High-Tech Strategy, guide the BMBF in its main discursive direction and structurally organize the entire ministry's flow of funds. No other strategy – and no other policy discourse expressing itself in a BMBF strategy – has a comparable degree of impact.

Neither FONA nor Internationalisation Strategy nor the International Cooperation Action Plan are completely subsumed under the High-tech Strategy; they exist as documents on their own. However, they are coherent with the High-tech Strategy's objectives. The Action Plan even explicitly states that it will "develop the instruments of the High-Tech Strategy to make them internationally compatible in order to strengthen Germany as a centre of innovation" (BMBF 2014d: 4).

The High-tech Strategy does not discuss international cooperation extensively but mentions it in relation to its function. International cooperation is considered as necessary because "developing competitive products and opening up new markets requires global cooperation" (BMBF 2010c: 9). Although not especially dedicated to fostering international cooperation in science, technology or innovation, the BMBF's core values as bundled in the High-tech Strategy influence all further discourses on science policy. In view of cooperation with developing countries and emerging economies in sustainability research, this means that even though the High-tech Strategy itself is not primarily targeted at either sustainability research nor international cooperation, it nevertheless shapes the larger policy discourse which presets the discursive orientation for research cooperation with developing countries and emerging economies in sustainability.

In contrast, and despite of the encompassing nature of sustainability in its broad definition, as a programme for sustainability research FONA is *not* a cross-cutting strategy for the entire BMBF. It does not suggest or prescribe sustainable research practices or sustainability orientation to research fields beyond those covered in the Sustainability Subdepartment, to which its scope is restricted. In contrast to the leitmotif of BMBF policy, the idea of sustainability is not a part of the ministry's core identity and is not an overall guiding frame for thinking and action. The sustainability discourse has not successfully spread throughout all veins of the BMBF and is far less influential.[4]

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4   The symposia on "Sustainability in Science" (SISI) provide further anecdotal evidence for this point. Since 2013, the Sustainability Subdepartment has organized these conferences in order to foster sustainability in the larger German science landscape (BMBF 2016e). However, the first symposium in 2013 revealed that high level ministerial staff still considered the topic of sustainability as less important (and essentially incompatible) to the BMBF's core discourse on high tech and innovation: On the same date, a strategy-building event for the High-tech Strategy on

Following from the argumentation that the BMBF's core ideas are condensed in the High-tech Strategy, I argue that neither the policy discourse on sustainability nor the policy discourse on cooperation with developing countries and emerging economies are comparable to the BMBF's core discourse in view of their scope and standing. The discourse of an economy-oriented science policy fulfils the function of a legitimating, underlying leitmotif, which reflects in all related policy discourses, and thus can be described as an historical a priori in preceding, enabling and permeating all further science policy discourses, hence functioning as their *conditions of possibility* (Foucault 1972a; Keller 2005). In case of the specific policies for cooperation with developing countries and emerging economies in the field of sustainability research, the pre-existing core discourse of the BMBF provides the grounds that enabled its emergence and further coins its direction. The specific discourse on cooperation is entrenched in the preceding core discourse and its dispositive. The core discourse strongly influences which knowledge is accepted as legitimate in the policy subdiscourses, and thereby provides a frame to the possible contents, legitimations, and objectives of the discourse on cooperation with developing countries and emerging economies as well as to other special science policy discourses such as sustainability research (figure 8-1).

In order to understand the specific policy discourse on research cooperation between Germany and developing countries and emerging economies, it is necessary to acknowledge the guiding framings through the core discourse as well as through the (sub)discourses on sustainability and on international cooperation.

According to SKAD, discourses interact with and can be set into relation to other discourses: They may be hierarchically arranged, exist parallelly on equal footing, or exist in nested and interconnected relation to other discourses (Keller 2001). In case of the BMBF, the production and reproduction of the specific policy discourse on cooperation with developing countries and emerging economies, take place within the larger and hierarchically superior core discourse of German science policy and its related dispositive. The BMBF as such, as an institution, including its core discourse and dispositive, precedes the specific discursive conceptualisations of research cooperation with developing countries and emerging economies and exists independently of it. The discourse on cooperation with developing countries and emerging economies is embedded within this larger core discourse. In other words, the influence of the BMBF's core beliefs on the discourse on cooperation with developing countries and emerging economies is not reciprocal. While the core discourse strongly influences the discourse on international

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„Prosperity through Research and Innovation" (BMBF 2013f) took place. While BMBF state secretary Schütte opened the Sustainability in Science event, BMBF minister Wanka as well as three state secretaries attended the high-tech event, thereby symbolically underlining the political predominance of the latter (fieldnotes on SISI, 23.4.2013).

cooperation (and on sustainability discourse as such) the latter do not influence the core beliefs. They rather seem to be subordinated to it, and exist only as an add-on, not as a delimited, separate discourse. In conclusion, I argue that the discursive conceptualisations of sustainability as well as international cooperation in the BMBF discourse follow from the core ideas of general science policy, i.e. to foster German prosperity through research and education.

8.3.1   Influence of the BMBF's core discourse on international cooperation

As the previous sections have shown, the BMBF is primarily orientated towards policies for *national* wellbeing. This sets it off from other German federal ministries, such as the BMZ or the AA, which are internationally oriented by definition – their main purpose is to guide international policies and cooperation. Accordingly, the BMZ and AA derive their *raison d'être* and main narrative from international relations and cooperation, while the BMBF legitimizes its general mandate by stating that it fosters prosperity based on science, education and education. In this larger context of a science policy dedicated to contributing to national objectives, international cooperation is mainly conceptualized as a tool of securing German interests of different kinds.

Figure 8- 1: Embeddedness of discourses in BMBF policy
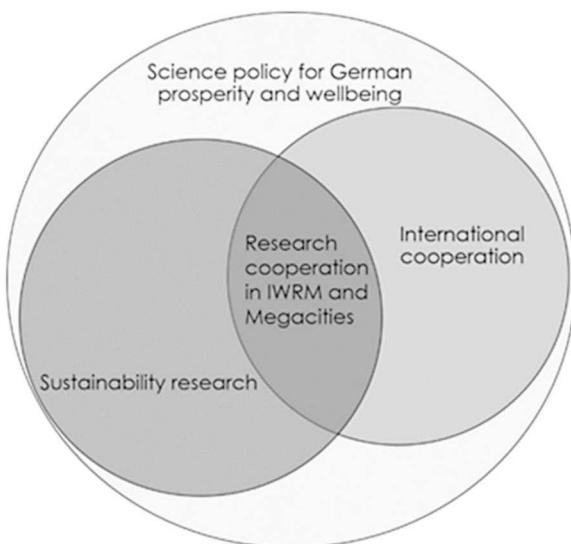
Source: Own elaboration

This is not a recent development: The BMBF and its predecessors have funded international cooperation in science since the initial days of the new German democracy after the Second World War. While Schütte (2010) argues that international cooperation was originally motivated by the need to reintegrate Germany into the international community and to build up trust in the new democratic state, some interviewees recollected that since its beginnings, the motivations and objectives of international cooperation – especially in view of cooperation with developing countries and emerging economies – were based on German interest in exporting technologies (interviews with PA12, PA14). Historically, cooperation in science thus has not been funded for its own sake, but as a means of pursuing a further goal. In this line, the BMBF still states that "[a]n international dimension is not a value in itself" (BMBF 2008a: 11). International cooperation continues to be fundamentally driven by national objectives, as from the perspective of interviewees, "[o]ur main task is to safeguard the German position as a centre of excellent science and research. And the international dimension is part of that" (PA07). Following, the BMBF dedicates a share of its budget to international cooperation activities and directs policies at international cooperation in research in order to fulfil the overall national goals. The arguments commonly used to legitimize expenditures on international cooperation are bundled in the Internationalisation Strategy as well as the follow-up International Cooperation Action Plan (BMBF 2008a; 2014e). These strategies, congruent with the overall leitmotif of the BMBF, are meant to provide an overall frame to the BMBF's international activities. However, as in I maintain in chapter 7, the Internationalisation Strategy does not have a prescriptive character – it does not guide future actions beyond the boundaries of the International Department. Nevertheless, in providing arguments for international cooperation in sustainability research, the Sustainability Subdepartment does not substantially deviate from the Internationalisation Strategy. I therefore argue that the Internationalisation Strategy fulfils a different, important function: It provides a repertoire of broadly accepted arguments that the thematic departments can make use of in order to legitimize international activities both vis-á-vis other thematic BMBF departments as well as externally.

As the Internationalisation Strategy's full title suggests, the main objective of the BMBF's international cooperation endeavours is "Strengthening Germany's role in the global knowledge society". In order to reach this overall objective, the Internationalisation Strategy identifies four major fields of action as targets of German science policy for international cooperation: First, "Strengthening research cooperation with global leaders" (BMBF 2008a: 21), second, "International exploitation of innovation potentials" (BMBF 2008a: 25), third "Intensifying the cooperation with developing countries in education, research and development on a long-term basis" (BMBF 2008a: 27), and fourth, "Assuming international responsibility and mastering global challenges" (BMBF 2008a: 29). As these different fields of action show,

the Internationalisation Strategy is a source of diverging, but co-existing strands of argumentation that back up international cooperation. Arguments range from direct benefits, such as strengthening German science and innovation through tapping international sources of knowledge, to indirect benefits, such as taking over global responsibility, responding to demands of international politics or science diplomacy.

The process of creating political strategies itself may have led to this broad range of arguments included: "Generally, all programmes, including the Internationalisation Strategy, avoid at all costs to minimize the room for action, so you can do as much as possible, as you cannot foresee everything." (PT08)

In consequence, strategies often provide room for multiple legitimations, which ensures their persistence even in change of political leadership. In addition, the multitude of arguments also mirrors the public service's take on how action should be justified: "The rationale behind international cooperation consists of many layers. Public action likes to try to bundle up very diverse goals." (PA07)

This is reflected in interviews and documents on specific funding initiatives. Instead of exposing a single objective, parallel goals intermix within them. In the practice of project funding, the variety of arguments included is favourable, as it facilitates finding suitable legitimisations for international cooperation. As arguments are part of an official governmental strategy, they seem salient and legitimate to the public, while at the same time they are accepted and shared knowledge within the discourse coalition.

8.3.2   German benefits as primary rationale of international cooperation

As cooperation takes place within the frame of the larger policy discourse of German science policy, it is not surprising that safeguarding German interests and German benefit is as prominent strand of argumentation for cooperation. Two entry points for this line of argumentation exist – first, benefits for German research as such, and second, benefits beyond research.

According to the Internationalisation Strategy, the main objective of cooperation with developing countries and emerging economies is to position Germany as a "partner of future new science and industry centres in developing countries and emerging economies" (BMBF 2008a: 27). A high-level BMBF representative shared similar ideas in view of emerging economies, stating that "[t]here are some highly interesting research partners, such as Korea... and in Africa there are some regions, such as medical research in South Africa, which are top-notch. There are enough things that you can and must have mutual scientific interest in" (PA11). Here, cooperation is aspired because the partners seem worthwhile to invest in cooperation. In the BMBF's view, some emerging economies have already acquired a scientific level high enough to inspire German interest as such – the motivation to cooper-

ate is thus accessing knowledge, or in an interviewee's words, "of course, that's the increase in knowledge and the access to knowledge in other countries" (PA06).

The BMBF discourse on cooperation with industrial countries resonates in these statements. German science is perceived to stay competitive only through interlinking with excellent research internationally. In this line of argumentation, cooperation with emerging economies is consequently funded in order to strengthen the German science and research landscape. The same idea underlies cooperation with developing countries:

> "In view of developing countries, it was the idea that at least in specific aspects there is a large potential. Not in breadth, but we are interested in identifying the potentials and to cooperate at least in certain topics with developing countries in order to develop more from there on." (PA09)

While they may not be strong in many areas of research yet, and thus lack broad excellence in science, developing countries might turn into interesting partners in the future, once their science systems improve (interview with PA01). Cooperation now is a strategic means to introduce Germany as a partner now and yield a return later:

> "Developing countries and emerging economies are the blossoming science nations. In view of publications and patents, they have the largest increase, or whatever you take as an indicator. Iran did the largest leaps forward in the last ten years, in relative terms. We therefore have a large interest in cooperating from early on, in view of their excellence. They are now leaping forward and will massively invest in science." (PA07)

Next to the access to research partners with potentially relevant scientific knowledge, a further rationale of funding research cooperation with developing countries and emerging economies is the access to research subjects abroad. The BMBF acknowledges that even applied research projects may be essentially driven by scientific interest. Within this line of thinking, funding projects in cooperation with developing countries and emerging economies grants access to research subjects abroad to German researchers (interviews with PA10, PA11). Project Management Agency staff reflected on the standard approach of research in developing countries and emerging economies in the past, which conveyed an inkling of colonial thinking:

> "Direct benefits [for the German partners] are in it when scientific interests are pursued. Traditionally, research funded by the BMBF had an after taste, they funded cooperation only if they were a research object, such as in view of geographic regions, biodiversity which doesn't exist elsewhere, and which was to be studied abroad. So, you go there, but you don't cooperate with the countries, or

only to a certain extent, but you rather conduct research in the countries. And when you are done, you leave, and that's that. Then you clean up a bit." (PT04)

Indeed, access to research subjects abroad remains an essential argument of funding cooperation even today: "The added benefit for Germany is that research questions are worked on that researchers are interested in. That is the reason for existence of institutions such as ZEF… ZEF researchers don't have to stay in Bonn, they can go to Africa and collect data there." (PA13) Next to a rationale of strengthening research through cooperation, another argumentative storyline has evolved around German economic interests. Emerging economies increasingly play a role in international politics beyond science policy. Based on their past and/or ongoing economic growth, high level political exchange fora such as the G20 summits take place regularly since 2008 (Bundesregierung 2017b). According to interviewees, the BMBF wishes to acknowledge this increasing international political and economic standing through intensifying cooperation (interview with PA09). Emerging economies as well as developing countries are conceptualized as import and exports markets – and research cooperation accordingly is portrayed as a way forward to unlock the door to these new economic arenas: "Such countries will be key players in the global competition of the future, and they thus offer considerable opportunities for development of new markets." (BMBF 2014e: 84) Or, as an interviewee put it: "In emerging economies such as Brazil, India or China it's evident. It's the growing scientific and technological potential seen there, their markets, their size. They play a role on the world market now." (PA09)

In the BMBF's conception, through research cooperation, Germany introduces itself as a reliable partner for other areas of interaction as well, such as economic cooperation and trading goods. Interviewees therefore suggested that strategic reasons played a role in fostering cooperation with those countries considered as promising in market terms. For example, economic motivations led to intensive cooperation with China (interviews with PT02, PT03, PA05). The core discourse of BMBF policy, to promote German economic prosperity, hence played a role in the choice of partner countries and topics.

In the BMBF's conceptualisation, markets encompass a broad scope. Next to the access to scientific knowledge and to research subjects, the BMBF is interested in importing human as well as natural resources from emerging economies and exporting own (technological) products or innovations. The idea of access to resources abroad is closely coupled to the rationale of strengthening the German science system through cooperation with internationally excellent researchers (to be): "And in its cooperation with newly industrialized countries, it seeks to concentrate on excellence and to develop it, to mutual benefit. Its efforts include working to develop markets, and to attract highly qualified skilled personnel." (BMBF 2014e: 24)

Legitimating research cooperation as a tool to expand markets in developing countries and emerging economies through research cooperation is one of the most common arguments in research funding for international cooperation. As such, it is widely repeated in interviews and policy documents of all kinds from strategies to calls for funding. Potential is seen for German technologies as well as for service supply such as vocational training schemes. In view of cooperation countries in Latin America, an interviewee stated:

> "Of course, we cooperate only with the Latin American emerging economies, the big ones. Well, with some developing countries as well by now. But in the emerging economies, our motivation is a different one. The typical BMBF motivation of cooperation on eyelevel and we need to really have a concrete benefit for Germany. We do not cooperate to strengthen the partner countries or support them. The motivation is different. The first case of a different approach is Peru. But in the end, we wish to gain access to resources, raw materials, the educational market there as well […] that is the educational market in view of vocational training, for German providers who would like to extend to the Peruvian market." (PT05)

This statement – as well as those by other BMBF employees, highlights the variety of co-existing arguments for cooperation, which nevertheless all aim to contribute to a *German benefit* as a main objective. The quote also illustrates that *cooperation on eyelevel* is not aspired as a mode of cooperation for its own sake – but is employed to correspond to the cooperation objective (ch. 9).

8.3.3   Sustainable development and international cooperation

As pictured in chapter 8.2, under the umbrella of sustainability as an accepted programmatic frame for research and funding, the scope of environmental research funded by the BMBF broadened, increasingly including social and economic aspects of sustainable development next to purely environmental approaches. This wider scope was accompanied by corresponding research paradigms as well as an increase of international cooperation within this area of research funding increased (ch. 5). The parallel surge of sustainability as a programmatic frame and the increase of international cooperation suggests a connection. The shifting discourse from environmental research to sustainability research opened up pathways to intensified international cooperation by providing new arguments for cooperation. With the global dimension as inherent part of the concept sustainability, the rationale of *global responsibility* surged in BMBF funding for cooperation in sustainability research with developing countries and emerging economies. However, the deeper analysis of funding rationales shows that framing sustainability as global challenge is commonly coupled with further funding rationales. Rarely, intervie-

wees emphasize a single motivation of funding, but rather list parallel objectives which combine into the funding rationale.

The concept of sustainability in the BMBF's interpretation coins FONA (ch. 8.2). Next to the general motivations laid out in the Internationalisation Strategy, FONA functions a second *pool of arguments* that policy makers can legitimately draw on to provide arguments for funding international cooperation – in case of FONA specifically in sustainability research: "The goals that the BMBF pursues in cooperation between Germany and developing countries and emerging economies are part of FONA, in its strand on global responsibility and international networks. There are structures in the programme that we build upon." (PA11)

In interviews as well as strategic BMBF documents, the financial and strategic focus on international cooperation in sustainability research is commonly legitimized through pointing at the global dimension of environmental challenges. In this line, the BMBF states in FONA2 that "[r]esearch for sustainability is international – and the only way to provide answers to the global challenges looming in the fields of climate, resources, health, safety and migration" (BMBF 2009a: 11). FONA3 continues with the same line of argumentation:

> "Sustainability is an issue of global importance. Problems like climate change and resource depletion cannot be solved by any nation singlehandedly. Consequently, by reinforcing the international partnerships for sustainability with its framework programme FONA[3], the BMBF is assuming responsibility on an international level." (BMBF 2015e: 8)

Sustainability is thus conceptualized as an issue of global scope and global responsibility. In the Sustainability Subdepartment, the decision for or against international cooperation consequently depends on the conceptualisation of the thematic focus as one international dimensions and global scope, which makes the international orientation of research funding seem legitimate. In this vein, interviewees state that international cooperation in sustainability is an obvious choice because it is thought to require cooperation: "My tendency is to say that the logic of the topic sustainability, which is an international topic, facilitates international cooperation." (PA03)

Problems have a global dimension; they pose a shared challenge and tackling them is thus of shared duty. The science to solve global problems should be equally global in its orientation, according to the arguments brought forward. It is not necessarily an altruistic notion that underlies the idea of cooperation for solving global challenges. Rather, the BMBF acknowledges that German wellbeing relies on jointly solving global problems through research:

> "Our role is to fund research, including for societal wellbeing. And you cannot deal with certain topics nationally and on smaller scales of cooperation. Climate policy

is a good example for this. It is necessary to cooperate especially with countries that are affected and that might ask different questions. And often, these are developing countries and emerging economies." (PA09)

In view of global sustainability problems, research cooperation is thus conceptualized as a means to creating solutions on a global scale, as German scientists are expected to cooperate with partners worldwide to develop globally robust solutions (BMBF 2016d). From the BMBF's perspective, impact of research on global challenges is reached only through international networking. At the same time, it is believed to increase excellence, as "[r]esearch on global challenges can only achieve excellence and be effective as part of an international network. Therefore, international cooperation is an integral element of FONA[3]" (BMBF 2015e: 29).

In supporting international cooperation, the BMBF also fulfils international political obligations – for example in view of agreements among the G8, such as on challenges on globalisation, signed at the G8 Summit in Heiligendamm in 2007 (BMBF 2008a), UN-conventions on biodiversity conservation, or in view of climate change (interview with PA07). These international political frames are used as an additional justification in the Internationalisation Strategy and FONA in order to attach authority to the arguments for cooperation with developing countries and emerging economies. However, pointing to the obligations seems to be rather fulfilling a back-up function, they were never mentioned as primary objective.

In chapter 9 and 10, I demonstrate that the broad conceptualisations of global sustainable development are not commonly transmitted into concrete funding initiatives. The policy discourse is thus not translated into the practice of funding. In addition, it often leaves out social and economic dimensions of global sustainable development.

8.3.4   Social and economic development as effect of cooperation?

While commonly, sustainable development is defined as a phenomenon encompassing social, economic and ecological dimensions, the BMBF's conceptualisation of sustainability, especially in its relation to international cooperation, is focused on environmental aspects. Although previous strands of environmental science policy were broadened, the BMBF did not adopt the concept of sustainable development in all its dimensions. Even if research cooperation is framed as research for sustainable development, the sections above demonstrate that global sustainable development, which encompasses aspects of global justice or social equality, is *not* targeted. It is not the main objective of the BMBF's policies for cooperation with developing countries and emerging economies to create benefits in the partner countries in form of development abroad. Other rationales drive German science policy in sustainability research. Following, there are no public strategy documents

or concepts which summarize the BMBF's conceptualisation of the general effects of science cooperation on development – apart from very generic statements found in the Internationalisation Strategy or the Action Plan. Likewise, many BMBF employees seemed irritated about my question regarding the BMBF's conceptualisation of science and (sustainable) development and evaded an answer. In retrospect, the fact that interviewees escaped the question or harshly reacted to it is quite telling. The interviewees' reluctance, irritation or lack of knowledge is a further indication that structural impacts of science in partner countries are not a core concern of the BMBF.

Of the different BMBF employees interviewed, only one interviewee within the international department was able to describe the BMBF's theory of how science affects development on a structural level and beyond environmental aspects:

> "Well we think that the leap… well that's theory with little evidence…well we always say that… innovation landscapes, we need innovation businesses and capacities for innovation, and that's what makes us successful. And the same holds true for developing countries and emerging economies. If a good research landscape and differentiated tertiary education exist, including vocational training as an important aspect, then there are capacities to develop wealth. Prosperity in Germany developed after the Second World War through vocational education, higher education of engineers, who turned into business men, who developed products. And in our opinion, the same development model should be applied by developing countries and emerging economies." (PA07)

While the interviewee acknowledged that science might also contribute to building a critical mass of intellectuals, in his concept science is put into the context of innovation and related economic aspects, as in the BMBF's core rationale. Ideas of catch-up development shine through in the statement. Other interviewees rather related to concrete examples of funding initiatives instead of abstracting concepts of development from these. This mirrors the level of conceptualisation in official ministerial documents. While in calls for proposals for specific funding initiatives, the BMBF does envisage benefits for partner countries in form of solving concrete problems, often related to issues otherwise framed as development issues (ch. 9, 10) in more the more generic view of *structural impacts*, the ministry remains quite silent.

In strategic documents such as the Internationalisation Strategy, the BMBF argues that cooperation is beneficial for the partner countries, despite of serving German interests as a primordial objective. The BMBF emphasizes the idea of strengthening science systems, such as through the "support for the establishment of professional organisations of scientific self-government, effective higher education management structures and the development of individual research management skills" (BMBF 2008a: 28).

Cooperation – including capacity development measures – is thereby believed to prevent brain drain (interviews with PA08, PT04). In contrast to the legitimations for national science funding, however, the BMBF leaves astonishingly blank how *exactly* science cooperation might contribute to wellbeing in partner countries, which the following quote illustrates:

> "Providing training and advanced training for researchers from developing countries and strengthening the scientific infrastructures in these countries contributes to their participation in scientific progress and helps achieve the Millennium Development Goals of the United Nations." (BMBF 2008a: 17)

The argument thus explicitly refers to the expected benefits of science for social and economic development in the partner countries as defined in the MDGs. This, in turn enables the partner countries further, according to the Internationalisation Strategy, as "developing countries can thus participate as equal partners in the global knowledge society and in the solution of global problems" (BMBF 2008a: 17). Summarized, the line of argumentation is that cooperation in science helps developing countries in achieving development goals and to become partners on the global scale. In view of emerging economies, the BMBF similarly claims that cooperation benefits the poor shares of the population:

> "Only about one-third of the very poorest people now live in 'developing countries'; two-thirds live in newly industrialized countries. Cooperation with newly industrialized, and economically emerging, countries is becoming increasingly important, and such cooperation thus often simultaneously involves practical efforts to combat poverty and its consequences." (BMBF 2014e: 24)

However, the ministry leaves open which chain of effects, interdependencies or mechanisms turn science into a means of poverty reduction or development and in which way scientific cooperation thus trickles down to those poor parts of society. The conceptualisations are not encompassing deeper causal explanations of any correlations between science, innovation and economic prosperity – or any other dimensions of social or ecological wellbeing. For example, the Internationalisation Strategy states that cooperation in research and education will lead to "the development of scientific excellence in the interest of a sustainable economic, social and political development of the partner countries" (BMBF 2008a: 27). It leaves open, however, why scientific excellence shows the way to sustainable development.

Similarly, research cooperation, capacity development and regional networking of existing scientific structures are pictured as basis of regional economic growth and social wellbeing in the Action Plan as well (BMBF 2014e). Beyond establishing a relation between these concepts, no causalities or interconnections between the concepts are explained. For example, it is left open, why the BMBF considers im-

portant that elites remain in the country. While probably, the underlying argument is a stable formal labour market, this is not made explicit.

The common lack of further elaborations of the interlinkages of science and development points at a phenomenon of *black boxing*. In constantly repeating an abstract idea of interlinked science and development processes, the BMBF presents the connection as a given fact which does not require further explanation. As a natural fact, there is no need to expose *why* science is important for the partner countries – its role is apparently self-evident: Science inevitably leads to economic development. This strategy narrows the room for questioning if the BMBF funds cooperation with developing countries and emerging economies in the most promising mode, on the most relevant topics.

In conclusion, although the BMBF points at development aspects as a positive side effect of concrete funding initiatives for cooperation with developing countries and emerging economies in sustainability research, social and economic development in the partner countries is rather an add on, not a core part of the BMBF rationale. A broader and deeper reflection on development does not fit the ministry's storyline on cooperation. I argue that this is also a result of the separation of sustainability and development into two concepts and the exclusion of social and ecologic dimensions of development from sustainability research funding (ch. 10). As the sections above show, development abroad serves as an add-on to the primary arguments of German interests, but it does not function as a rationale on its own. Even contributions to the MDGs are portrayed in lines of German indirect benefits. Thus, although BMBF activities are listed as expenditure as Official Development Aid (ODA), and although cooperation between Germany and developing countries and emerging economies is sometimes backed up through drawing on developmental aspects, development is never used as an outstanding primary argument.

8.4   Policy rationales as elements of political identity and symbols of difference

In view of an overarching rationale for the field of cooperation with developing countries and emerging economies, an unease can be perceived among the BMBF staff. It seems as if the ministry was struggling to find a shared conceptualisation of its endeavours, which at the same time would allow the BMBF to clearly delimit itself from other ministries:

"We haven't really answered the question for the ministry as a whole – why, what for, and how – the cooperation with developing countries. We also enter the territory of a different ministry that we are not as familiar with. And we don't want to

do development aid. And we don't want to be taken over by the BMZ or by the GIZ. Currently, that is a difficult institutional question." (PA09)

On the one hand, the quote illustrates that strategies often follow practice rather than practice being guided by strategical thinking (ch. 6); and that the BMBF's relation to the BMZ is coined by rivalry (ch. 7). On the other hand, the quote also pinpoints an essential characteristic of cooperation funded through the BMBF: It is not envisaged as a twin to development cooperation. On the contrary, the BMBF repeatedly and explicitly stresses that it does not have developmental objectives. The ministry states that "in its cooperation with such countries, the BMBF does not provide development aid, and it expects its partners to assume responsibility in the form of 'ownership'" (BMBF 2014e: 24). According to BMBF staff, the approaches to cooperation differ in view of their motivation: "Our research programme is motivated by science and research and has got nothing to do with development cooperation. Development cooperation is no decisive driver for our policies." (PA07)

While the BMBF is rather not driven by science, but rather by objectives beyond it, such as economic wellbeing, the ministry is very open and clear about not primarily pursuing developmental objectives in partner countries. Not acting out of altruistic intentions is frequently repeated in the BMBF. Most interviewees are quick to mention that the BMBF's policies and funding measures are not motivated by selfless notions, as the following quote depicts: "This is not selfless, I have to tell you straight away. We don't do that because we act altruistically. There are several motivations for it." (PA08) Altruism and acting out of a rationale that does not enhance German economic interest seem to be unacceptable and illegitimate in the common BMBF discourse:

"We are not only do-gooders [*In the German original, "Gutmenschen" is used, a term with a pejorative inkling*]. Well we are do-gooders, but not only. We spend German tax money, and therefore we aspire an advantage for this country. That's legitimate and not to be criticized. We want to improve local conditions through German technologies, which the countries shall buy from our businesses. That's the context, in a simplified nutshell." (PA02)

As in the quote above, some interviewees put strong emphasis on the need and legitimacy of safeguarding German interests – to an extend that almost seems like an instance of offense as the best form of defence in justifying the own rationale. In more neutral statements, the mutual benefit for both sides is stressed:

"Scientific and technological cooperation with Germany broadens the range of research options in the interest of both sides, improves international networking and facilitates collaborations with companies in order to enhance the transfer of technology from research into practical application." (BMBF 2008a: 17)

The BMBF's perceived need to delimit itself from any intentions in the interest of partner countries is noteworthy also in view of the institutional relations with the BMZ. As I have shown ch. 7, the relation between the BMBF and the BMZ is coined by competition. This also is reflected in the BMBF's policies and their underlying rationales. In view of the institutional competition, it seems that the BMBF tries to set itself off from any rationales that might be associated with the BMZ's rationale of development cooperation – even more so as both ministries have funded research-based, large-scale applied research/tertiary education projects already (ch. 5).[5]

The BMBF successfully established and maintained a discursive storyline on research and education as important factors of German wellbeing in the Federal Government. This secures its own funding, but at the same time bears the danger of other ministries, such as BMZ and AA, appropriating the topic as well in an attempt to benefit from the topic's catchiness. The BMBF therefore fears that other ministries might appropriate fields of responsibility which traditionally belong to a science ministry (ch. 7). At the same time, the BMBF is aware that by funding cooperation with developing countries and emerging economies, they enter classical BMZ terrains. To avoid becoming appropriated by a development-oriented BMZ rationale, the BMBF tries to clearly demarcate the differences between its policies and others (interviews with PA07, PA09). From the BMBF's perspective, a further reason to differentiate itself, rather than to complement the BMZ's objectives, might be the BMZ's minor role, lack of budget and power in the federal government. Development-related issues are of little relevance for the overall public German (self-)perception, discourse as well as in other fields of public policy (Maihold 2010).

Development thus is not part of the BMBF's discourse and as such, some arguments that potentially might be used to document development as a rationale are *not* taken up – they are not considered as valid knowledge or useful legitimation. The BMBF's relation to ODA exemplifies this. The BMZ encourages all German ministries to contribute to fulfilling the German ODA quota, and the BMBF

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5   In this respect, it is interesting to note that research on development policy rationales argues that despite of a shifting discourse towards partner-driven demands, mutual interest has always been a rationale of development cooperation. However, due to restrictions in declaring actions as ODA, donor interests needed to be declared as secondary next to the main objective of developing country benefits, which is why self-interest was likely downplayed in the past. Nevertheless, in development cooperation – as in science policy – manifold legitimizing arguments co-exist, and altruism is rarely the only reason provided. Framing development cooperation as mutual interest may be a strategy of increasing the social acceptance of international cooperation in times of global economic crisis, restricted public budgets and *aid fatigue* within donor countries (Carbone 2014; Keijzer and Lundsgaarde 2017).

indeed reports some of its funding activities as such (Maihold 2010). With its programmes for cooperation with developing countries – or more precisely with the programmes BMBF reports as such – the BMBF contributed 1.1% of the German ODA, amounting to EUR 112.7 million in 2012, thus ranked 4th after BMZ, AA, and BMU (BMZ 2013). The OECD is quite critical about German policy coherence and suggests stronger efforts to align policies:

> "There is considerable scope for the German government to deepen its commitment to the MDGs by making international development a more tangible goal of other government policy areas[...][A]wareness of and expertise in development issues should be strengthened in other German ministries." (OECD 2010b: 15)

Nevertheless, the BMBF's legitimations hardly draw on development-related discourses such as policy coherence. The OECD provides a perfect template for a usable, rational legitimation – which is not taken up as such, however. Instead, even the contribution to Germany's share of ODA is conceptualized as an indirect benefit for Germany:

> "Germany benefits as well. Indirectly, because Germany is obliged to invest 0.75% of its GDP into development cooperation. And the BMBF has to contribute its share. That is done exactly through those measures in which responsibility for the MDGs is taken over by the BMBF. That's an indirect benefit." (PT04)

The example of ODA – and in extension the same holds true for ODA in the context of the SDGs – once again demonstrates that policy making is not based on rational facts or needs but is inherently value-laden.[6]

In contrast to demarcations from the BMZ, the BMBF does not feel the need to set off its ideas and actions from the BMWi. No interviewee mentioned rivalries or overlapping competencies with the BMWi as a problem; nobody tried to delimit the BMBF's from the BMWi's innovation policies. This is remarkable, as the BMBF only lost its official responsibility for technology to the BMWi in 1998 (BMWi 2015). Despite having similar objectives and mission in view of innovation and technology policy, economic rationales seem to be broad enough to span both ministries' objectives. While altruism does not serve to justify policies, the capitalist discourse of economic wellbeing for Germany is deeply rooted in society and policy and therefore may function as an overarching umbrella for several ministries.

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6 Similarly, the BMBF rarely sets its policies for international cooperation into the context of science diplomacy, while the German Foreign Affairs Ministry (*Auswärtiges Amt*), explicitly draws on peace-building arguments in its initiative on external science policy (Auswärtiges Amt 2013). As in case of development-related rationales, not making use of plausible rationales is a way of distinguishing oneself from others.

8.5   Problematizing German interest

Drawing on a sociology of justification, social scientist and philosopher R. Forst outlines that societies have different conceptions of justice and the role of individuals and institutions to contribute to a common wellbeing or public welfare. Forst argues that the room of potential narratives of legitimation, and thus what is considered as a suitable legitimation, is socially constructed and limited. Within an overarching shared definition of public welfare, such as dignity of humankind as a grand principle, the potential justifications are ordered, structured and may compete (Forst 2015). In case of the BMBF's policies, justifications of economic wellbeing have successfully competed against other rationales. The BMBF often employs an abstract concept of German interest in order to justify a German benefit in the cooperation with developing countries and emerging economies. In view of cooperation with Asian countries, the Action Plan for example states that "[i]n all cooperation, it must be ensured that accelerated knowledge and technology transfer – which newly industrialized countries often call for – must be carried out in a controlled manner that is in harmony with German interests" (BMBF 2014e: 46). Here, the underlying assumption is clearly that cooperation might lead to a German disadvantage if German partners do not carefully guard their interests.

As other terms, interest may be defined, interpreted and conceptualized in a plenitude of ways. In case of the BMBF, German interest is mainly defined as economic interest. In interviews, the *German tax payer* is often mentioned as an anonymous authority epitomizing public interest. As a rhetoric device, the reference to the German tax payer thus is made to demonstrate that research funds are spent well:

> "We fund over 500 international projects with a volume of EUR 300 million, in 60 countries on five continents. And you have to justify that toward the taxpayer. And you cannot only put forward knowledge generation as an argument. In addition, we will have to try to solve concrete problems abroad." (PA11)

According to this interviewee, the German tax payer apparently would not approve science without further impact than generating new knowledge; but would endorse research for problem solving. Much more commonly, however, interviewees referred to the German tax payer to back up the idea that research funding needs to return German economic benefits. An assumed interest of the German tax payer in economic returns is used for legitimizing that the BMBF sticks to a rationale of science policy aimed at the export of German technologies. The logic behind this view entails that first, the taxpayer seeks German benefits; second, that he/she seeks these benefits in economic terms, and third, that the taxpayer in some way benefits from technology exports. The underlying assumption of the tax payer is that of a *homo oeconomicus* who through a mechanism not specified, in a sort of

trickle-down-effect, benefits from technology exports that the BMBF seeks to enhance through participation of SME in research consortia.

The reduction of the alleged tax payers' requests for German economic benefits and the contrasting dismissal of altruistic notions in international cooperation demonstrates the main accepted storyline for cooperation with developing countries and emerging economies in the BMBF's policy discourse. Both the reduction of policy objectives to German interests as well as the further reduction of German interests to economic interests have been criticized by bearers of the alternative discourse coalition. In this sense, a member of the advisory board of the Megacities funding initiative stated that "[i]n development cooperation, too, I observe a tendency to narrow down cooperation to German interests, which in turn are narrowed down to business promotion. This is such a strong reduction. German interests go beyond business development." (EE06)

9 Objectives and expectations of the IWRM and Megacities funding initiatives

After scrutinizing the policy discourse on cooperation with developing countries and emerging economies in sustainability research in strategies and general statements, this chapter turns to the policy discourse in the IWRM and Megacities funding initiatives as examples of the transmission of policy discourse into concrete funding initiatives, which generally aim at causing a certain effect. The expectation of a certain effect on social reality is part of any policy's *raison d'etre* (Pressman and Wildavsky 1984). The BMBF's policies are no exception to this. Both the IWRM initiative as well as the Megacities funding initiative have concrete objectives which lie beyond the generation of scientific knowledge. The BMBF accordingly does not only expect scientific publications as results of the projects funded, but furthermore expects research-based results to have an effect – an *impact* – on the real world as an outcome of funding. These expectations can be traced from the calls for funding through all further stages of funding projects – in their selection, in later interim reporting, status seminars, in final evaluations and reports etc (ch. 10.1).

Speaking about impact of policies requires a caveat: Instead of *evaluating* the success or failure of policy in view of its implementation, measuring its outcomes or other quantifiable policy results, I chose the perspective of SKAD. I thus focus on the preceding stages of *conceptualizing* policy expectations in the BMBF as parts of the policy discourse. Instead of quantifying the policy outcomes as such, I am interested in the *idea* of specific outcomes. As Ely and Oxley (2014) contend, the framing of impact is political – as political as the larger policy objectives that the idea of impact is coupled to in the BMBF's case, I argue. Through these concrete objectives and expectations of effects, the BMBF's discourse tries to shape a specific reality in partner countries and thus exerts a power effect. It is therefore highly relevant to analyze which specific objectives each funding initiative pursues and which type of effect it foresees. The different types of effects of policy discourse and its influence on the projects' reality in their implementation attempts, will then be dealt with in the next chapter. At the same time, by envisaging specific types of effects through the projects, policies also shape the type of research aimed

at achieving these effects. I argue that this may have long-term consequences for the German science system as well.

Based on the SKAD perspective and a phenomenological analysis of the discourse contents, in this chapter I consequently put the specific objectives of funding in the IWRM and Megacities funding initiatives in the spotlight: the BMBF's underlying expectations of outcomes, as well as the assumptions of how impact is generated, which manifest in the mode of science promoted. I argue that the specific policy discourse is made up of different concepts which fulfil different functions around the main storyline of cooperation with developing countries and emerging economies in sustainability research. The analysis of the discourse contents of the policies for cooperation with developing countries and emerging economies in IWRM and Megacities as exemplary funding initiatives is structured along the concepts' function: I first analyze the *causal or final concepts*, which embody the underlying rationale and the objectives of cooperation in the BMBF's conception in each funding initiative (ch. 9.1). After, I expose the *instrumental* concepts which are closely related to the objectives in establishing the mode and pathways to reach these – thus the mode of research that the BMBF considers apt for cooperation and sees as a means of producing impact (ch. 9.2). Hence, this chapter centres on both the objectives as well as the path of action that policy proposes, the mode of science that the BMBF prescribes to reach the objectives. I shed light on the divergence of high expectations and low level of conceptualisation of effects in the concluding section (ch. 9.3)

9.1   Deviating expectations in different funding initiatives of the Sustainability Subdepartment

In view of their policy direction, the policies of the different working units within the Sustainability Subdepartment can be juxtaposed. The funding initiatives for cooperation with development countries and emerging economies originating in the Global Change Unit, like the Megacities Programme, differ from those originating in the Resources Unit, such as IWRM, in certain aspects. They are motivated by different rationales, use different sets of arguments, aim at different objectives, envisage differing types of impact and propose different potential solutions.

9.1.1   IWRM as a showcase for a predominantly economic rationale in the BMBF's Resources Unit

The IWRM funding initiative fits smoothly into a long line of BMBF funding for international cooperation in water-related research. Closely coupled to a technological approach, water related funding has a long tradition in the BMBF's funding

portfolio (ch. 5). Throughout the BMBF's past, funding international cooperation in water-related research has primarily been legitimated through targeting German economic benefits. With its funding initiatives, the BMBF wishes to contribute to Germany's leading position in the water sector, which it considers as a lead market, expected to grow to EUR 800 billion in the next 10 years, with an annual growth rate of 6% (BMBF 2012c). As these numbers show, the German industry in the water sector is strong. In this respect, it is important to point at the co-development of policies and institutions. As one interviewee put it, "German enterprises are strong because they have been funded for 40 years" (PT03).

The BMBF has a strong tradition of supporting water related technology development – and in doing so has substantially strengthened its structures. The case of the German Water Partnership (Box 7-2) illustrates how the policy discourse led to the institutionalisation of actors and actors' networks. As external speakers within the discourse coalition, these then contributed to a continuation of a storyline of cooperation with developing countries and emerging economies based on and aiming at market opportunities. The focus on international cooperation specifically in research on water technologies can be explained by a lacking local demand in Germany itself:

> "In the case of water, the biggest problems don't occur in Germany but elsewhere. It is an obvious consequence to go to arid or semi-arid regions to adapt existing technologies or solve their problems otherwise. Therefore, the [international] orientation is not surprising in case of water. And it was done from early on." (PT03)

In extension of the rationale of getting access to research subjects abroad, the motivation here was to obtain access to water issues as a research topic of interest on the one hand, and as a business opportunity for technological stakeholders within the research consortia on the other. The Masterplan Environmental Technologies, issued by the BMBF and the BMU in 2008, makes this underlying rationale explicit. The transfer of adapted technologies to foreign markets aims at economic benefits for the German side:

> "From the perspective of the German water sector, creating a big market demand and direct financial support of innovation activities are the most important drivers of innovation. On the background of a massively expanding world market, the connection between innovation support and export orientation turns into a decisive policy lever." (BMBF and BMU 2008a: 17, *own translation*)

In this line, past BMBF's funding activities included a number of research projects and capacity development measures specifically dedicated to exporting water technologies to developing countries and emerging economies. In addition, the ministry sponsored meta research on exporting technologies (BMBF 2014j; 2014k; 2014l). In these funding initiatives as well as in the Masterplan Environmental

Technologies, the rationale of the BMBF largely overlapped with the demands of the German water industry.[1] Science and research cooperation turned into tools of reaching economic benefits: "To be more widely competitive on the global water market, we need to target new paths for technology export. Science cooperation can be used as a vehicle to anchor technologies at international markets." (BMBF and BMU 2008a: 18, *own translation*)

It is interesting to note that the exporting demands of an economically important industrial branch are listed as a strategic goal in a strategy of the BMBF and the BMU, two federal German ministries whose core mission supposedly is not taking care of economic progress, but of research and education in the case of the BMBF, and of environmental issues in case of the BMU. While in interviews, BMBF employees pointed at fostering research as one of the main objectives of policy and funding, viewed in the bigger picture of the strategic frames, science as such plays only a subordinate role to superior economic objectives in water related research and technology funding.

The close-up perspective reveals a more detailed picture, however. In the IWRM initiative as well as other research funding initiatives on water management and technologies, the BMBF made use of diverse argumentative strands to justify funding. Beyond economic benefits for German side, the importance of cooperation on water issues was stressed for the partners, as well. In doing so, the BMBF used rational arguments to come to inherently value-based decisions. The ministry argued that water research and funding require an international orientation because "the protection and sustainable use of water resources plays a decisive role for the future of humankind" (BMBF 2008c). In the same line of thinking, the official brochure on the IWRM funding initiative opened by stating that "[w]ater is mankind's most important resource – water is life" (Ibisch et al. 2013).

Project participants interviewed similarly argued that water was an essential element for all life, and that funding IWRM research therefore logically needed to turn into a priority of funding (fieldnotes IWAS Brazil, 1.10-30.11.12, informal conversation with PP28). The argumentation bears an inner logic, as the importance of water as such and the need for international cooperation on water related topics is hard to deny. Nevertheless, the same line of argumentation might be equally used to justify cooperation in other areas of sustainable development, such as climate change, health, agricultural research or research on social development. Still,

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1 The bond between the water industry with the BMBF as a science ministry instead of a bond with BMZ is not surprising if considering the strict regulations and debate around *tied aid*, which restrict the opportunities of the water sector to enter markets in developing countries and emerging economies via development cooperation (OECD 2010; OECD 2014). Cooperation in research and innovation, restricted far less by international conventions (ch. 7) thus opens new gates for exporting technologies without bearing high risks of investments.

in contrast to water-related research the latter have a much more recent funding history or have not been funded at all so far (ch. 5).

I'd like to maintain that next to those arguments promoted in public documents, institutional demands also play a role in choosing funding priorities. While the needs in other areas of sustainable development may be equally crucial, they may not be publicly discussed and thus provide lesser visibility to the ministry in public; problems might require long term research; or potential solutions may be more complex and not be solved by simple technical interventions which shine back positively on the BMBF as a funder. As one interviewee stated in view of water-related research:

> "I think that two criteria meet. First, water needs are very obvious needs. In other areas, they are not as evident. But if water provision is not working, you notice right away. And therefore, the demands from the countries are bigger. And at the same time, the BMBF is motivated by strengthening the German economy and to access markets. In the area of water, German businesses have something on offer. That contributes to promoting water as a topic." (PP04)

Prioritizing certain topics and areas over others, such as in case of water-related research, illustrates that rational arguments can be used to legitimize value-based decisions in policy making, as constructivist research on other fields of policy have shown (Leach et al. 2010). This does not mean that funding IWRM was based on invalid arguments, but rather points to the fact that a *prioritisation* of (rational) arguments is often based on norms and values. A strict separation between value and ratio in political decision-making is therefore impossible.

Value-based decisions may lead to contrasting patterns of action: While in the Sustainability Subdepartment, cooperation with developing countries and emerging economies was promoted, in the Department of Key Technologies, international cooperation with developing countries and emerging economies was barely funded, even though there was a demand from the latter. The same underlying motivation – strengthening the German economy – lead to different policies: In case of key technologies, such as information and communication technologies, developing countries and emerging economies were not interpreted as future markets, but as competitors. Cooperation was avoided in order not to enable future opponents (interviews with PA05, PA08, PA14).

The IWRM initiative in detail

As Keller (2011b) argues, discourses are not always explicit in statements – there may be gaps between statements and underlying interest (ch. 3). As such, the deeper rationales of funding may be hidden from plain sight and may not openly be mentioned as an argument in official documents. Vice versa, rationales openly mentioned may not lie at the core of the objectives but may be rather used as a

fig leaf or as a pretext. In this vein, it is interesting to observe that the rationale exposed in strategies, such as the Masterplan Environmental Technologies, differs from the one expressed in interview statements, or from the original call text of the IWRM funding initiative (BMBF 2004a). The original funding announcement provided a larger context for the IWRM initiative. The BMBF established a direct link between the IWRM initiative and the international objectives agreed upon at the UN Millennium Summit in 2000, the UN World Summit on Sustainable Development 2002, and the Dublin Principles on Water and Sustainable Development stemming from the International Conference on Water and the Environment in 1992. The BMBF thereby put a rationale of development and sustainability into the centre of its argumentation of a funding initiative for IWRM.

The call text furthermore explicitly mentioned that funded projects were to improve local situations, thus exposing a funding purpose that primarily contributed to fulfilling needs abroad. While the BMBF also mentioned access of German enterprises to markets abroad as one of the funding initiative's objectives, this was not the central argument of the call text. It rather appeared as one goal among other goals, in their majority scientific and/or targeting an analysis and improvement of the water management situation abroad. In the call, the interest in and contribution to German economic benefit was merely accompanying the primary objective of solving water related problems in model regions.

However, the multifaceted rationale revealed in the call text was put into perspective by statements in interviews, conferences and on other occasions, which emphasized technological, economy-driven objectives – as the strategies such as the Masterplan Environmental Technologies do as well. Indeed, interviewees from the BMBF, project management agencies, external experts and project participants stressed that the initiative pursued German economic benefits as a commensurate objective next to improving local situations. BMBF employees even explicitly stated that altruism was *not* a primal motivation of BMBF:

> "There is always an economic aspect. We don't only want to do good for the local people. We are not the Development Ministry. It's about companies. They are always included in the consortia. You will see that projects are never purely scientific. Business partners are part of the projects because it is one of our big goals to assist them in getting access to countries, to show what works well. We are not exclusively economy-oriented, there is the BMWi as well. We are somewhere in the middle. We support German research and the research abroad and the German businesses, and we are happy if that leads to an improvement of the living conditions abroad." (PA02)

Speaking about the funding initiative, an employee of the responsible project management agency argued similarly:

"We do not only wish to contribute to the MDGs, but also, that's our line of argumentation, to strengthen Germany, to promote exports. That's why ideally, all projects should include technology partners of areas such as waste water or water supply technologies, which should be further developed according to the local conditions. And ideally, a market should develop for the German businesses abroad." (PT06)

In interviews, strengthening Germany economically seemed to be a rationale at least as strong as a contribution to improved IWRM and sustainable development as such.

Based on my empirical findings on the rationale, mode and effects of funding I'd like to argue that IWRM presents a case of an objective following from the instruments and solutions available, which happen to be water *technologies*. The means thus justify an end. As the saying goes, if your favourite tool is a hammer, every problem is a nail. In case of the BMBF, the preferred tool for solving water problems is technology, which in turn is an effect of its core rationale aimed at strengthening the German economy. Objectives of research and solutions proposed in international cooperation are thus chosen accordingly.

Viewing developing countries and emerging economies as an export market necessarily entails to view water-related problems as predominantly *technological* problems. This was mirrored in the conditions of funding and in the selection criteria. While the announcement did not mention that the participation of German SME in the research consortia was *mandatory*, their participation was encouraged, and they were entitled to receive BMBF funding for up to 50% of project-related costs (BMBF 2004a). An application of research consortia *without* partners from the water industry able to bring in technologies, would not have been in line with the overall aims of the funding initiative. In this sense, during the first status seminar of the IWRM funding initiative, which took place in November 2008, a BMBF representative once again set off the IWRM initiative from a previous funding initiative stemming from the Global Change Unit, GLoWa. According to the opening presentation, IWRM provided a common ground for both funding initiatives. But while GLoWa aimed at a systemic analysis of the impacts of global change on the ecosystem as well as on the socio-economic system, the IWRM initiative was to strengthen German industrial competitiveness (Zickler 2008).

According to the IWRM call, projects were to develop holistic water management concepts, but technological components were required to be tested and implemented. The IWRM call was thus very much in line with High-tech Strategy objectives, while at the same time trying to achieve impact on sustainable water management in the partner countries (BMBF 2004a). Through the economy-oriented rationale and the subsequent involvement of business partners in the research consortia, the BMBF blazed the trail for technological solution pathways.

While a focus on technological solutions potentially provided economic benefits for the business partners involved, technologies as prescribed solutions were also perceived as beneficial for the visibility of funding initiatives and their success (ch. 9.3).

In view of additionally putting the initiative into the context of development objectives, an interviewee asked: "The question is in how far the MDGs are just the flag under which your boat is sailing. And what is the cargo of the ship under deck?" (PT03) The interviewee thus suggested that internationally accepted concepts, such as the MDGs, were used as an additional legitimizing frame, as a fig leaf for different objectives. This line of argumentation can be extended to the BMBF's usage of the idea of IWRM as such. The fact that the BMBF made use of the concept of IWRM as a frame for its funding initiative is worth a closer analysis, as the concepts seems to differ from the BMBF's objectives.

While ideas of an integrated and systemic water management have been around for long, the concept of IWRM has turned into a discourse of global scope since the 1990s, embedded in policies and norms at regional, national and international levels (Biswas 2004; Mukhtarov 2008; Saravanan et al. 2008). As such, the concept of IWRM is a holistic, systemic concept of water management. It acknowledges that water management is complex, as water is crucial for the natural environment as well as for socio-ecological and economic systems. As water is a finite resource within the global eco-systems, water management needs to adequately take into account the needs of the natural environment as well as accommodate the diverse physical, social, cultural, and economic needs of humankind (Agarwal et al. 2000; Biswas 2004; Grigg 2008; Allan 2012). A basic definition of IWRM is given by the Global Water Partnership, an institution established to enhance IWRM (thus fulfilling a function of discourse perpetuation and dissemination, itself part of the IWRM discourse's dispositive): "IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems." (Agarwal et al. 2000: 22)

The concept of IWRM is based on the principles of bridging and integrating different (sectoral) needs in a participatory and inclusive process. It suggests cross-sectoral policy making across all relevant fields (food, energy, ecosystems, industries etc) and points at the role of management instruments; the importance of an enabling environment such as policies and legislation; and of adequate institutions and their governance and coordination for a sustainable management of water (Agarwal et al. 2000).

The concept of IWRM thus essentially stresses the role of management, governance and participatory processes to secure sustainable water. Researchers have accordingly scrutinized the aptness of institutions surrounding water issues in

view of their institutional fit, scale, or interaction (among others Moss and Newig 2010; Horlemann and Dombrowsky 2012) and examined stakeholder integration and participation (among others Pahl-Wostl 2002; Carr et al. 2012). Additionally, learning and capacity development are portrayed as essential crosscutting elements to enable individuals and institutions to participate in IWRM and fulfil their roles adequately (among others Pahl-Wostl et al. 2008; Lebel et al. 2010; Leidel et al. 2011). While these aspects were stressed substantially in the implemented projects funded in the BMBF's IWRM initiative, they received far less attention from the policy-makers side, who stressed technological aspects (ch. 10).

The concept of IWRM has been criticized both in view of the shortcomings of the theoretical concept as well as in view of the limitations of its implementation. Different authors stress that IWRM neglects the highly political nature of water – or rather the power asymmetries among stakeholders; the conflicts that may occur; the trade-offs between different usages, and rather conceive of it as a normative vision than an implementable option (Biswas 2004; Molle 2008; Mukhtarov 2008; Allan 2012). However, in its common discursive meaning, IWRM is certainly *not* a concept that stresses the infrastructural or technical side of water management, but rather focusses on the *non-technological* aspects of it. Indeed, most authors attribute only a minor role to the actual technologies involved in the larger context of IWRM. For example, in the Global Water Partnership's definition, technologies are pictured as one part of the puzzle of achieving a sustainable management of water, while at the same time, the authors warn about the uncritical application of technologies and advises context-adapted, suitable solutions (Agarwal et al. 2000).

However, IWRM may be and has been utilized to pursue other means below its label. In this line, Biswas (2004) states that "people have continued to do what they were doing in the past, but under the currently fashionable label of integrated water resources management in order to attract additional funds, or to obtain greater national and international acceptance and visibility" (Biswas 2004: 251). In case of the BMBF's uptake of IWRM as a frame for the IWRM funding initiative, I conclude that a similar dynamic was at play. Linking up to objectives and frames of (sustainable) development, such as to the MDGs, as well as to IWRM, fulfilled a dual function for the ministry. Both discourses are used as *vessels* to transport the BMBF's core objectives of technology export, thus contributing to German economic benefits in the long run. Embedding a funding initiative in an international discourse of general consent provided additional legitimacy and visibility to the policy. Framing the funding initiative as IWRM allowed the ministry to set it into a larger development-oriented context while still maintaining the focus on German economic benefit. On the other hand, combining different objectives by drawing on different discursive sources also potentially addressed and appealed to a larger group of discourse recipients, including applicants for the funding, other min-

istries as well as the Bundestag, and the larger public – thereby providing a higher degree of visibility for the BMBF.

Depoliticizing effects of the technology focus

In view of IWRM in general, Molle has argued that using IWRM to frame water management may lead to a *depoliticisation* of water (Molle 2008). In view of the BMBF's reinterpretation of IWRM, depoliticisation may be an even higher risk, as the concept of IWRM is used to primarily promote *technological* solutions. In this vein, the reduction of the following international initiative issued by the Resources Unit, the CLIENT initiative (BMBF 2010b) to pure technology development seemed a consequent development towards depoliticizing water management in difficult contexts. Asked why CLIENT did not embrace the analysis of the socio-economic conditions of technological research and innovation in China, a ministerial interviewee stated, that "[t]he Chinese would have been against any interference. That's too big and too political. Therefore, you rather take these kinds of steps in order to reach a larger one. That might be more sustainable than the IWRM projects. If you leave these behind, they might collapse" (PA05).

CLIENT thereby epitomizes the tendency of the ministry to promote a *one-solution* technology, which in the IWRM funding initiative already shone through. Potential trade-offs or contradictions within society, the social aspects of water, such as promoting sufficiency instead of technological efficiency, are excluded as research questions. From the policy perspective, this might be a convenient approach, as it enables the ministry to maintain good relations on the policy level even with non-democratic partner countries.

While framing IWRM and other environmental problems as technical problems may have originated as a conscious or unconscious discourse strategy, it has also turned into a deeply internalized belief. The belief in a technological approach to IWRM among some interviewees in the ministry, the project management agency and projects was so strong that the idea seemed unquestionable. Technology was seen as the most effective solution – which the quote above illustrates. Provoking the thought that IWRM might be more than technological interventions was met with total incomprehension in some cases (interviews with PT06, PP09, fieldnotes FONA Forum, 09.-11.09.13).

This exemplifies a high level of discourse dominance: Water management as a *technological challenge* was perceived as a natural fact, and actors thereby unreflectively reproduced the discourse without being aware of it. Based on Latour, this phenomenon of making a concept appear as a given fact is described as *black boxing* (Hajer 2003a; Keller 2013), a notion similar to that of Foucault's *political technology*, through which political, discursive issues are "set out as objective, neutral, value-free" (Sutton 1999: 14).

In conclusion, the BMBF's focus on IWRM, and specifically on the technological aspects of water management, did not stem from an orientation towards the needs and demands of partners. I argue that the objective of the initiative was not to investigate context-adapted solutions at any potential entry points. Instead, the solutions were predetermined by the underlying economic rationale, which translated into a technology focus. This was beneficial for the German business partners involved as well as for the BMBF: Technology provides easy visibility which can be pictured as manifestations of impact, which shines back positively on the ministry.

By combining different argumentative strands into its objectives, i.e. strengthening the German economy *and* contributing to sustainable development, the IWRM funding initiative essentially transmits an overall rationale congruent to the High-tech Strategy as well as other policy strategies, such as the Internationalisation Strategy, FONA and the Environmental Master Plan. The funding initiative presents technology-based solutions as best options for solving water-related issues and for reaching sustainability, while at the same time allowing and stimulating economic growth. The same holds true for CLIENT (BMBF 2010b) and other funding initiatives for cooperation with developing countries and emerging economies which aim to tackle environmental problems abroad mainly through technological solutions, with an underlying rationale of contributing to German economic prosperity. In doing so, with IWRM or CLIENT the BMBF follows a tradition of eco-modernism – concentrating on technical solutions of environmental problems, on cost of a holistic concept of sustainability (on eco-modernism, see Jessop 2012; Partzsch 2015, ch. 2).

The technology focus has some negative side effects. In their focus on technologies at the expense of taking into account the entire socio-ecological system, policy makers forget that technologies always have a social, political context. The focus on apolitical, technical solutions apart from their social context is not likely to be successful. Moreover, the policy focus on economically viable knowledge and depoliticized technology may also have damaging effects on the science system as a whole. If the science system shall adequately cope with global challenges, next to technological research capacities, *critical* social sciences are essential to address complex problems: Sustainability challenges always have a political dimension.

9.1.2 The Megacities funding initiative and other initiatives of the Global Change Unit: Using room for manoeuvre

The Megacities funding initiative illustrates a case that differs from IWRM in many aspects – not only in its thematic focus. The Megacities initiative was set up in the same year as the IWRM call, in 2004, but originated in the Sustainability Subdepartment's Global Change Unit, while IWRM stemmed from the Resources Unit. Whereas funding IWRM research fell into a tradition of water-related BMBF fund-

ing activities, Megacities were a new topic for funding without any antecedents. Urbanisation entered the funding agenda as a hot topic in the beginning of the millennium, with two further funding initiatives on Megacities emerging at the same time as a research initiative in the Helmholtz centres (UFZ 2007) and as a DFG priority programme (DFG 2006).

The BMBF set its Megacities initiative into the context of global ecological change and global responsibility and specifically addressed future megacities in developing countries and emerging economies. The call text stated that shaping the development of fast-growing megacities would be essential for reaching all dimensions of sustainable development. Megacities were presented as hubs of economic activity, centres of humans and resources with large effects on the surrounding rural areas. The global interdependencies of megacities were emphasized as well. According to the initial call for proposals, the funding initiative was aimed at identifying risks and options for sustainable city development, developing solutions for problems that posed severe challenges to a sustainable development path of the respective cities. Projects were to carry out research "for megacities instead of research about megacities" (BMBF 2004b).

In contrast to the IWRM initiative, the BMBF took a more holistic approach in the Megacities initiative with the overall aim of fostering sustainable development and joint problem solving of potentially global scope. This overall objective was *not* chosen based on German technologies as pre-existing instruments to prescribe a type of solution. Indeed, the call text did not specify any solution or sector to address in the projects, which were encouraged to develop solutions and strategies for sustainable mega urban futures, and to put these into practice in pilot studies (BMBF 2004b). Potentially, social, cultural, policy or other types of non-economic innovation could equally turn into entry points for problem solutions in fields relevant to the sustainable development of the cities at stake, such as water supply and waste water, food, mobility, energy, housing, work, health and quality of life. The call additionally explicitly asked for research projects bridging different sectors and scientific disciplines in an encompassing approach (BMBF 2004b).

In a later stage of the funding initiative, the BMBF refocused the Megacities funding initiative to address energy efficiency and adaptation to climate change within the projects. Interviewees set this refocus, unusual in funding, into the context of new knowledge about the severity of climate change, as exposed in the IPCC report in 2007, which resulted in increasing importance attributed to the topic in political discourse and action. In this light, Megacities in developing countries and emerging economies were now conceptualized as centres of emission – thus demanding mitigation efforts. Additionally, Megacities were pictured as places most susceptible to the impacts of climate change, thus most needy of adaption measures (BMBF 2010d; Ehlers et al. 2010, interviews with PT07, EE25).

Next to those arguments, the refocus allowed the BMBF to put an existing initiative into the context of the new High-Tech Strategy for Climate Protection, issued in 2008 (BMBF and BMU 2008b). Along with the thematic reorientation, the previous openness to all potential solution pathways and all sectors of life and economy in the city narrowed, or at least required a shift of focus of the projects which had already been running for a few years at the time of the refocus (ch. 10).

In contrast to the IWRM call, with its focus on supporting German businesses and its technological approach, the Megacities funding initiative encouraged German business partners, but their inclusion was not a condition for obtaining funding. Interview statements enhanced the objectives exposed in the call and did not show divergence. In this sense, an interviewee from one of the project management agencies stated that the underlying rationale of the Megacities initiative was to "[f]ight problems where they emerge, global responsibility...and of course we hoped to introduce German technologies to export markets of the future." (PT09)

Despite of strong German institutions and business in environmental technology, the funding initiative did not completely submerge in the core discourse of German science policy as expressed in the High-Tech Strategy. Acknowledging the necessity of a "multi-faceted way towards a climate-adapted and energy-efficient Megacity" (Ehlers et al. 2010: 10), the BMBF enabled the funded projects to carry out a systematic analysis of the problem context in their first stages (fieldnotes Lima, 01.08.-31.09.12; interviews with PP40, PP39) in order to search for adequate types of solutions at different entry points of the urban landscape, which thus included different solutions – even those not aimed at German economic benefit. In view of the suitability of German high-tech solutions for the cities at stake, a member of the Megacities advisory board differentiated as follows: "With high tech and Megacities, you'd compare apples and oranges. That wouldn't fit together. You can't have everything. In the projects' interest and for the good of the stakeholders [...] I'd rather have adapted technologies, modified to suit the conditions." (EE25) Aware of the dominant policy discourse focused on high-tech, the interviewee added in view of the megacities initiative's missing technological focus, "[i]t is worth acknowledging that research on megacities follows a different approach, research question, methodology and theory. But that does not mean that the projects are of inferior standards." (EE25)

The statement illustrates that the high-tech discourse had turned into such a strong normative background for BMBF funding initiatives that this member of the advisory board felt the need to provide a justification for *not* following technological thinking with the funding initiative. Fostering technologies, preferably high-tech, seemed to be the most valid legitimation within the ministry.

Instead of focusing on a specific type of solution, in later stages of the Megacities Initiative the BMBF introduced the notion of *transferability of solutions* as an objective of the funding initiative. While individual projects necessarily focused

at creating impacts on the local scale in form of context-adapted solutions for a specific topic within the respective city, at the same time the ministry pushed for a transferability of results beyond the individual projects' cities and arranged the exchange of ideas about transferable solutions between the projects at conferences (interview with PT07).

According to some researchers, the policy assumption that solutions developed for a particular setting can be generalized, upscaled, and applied in different settings is wrong, as solutions have to be socially and ecologically embedded in the local context (Ely et al. 2010; Leach et al. 2012). Other researchers, however, put forward that only by aiming at transferability, solutions turn into international public goods (Douthwaite et al. 2003). In case of the Megacities initiative, fostering the transferability of results through abstracting from specific city contexts can be seen as the BMBF's attempt to achieve a broader impact as well as a better visibility of funding, thus adding legitimacy to spending public money on the funding initiative. However, the projects re-interpreted these demands. They rather exchanged their transformation knowledge and discussed its applicability to other contexts (Future Megacities Support Team 2012). In the same line, final transferability reports, such as the one issued by LiWa (Schütze 2015), did not promote the solutions as such as blueprints for other cities, but rather reflected on methods and pathways of impact potentially adaptable in other contexts.

The African Regional Science Service Centers, funded within the same Global Change Unit of the Sustainability Subdepartment, presented a similar case of funding that did not follow a predominantly economy-based rationale. The BMBF's core discourse on high-tech and German benefit is less influential in this initiative, too. An interviewee from the project management agency, involved in WASCAL and SASSCAL, argued:

> "In the end, what remains is a feeling of international responsibility. And we noticed that the BMBF had previously neglected its responsibility for the region. It's rather a moral cluster of arguments. In the pragmatic politics of international relations, it seems hard for the countries to realize that this is really our motivation. But it is." (PT01)

While German scientific interest and potentials of future cooperation, motives stressed in the Internationalisation Strategy, also played a role, the benefits of the partner countries – through jointly developing (scientific) knowledge about global change, but also fostering science capacities both institutionally and personally – were a major rationale of the initiative: "It's about solving problems of the regions practically, developing scenarios, starting cooperative projects. Or even building structures, such as the climate competence centres. The benefits of the countries are paramount." (PT04)

This is a very interesting finding, not only content-wise, but also in view of the relation of funding initiatives, programmes and higher-level strategies. In its funding initiatives, the Sustainability Subdepartment's Global Change Unit, responsible for the Megacities funding initiative as well as the African RSSCs, was able to choose a line of argumentation that diverged from the line of argumentation legitimizing IWRM. Calls originating in the Global Change Unit prioritized the arguments included in programmes and strategies differently. They emphasized rationales which were not as central in higher level strategies, such as the High-Tech Strategy or the Internationalisation Strategy, or even FONA – in contrast to the Resources Unit, which rather repeated the rationales of higher-level strategies in justifying its initiatives such as IWRM or CLIENT. Global Change Unit thereby deviated from the BMBF's core discourse and its standard storyline of justifying funding. The policymakers within the unit made use of the spaces for alternative discourse and funding practice within a playing field that is enabled by the non-prescriptive role that strategies have in policy making (ch. 6), as well as through the broad lay-out of strategies, which functioned as a pool of arguments.

The strategies left sufficient room for coexisting legitimations and interpretations, which in consequence enabled various approaches to cooperation with developing countries and emerging economies to coexist within BMBF, based on different strands of legitimations, with different objectives, and different modes of cooperation proposed. While in case of the IWRM Initiative, the high-tech objectives were prominent, in case of the Megacities Initiative, sustainability was a guiding concept. FONA provided a pool of legitimate arguments to back up funding, even if deviating from the BMBF's core discourse: "For the working unit, FONA is a great point of departure. It can refer to it and state that this is the programme that an initiative is based on." (PT07)

While some interviewees criticized the vagueness of programmes and strategies, at the same time the inclusion of a broad range of rationales also enabled deviation from the main storyline. Different working units used their agency to cherry-pick from strategies to different degrees. Whereas some, like the Resources Unit, remained within the safe lines of the predominant technology-oriented BMBF discourse, others, like the Global Change Unit, seized their power to emphasize different aspects of strategies and drew on different side-lines of argumentation included in the overarching policy documents. In reinterpreting and modifying the dominant policy discourse, they nevertheless stayed within its frame. By not transgressing the discursive boundaries, the working units were able to endorse even non-standard policy initiatives through the back up of policy strategies.

Remaining within the discursive frame, not totally disobeying it but merely stretching it out, may be interpreted as a measure of institutional self-protection. Although deviation from the standard discourse was possible (ch. 6), any reorien-

tations of the policy direction bear a risk of endangering the own organisational status quo. Despite the agency of decision makers to prioritize certain strands of arguments, most funding initiatives therefore did not make use of alternative rationales. Transcending traditional cooperation approaches put a high pressure on the responsible working unit to justify funding activities within the BMBF as a whole and among other units of the Sustainability Subdepartment in particular.

Units such as the Global Change Unit, which promoted funding initiatives beyond the dominant policy discourse were often met with resistance and scepticism by other BMBF units and departments. An interviewee involved in setting up the African RSSC initiative stated that they soon were viewed as troublemakers in BMBF (interview with PT01). Another interviewee, involved in crosscutting coordination and dissemination activities for the Megacities funding initiative, added:

> "Often, the target group of public relation is the BMBF itself, which has to be convinced. The different target groups within the programme are only secondary. While the brochures we design, info sheets etc should be aimed at the practitioners, they are really aimed at the ministry. The level of insecurity among the funding ministry was quite a surprise for us." (PP27)

The perceived need for legitimation can be explained as an attempt to calm potential critics within the ministry who were sceptical about the unconventional funding activities of the unit. In this line, other interviewees added that the respective working unit didn't have a solid standing within the BMBF: "What Working Unit 723 [the Global Change Unit] is doing is not well-accepted within the BMBF [...] And the current ministerial leaders do not understand the argumentation of global responsibility anymore. Its legitimacy is low." (PT09)

Further interviewees even mentioned that other working units within the BMBF were eager to take over responsibilities in case of a failure of the initiatives funded in the Global Change Unit (Fieldnotes FONA forum, 09.-11.9.13). Having deviated from the dominant BMBF discourse, funding socio-ecological rather than technological research, thus led an outsider position and institutional insecurity for the unit – which explains why alternative conceptions of cooperation do not easily become institutionalized in policy making.

9.1.3   Capacity development as crosscutting expectation in both funding initiatives

In scientific literature as well as in practice, capacity development is a concept brought forward as a key for beneficial research cooperation between industrialized countries, developing countries and emerging economies (Hurni 2001; Velho 2004). In this sense, Wall (2006) argues that science *for* development is achieved by adding a capacity development dimension to research *on* development. Capacity

development is said to ideally take place at multiple levels: At the individual level in form of education and training; at the organisational level through strengthening capacities of cooperation as well as through developing rules and institutions; at the sector/network level by enhancing larger frames and networks; and at the level of the enabling environment, which is made up of the former three and defines the overarching frame through policies (Van Hofwegen 2004).

As chapters 9.1.1 and 9.1.2 show, the IWRM initiative as well as funding initiatives such as CLIENT, stemming from the Resources Unit, differ from the Megacities initiative and other funding initiatives stemming from the Global Change Unit in view of their objectives, the type of solutions proposed, outcomes of projects envisaged as a result of the research activities. However, in both the IWRM as well as Megacities initiative, the BMBF raised expectations in view of capacity development on different levels. Funded research projects in both initiatives therefore included measures of capacity development as a type of project output (Appendices B-3a and B-3b).

The IWRM call already put the transfer of know-how into the centre next to technology transfer; and the IWRM accompanying measure specifically focussed on capacity development as a crosscutting aspect of the IWRM projects (BMBF 2004a; 2013b). In the Megacities funding initiative, the importance of capacities in the partner countries was equally acknowledged in the call text; additional funding for capacity development on the scientific level was available through the DAAD, which provided scholarships for PhD students within the funding initiative's frame (BMBF 2004b; PT-DLR 2012, interview with PA3).

Despite the differences among the outcomes envisaged for each funding initiative, the aspirations in view of capacity development were comparable. Capacity development measures explicitly accompanied both funding initiatives, targeting different levels of know-how, ranging from capacity development for the application of new technologies, to scientific capacity development. Capacity development was pictured as a long-lasting impact of research cooperation, beyond the projects' restricted time and scope.

On a very practical level, capacity development of technical staff was portrayed as necessary to enable partner countries to apply the new technologies. BMBF staff were familiar with stories of previous projects of technology transfer that failed due to lacking capacities to implement, monitor and maintain technologies and were therefore considered as failures. A member of the Megacities advisory board stated in this sense that in "the Megacities projects, capacity development was important. Educating people to become familiar with the new technologies." (EE25) On the other hand, capacity development of technical staff was also pictured as a condition of German benefits from research cooperation. Capacities in the educational, technical and research sectors were perceived as a prerequisite for cooperating:

"How do you want to run a laboratory, cooperate internationally, if the staff doesn't have the adequate capacities for specific non-scientific auxiliary tasks?" (PA09)

From a more strategic perspective, capacity development in countries of political interest was also pictured as an instrument of creating international ties. Interviewees argued in view of IWRM, that through capacity development measures, linkages were built and kept up between partners, which potentially led to further cooperation or to German brain gain: "We have to invest in the interconnections, such as through PhD programmes. From a German perspective, it is not tragic either if PhD students stay here after they graduate. We gain good brains. That is egoistic, but it happens." (EE17)

Next to deriving German benefits, capacities were also seen as a more *enduring* outcome of funding for the sake of sustainable development. Beyond the direct impact of a funded project, a positive outcome was seen in influencing the mindset of the people involved towards a more holistic sustainability thinking, which they would transport into future employments. The same idea was portrayed by a BMBF employee in view of the Megacities initiative:

> "The people working in the projects within the partner countries are important for the projects' legacy. That's those who convey the message, who may join the public authorities, who start a waste business etc. Those people who hopefully continue to be there when the German PhD students and professors have moved on to the next project." (PA03)

Capacity development was thus expected with different underlying motivations. While it aimed at strengthening capacities on individual and systemic level abroad, at the same time it indirectly targeted German labour market demands of capacitating people as future potential staff. The BMBF's request for capacity development also requires some scrutiny in view of the interlinkages between capacity development, as an expected *result*, and cooperation on eyelevel as expected *mode* of research partnership, which will be addressed in chapter 9.2.

9.2 Policy expectations and mode of science

The BMBF does not provide any overview depicting their *theory* of policy effects such as impact or knowledge transfer. If a theory about the impact pathways exists, the ministry doesn't make its conceptualisation explicit. Nevertheless, the implicit theory becomes evident in different statements in strategic documents, calls texts, selection criteria for project set up, etc., which hint at the underlying model.

Implicit theories of how policies influence social reality are a necessary element of any policy. The theory of a policy's mechanism, the concept of its pathway to cause effects, is not necessarily consciously reflected. In form of tacit and/or

explicit knowledge, theories are deeply engrained in policy (Hofmann 1993).[2] Theories of impact are context specific and depend on the type of policy, its content and on the type of effect it foresees. In case of the Megacities and IWRM initiative, the BMBF tried to ensure effects through prescribing a certain mode of science ex-ante (instead of assessing impact ex-post impact, ch. 10): *Transdisciplinarity* and *cooperation on eyelevel* are conceptualized as silver bullets to ensure that projects produce impacts.

While in the previous sections, I have analyzed the objectives of BMBF funding initiatives for cooperation with developing countries and emerging economies, this section elaborates which concepts the BMBF employs to *pursue* its objectives, thus, how the BMBF accordingly conceptualizes the adequate mode of science and cooperation with developing countries and emerging economies. The specific conceptions of the means and ways of reaching the objectives of funding initiatives, the *modal* concepts, are closely related to the policy goals and expectations of impact, as they provide guidance on the *how to* of intervention that in a specific discourse is considered as an adequate way of dealing with a phenomenon (Keller 2005).

There is no document that explicitly prescribes a certain mode of cooperation, such as inter- or transdisciplinarity or cooperation on eyelevel. As concepts they are informal but prevalent and crosscutting in the policy discourse on cooperation with developing countries and emerging economies in sustainability research. They are used in different policy contexts and in different funding initiatives, but with different functions, as the analysis shows.

9.2.1   The politics of transdisciplinarity

Arguing from a normative background of sustainability, scientists within the field of sustainability sciences consider transdisciplinary set-ups of knowledge production in science as most adequate to align science with the needs of society while respecting ecological boundaries, providing holistic problem analysis and solutions and thus contributing to objectives of sustainable development through research (Hirsch Hadorn et al. 2006; Pohl et al. 2010; Lang et al. 2012; Jahn et al. 2012).

The concept of transdisciplinarity entails the idea of *participatory* research, hence the coproduction of knowledge between scientists and non-scientific stakeholders, on the one hand. On the other hand, transdisciplinarity also encompasses the idea of considering all sides of a problem through *interdisciplinary* research; which enables the research team to find a holistic perspective on a real-world problem (ch. 2.4.3). Transdisciplinary projects are perceived to have a large potential

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2 Interestingly, the public acceptance of a policy and its underlying theories depended on its *plausibility* – rather than on the *evidence* of results, as Hoffmann showed in view of German technology policy in the 1980s and 1990s (Hofmann 1993).

of generating systemic and strategic knowledge as well as target and transformation knowledge, which are necessary for transformations to sustainability (Schneidewind and Singer-Brodowsky 2013b; Grunwald 2013).

As pictured in chapter 8, the introduction of sustainability as a frame of funding in the Sustainability Subdepartment led to a broadened scope of topics funded; next to the traditional environmental core of research subjects, social and economic aspects of sustainability were now included as topics (Weingart 2006). The more encompassing approach of previously separate research subjects also introduced inter- and transdisciplinary approaches in the BMBF's research funding portfolio (interview with PA04). Since then, transdisciplinarity has turned into a standard element for the Sustainability Subdepartment's funding of applied research (interview with PA11).

Consequently, both the Megacities as well as the IWRM funding initiative, as most other research funding initiatives issued within FONA, requested their projects to be application-oriented and transdisciplinary. Thus, within the consortia, the cooperation between scientists of different disciplines (*interdisciplinarity*) with local stakeholders and problem owners (*transdisciplinarity*) was required in order to ensure a focus on real world problems (*application orientation*). The subsequent problem solution through technology transfer was to be ensured through the involvement of technological businesses in IWRM (*solution orientation*).

Within the Megacities funding initiative, the concept of transdisciplinarity maintained its more encompassing characteristics:

> "You consider which partners you need to ensure that you achieve a useful result from the tax money you invest. In sustainability, you rarely come across purely natural science questions. In general, the problem is complex, otherwise someone would have solved it 20 years ago. The social component of research, including the translation of results, is immanent part of the process." (PA03)

According to this definition, transdisciplinarity is not just a means of ensuring impact, but also a way of integrating different perspectives from different disciplines, a mode of science to tackle complex problems. However, I argue that the BMBF has re-interpreted transdisciplinarity in order to fit to its funding concepts in the IWRM funding initiative, where transdisciplinarity was predominantly conceptualized as a mode of science to ensure impact in form of the transfer of technologies. In this sense, a ministerial representative stated in view of the IWRM initiative:

> "Composing research projects out of science, business and practice is key to address those issues that are needed in that country, so they don't consider results as irrelevant. Therefore, it is a precondition for the projects to include local users, suppliers etc, who state what they are interested in." (PA02)

In the IWRM initiative as well as in other funding initiatives stemming from the Resources Unit, such as CLIENT, transdisciplinarity was reduced to its element of ensuring technological impact through stakeholder integration and interdisciplinarity. The involvement of social sciences within the research projects was consequently not part of a complex problem analysis but meant to detect potential barriers for implementing a predetermined technical solution. Social sciences were portrayed as an add-on to technical and natural sciences, as the head of department, Huthmacher, stated in a session of the Parliamentary Committee of Education, Science and Technology Risk assessment, that "[…] you have to acknowledge that social-ecological research, SÖF, cannot be our one-and-only approach in the future. We need to integrate SÖF into technology development." (17. Deutscher Bundestag 2012b, *own translation*)

Realizing that technologies fail if the context is not taken into account, the BMBF instrumentalized transdisciplinarity to ascertain that technology transfer worked out:

> "It is our interest to use nature more sustainably and to employ the most advanced technologies. And our goal is to enable these countries through cooperation to make that possible. It is about technologies, people, capacities to use them, about socio-economy. Therefore, the cooperation with humanities and social sciences in these countries is very important. So you know how to implement that in the countries. Because it may mean a total cultural change for the people." (PT04)

Considering its different functions in Megacities and IWRM funding, transdisciplinarity can be employed to achieve different goals and objectives. There is a layer of *politics* involved in utilizing the concept as such as well as its components. As others have argued in view of participation (Leach et al. 2010; Cooke and Kothari 2001), transdisciplinarity can be instrumentalized in manifold ways – as a means of achieving researchers' goals, as a means towards more ownership and emancipation of stakeholders; for broader problem framings as well as for business-oriented aims. By using transdisciplinary modes of science to ensure technology transfer, the BMBF is estranging the model of transdisciplinarity from its original intentions. In the discourse of sustainable development, participatory processes were traditionally not only seen as a means to an end. In its quality of enhancing collective learning and emancipation, participation was considered as a value as such (Newig et al. 2011; Kuhn and Heinrichs 2011).

While present in the Megacities initiative, aspects of stakeholder emancipation, of encompassing problem framing from non-technological, non-scientific points of view are lost in the adaptation of the concept to the BMBF's ends in funding initiatives such as IWRM. The economy-oriented twist of the concept is not new (Lundvall 1985), but stakeholder participation and integration of social sciences are derived of their encompassing potentials and utilized to merely provide a context

for a smooth technology adaptation or implementation. This fits well to the de-politicisation through a focus on technological solutions observed in case of the IWRM funding initiative described above (ch. 9.1.1).

9.2.2   Cooperation on eyelevel – replacing old cooperation patterns?

Next to transdisciplinarity, *cooperation on eyelevel* was a further principle often stated to underlie both the Megacities and the IWRM funding initiatives. At the time of research, BMBF funding for cooperation with developing countries and emerging economies in general followed the same model of cooperation as funding for cooperation with industrialized nations – both in the thematic departments' unilateral initiatives as well as in the frame of the International Department's bilateral ST&I agreements. As a standard, and in contrast to development cooperation, each partner country provided the funds for its own researchers. Interviewees standardly used the motto of cooperation on eyelevel to describe the type as well as the rules of the partnership (interviews with PA01, PT01, PA03, PA7, PA11, among others).

However, among the different interviewees, no shared definition existed of what cooperation on eyelevel meant – neither theoretically nor in practice. Apart from the different concepts of eyelevel as such, conceptualizing cooperation within BMBF-funded projects as cooperation on eyelevel was accompanied by diverging assumptions in view of *ownership* and other side effects of cooperation.

In some funding initiatives, especially in those for cooperation with emerging economies, such as in CLIENT, BMBF employees conceptualized eyelevel by referring exclusively to the expected *financial eyelevel* of the partner countries. However, it was widely accepted that contributions in kind (such as through providing scientific staff, infrastructure and/or time for the joint research project) also counted as financial contribution, but as a basic principle, each partner country provided funds for its own project participants (interview with PA06). A further interviewee equally pointed out that in CLIENT, eyelevel meant cofinancing: "The Chinese have to pay 50% themselves. They have to wisely consider if they want to invest money in something they don't manage themselves later on. If it doesn't work, who is in trouble, who bears the risk? It's the Chinese, and that's good." (PA11) In this conceptualisation, cooperation on eyelevel thus entailed equal cofunding. According to this statement, cofunding was employed to create ownership in the partner country, which in turn was believed to ensure long-lasting effects of the technological innovations stemming from the projects. Other interviewees hinted at a different underlying rationale, in searching for cooperation on eyelevel with emerging economies, however: "We search for a concrete and specific benefit for Germany. Eyelevel means we don't cooperate to strengthen partner countries or support them." (PT05)

In view of cooperation with developing countries, the conceptualisations of eye-level cooperation included similar dimensions, such as in this statement of a head of department of one of the project management agencies in view of the African Regional Science Service Centers:

> "For me, eyelevel means that a partner defines the own interests, and these are taken as seriously as our own. And it's about how you pursue these interests. Partners have to contribute something in line with their possibilities. They shall not expect funding just because they are poor. They must contribute what they can. There will be imbalances in many cases in view of financing, that's ok. What's important is mutual appreciation, to take the interests of the other serious, and not to say: 'I pay, and therefore I decide.'" (PT04)

The idea of *ownership through cofinancing* was conceptualized as closely tied to cooperation on eyelevel in other definitions as well. An interviewee stated in view of the Megacities funding initiative that "[o]n the German side, we have to be convinced that there is a high and resilient interest in the partner countries. It's secondary if the own contribution is in kind or in cash. Then the probability is high to achieve some kind of impact. And impact is what I want." (PA03)

Accordingly, conceptualisations of eyelevel with developing countries encompassed ideas of ownership, joint decision making and financial contribution as well. Although interviewees acknowledged that the financial contribution would not have to be on equal terms to lead to a cooperation on eyelevel, but deemed in-kind contributions or lower shares sufficient, only cofinancing was an acceptable proof of interest, and thus guaranteed ownership of partner countries in the joint research cooperation.

In case of the IWRM and Megacities funding initiatives, which in contrast to newer funding initiatives as the African RSSCs still originated unilaterally in the BMBF, the insistence on eyelevel cooperation also argumentatively backed up the practice of unilateral funding. The BMBF pictured the provision of cofunding through the partner countries as a precondition of their ownership. Defining eyelevel as financial ownership provided the BMBF with a plausible legitimation of not stepping in with any support in case of insufficient funding on the partner countries' side.

As in case of transdisciplinarity, the conceptualisation of eyelevel cooperation was a political issue and employed to serve a purpose. Framing cooperation as *on eyelevel* fulfilled a legitimizing function. Eyelevel implies a balanced, fair cooperation among equal partners. The term sounds ethically and politically correct. Nevertheless, the practices of cooperation subsumed under the term rather served to maintain a German benefit and perpetuate imbalances.

Cooperation on eyelevel as a unique model of cooperation?

In fostering cooperation between researchers from Germany and from developing countries and emerging economies, science policy for international cooperation with developing countries and emerging economies takes place in a discursive context that has traditionally been shaped by ideas of colonialism and more recently, development cooperation.

In this context, conceptualizing research cooperation as a cooperation on eyelevel, as a type of cooperation specific to research cooperation funded by the BMBF, may also be interpreted as an attempt to demonstrate the ministry's uniqueness. The following quote illustrates the BMBF's idea of eyelevel cooperation as well as its wish to set research cooperation and science policies off from development cooperation and policies:

> "[T]he BMBF does not provide development aid, and it expects its partners to assume responsibility in the form of 'ownership'. The BMBF emphasizes partnerships in which both sides are on equal terms. The BMBF's activities abroad are thus always cooperation efforts 'with a country' and not efforts 'in a country'. This also applies to its cooperation with developing countries." (BMBF 2014e: 24)

It is paradox, however, that next to mutual interest and benefit, the ministry uses *ownership* as a means of differentiation from development cooperation. The BMBF here relies on an obsolete image of development cooperation. In development cooperation, the concept of ownership actually has a strong tradition, having turned into one of the international binding principles agreed upon in the Paris Declaration from 2005 and the follow up Accra agenda in 2008 (OECD 2008).

Nevertheless, the concepts attached to ownership and cooperation on eyelevel within research cooperation and in development cooperation differ. While according to the Paris Declaration, ownership means that "partners have operational development strategies" (OECD 2008: 9), hence that partners *own* ideas, strategies, and are in power to put these into practice. In the prevalent definition in development cooperation, ownership is consequently not necessarily tied to the financial resources necessary to achieve objectives.

As pictured above, in previous funding initiatives including IWRM and Megacities, the BMBF presented the contribution of own financial resources as essential for a balanced cooperation in research. In FONA3, a change of conceptualisation is evident: Here, the Sustainability Subdepartment tied the concept of *eyelevel* to common interest, joint agenda setting and instruments adjusted to each partner country's potential – without mentioning financial modalities at all (BMBF 2015e). The BMBF's definitions of ownership and eyelevel cooperation thus begin to converge with the BMZ's idealtypes of partnership with developing countries and emerging economies, rather than serving as a distinguishing mark.

Despite all attempts of science policy to demarcate itself from development cooperation, it builds upon the same, deeply engrained public discursive assumptions and perceptions of the world in view of knowledge, development, order, and roles (ch. 2.3). As such, many underlying assumptions about the role of developed countries in cooperation with less developed countries, as well as the patterns of cooperation, are used both in development as well as in science cooperation, although they operate in different political settings.

The perception of the Western, civilized, advanced expert who transfers knowledge, capacities, technologies to less advanced stakeholders is one of the world views shared in both settings. Some interviewees were aware of the difficulties that arise as an aftermath of the colonial legacies of viewing cooperation countries merely as a source of data, but argued that cooperation today follows a different logic: "The science colonialism of 50 or 20 years ago doesn't exist anymore." (PA07) In this respect, from their point of view cooperation on eyelevel could potentially provide a frame to new emancipatory practices replacing disrespectful, unbalanced forms of (exploitative) cooperation.

However, I maintain that the practice of not designing bilateral calls, as in case of the IWRM and Megacities Initiatives, still embodied the idea of viewing countries as a research *subject* instead of research *partner* (ch. 7.2). A paternalistic attitude remained among some interviewees within the BMBF. In view of cooperation with Africa, one of the interviewees stressed that access to data sources remained one of the key objectives of science funding for the German side:

> "We don't fund research for sustainability or solving problems of the Third World or of emerging economies, but knowledge-driven. That way both sides benefit. In Namibia, they get complete atlases of biodiversity, which they can use for political decision processes. That's science, basic research." (PA11)

While the statement rightly points at the mutual benefits of cooperation, in terms of knowledge creation, statements like the above convey old patterns of thinking: Knowledge is created by German partners, who derive a scientific benefit out of the access to biodiversity as a subject of research. The product is then handed over to their partners in Africa, who are merely recipients of expertise, and thus are *not* partners in cocreating knowledge on eyelevel, to use the BMBF's terminology.

Cooperation on eyelevel and capacity development

While one could argue that cooperation on eyelevel would entail the mutual exchange of knowledge in multiple directions – between partners from developing countries and emerging economies and German partners, between different stakeholders and scientists, across disciplines, etc – the BMBF does not include any concepts of *mutual learning* in its policy documents, which would imply an equal value of all different types and sources of knowledge. In a sense, the BMBF thereby reaf-

firms its hierarchical view of valid, western scientific knowledge as opposed to the knowledge of partners in developing countries and emerging economies, which need to catch up to become truly equal partners.

Without reflecting about any implications in view of the validity of different types of knowledge, the BMBF established a causal relation between capacity development and cooperation on eyelevel in more recent funding initiatives such as the African Regional Science Service Centers. Capacity development was pictured as a precondition and used as a means to enable partners abroad to cooperate on eyelevel. Capacity development efforts aimed to overcome the existing inequalities between countries in view of science as well as the larger institutional landscape of science management and funding.

While from a critical perspective, capacity development efforts don't challenge the Western epistemological hegemony and leave the superiority of western knowledge in the global science system unquestioned, from a more sympathetic perspective, incorporating capacity development aspects within the newer funding initiatives are attempts of structural change, overcoming knowledge gaps in research, and fostering the independence of the African partners from the German partners.

In case of the African Regional Science Service Centers, independent decision making was encouraged on the political level, too, as this was seen as one of the pillars of cooperation on eyelevel in the funding initiative. According to interviewees in the Sustainability Subdepartment and the corresponding project management agency, capacity development measures were included wherever inequalities became apparent – ranging from scientific to institutional capacities, such as managing research funds (interviews with PT01, PA11).

However, critical interviewees doubted that cooperation on eyelevel was possible at all as long as any asymmetries of resources existed between partners. In their view, cooperation on eyelevel was an illusion as long as one partner was able to preselect topics, types and mode of cooperation and thereby to set the agenda: "Cooperation on eyelevel begins if partners share a mutual interest and ask themselves which comparative advantages exist between them; which knowledge and capacities are brought in by which partner and how can they be combined in a structured way." (EE06) Essentially, cooperation on eyelevel thus is a question of power distributions. This is also reflected by the analysis of cooperation patterns in the practice of cooperation on the level of projects.

Cooperation on eyelevel in project practice

Fulfilling normative expectations of *partnership* seemed difficult in cooperation in practice within many projects funded in both the Megacities as well as the IWRM funding initiatives. Existing structural inequalities between partners from industrialized countries, developing countries and emerging economies, such as unequal

quality of tertiary education, lacking access to data or publication options in the partner countries, and a tendency of the international peer-review system to favour researchers from industrialized countries (Bradley 2007; Upreti et al. 2012) contributed to imbalances in the consortia. Additionally, the arrogant mindset of some German researchers complicated interaction as equals.

However, even stronger negative effects on partnership were caused by the lack of access of the partner countries' governments to decision making. As a side effect of the practice of unilateral calls for funding, researchers in the partner country were not illegible to receive matched public funding within their countries. The reason behind the lack of cofunding however, was not, as the BMBF had argued, a lack of interest within the partner countries. The case of the Megacities project in Lima illustrates a problem encountered by other projects in cooperation with teams from developing countries. At the time of the project's start, the Peruvian funding structures for research were still not well-developed. While the country had economically prospered, its research governance was still lagging behind. In an interview, a Peruvian government official stated that the available governmental research funds were scattered among different ministries and not well coordinated. A memorandum of understanding for cooperation with Germany, had not been signed yet at the time. Cofinancing a project was still not possible, as the Peruvian funding structures simply did not match the requirements of international project funding yet (interview with EE12).

In case of IWAS Brazil, as a cooperative project with an emerging economy, the problem was rooted at a different level. With a long-established Ministry for Science, Technology and Innovation, well developed funding structures on the national and regional level, endowed with substantial funds and a corresponding institutional set up to distribute those, as well as a ST&I agreement between Germany and Brazil, the lack in cofunding was not caused by inadequate institutional structures. Rather, the lack of cofunding was a direct consequence of non-cooperation on the ministerial level and subsequently of the well-defined bureaucracy in place, whose norms and rules for project funding did not permit a posterior grant of funding:

> "The CNPq cannot just jump onto an existing unilateral funding if the Brazilian partner is already selected. IWAS only approached us when Germany had started funding […]. There was no joint decision for this project between the funding institutions. In the Mata Atlantica project, it was similar. Our hands are tied, it would be contradictory. The CNPq funds projects based on competitive calls for proposals, as the BMBF does. And all researchers have to stick to that. Special projects such as in the case of IWAS would be out of the funding rules, beyond legal requirements." (EE08)

The practice of not coordinating calls with partner countries' governments on time thus led to missing funding on the Brazilian side of the IWAS Brazil consortium. Additionally, the projects in both the Megacities as well as the IWRM funding initiatives lacked political back up in the partner country as a consequence of insufficient cooperation in agenda-setting practices. Due to missing political links between the BMBF and the partner countries' governments, researchers encountered practical problems such as lacking research permits, difficulties to establish links with higher officials in partner countries, problems with importing research and lab equipment, and the like (fieldnotes LiWa, 01.08. -30.09.12, fieldnotes IWAS Brazil, 01.10.-30.11.12, interview with PP03).

More importantly, however, the unilateral mode of agenda setting as well as the discourse of cooperation on eyelevel – as a legitimation of not providing funds for partners – led to power effects in terms of the *subject positions* offered within the projects. In almost all projects of the Megacities as well as IWRM funding initiatives, partners from the partner countries supplied person power, research infrastructure, office spaces, access to data, etc, thus contributed in kind to the research projects. They unanimously stated that their workload was very big, as a consequence of lacking funding: "We don't have any additional funds for research. We often pay this ourselves." (PP15)

Partners did not receive funding comparable to the German partners, neither from the German side nor from national funding institutions. In some cases, German project coordinators partially financed project members in partner countries through sub-contracting or other gaps that the BMBF's principle of "no exchange of funds" left open (fieldnotes LiWa, 01.08. -30.09.12; interview with PP38). Nevertheless, in most projects, participants of the partner countries had to carry out the project work next to their daily routine work in universities, administration, etc, and had less time than the German partners to spend on the projects. In contrast, German partners were endowed with funds for research, and in many projects PhD students and post-docs exclusively worked for the project's objectives. A German member of the IWAS Brazil project stated that

> "[t]he partners need cofunding. The Brazilians worked for the project at the sidelines of their jobs, while we had whole working groups exclusively for the project, burning for it. But in international cooperation, you need partners. If they lack capacities and incentives, it's no wonder that work is done at a different pace. Exchange of data and discussions were difficult. Cooperation was difficult." (PP07)

Next to the financial imbalance and the inequalities in available time dedicated to the project, in many IWRM and Megacities projects a further skew consisted in the *type* of project participants: Researchers were often concentrated on the German side of the consortium, while on the partner country's side, the team was primarily made up of non-scientific partners, such as problem-owners or stakeholders. A

Peruvian project participant of LiWa noted that "[t]here were not enough Peruvian researchers in the project. There was no money, it was more of a German research. But it should be equal – one German on one Peruvian researcher" (PP02). Project participants argued that the project-internal hierarchies were not based on a typification into *Germans* and *partners of developing countries and emerging economies*, but rather on the financial back up: "The hierarchy within the project depended on the role in the project. A partner with little budget and less tasks is set up differently than one who has loads of money for workshops, travel, person months. They have more room to spread." (PP40) However, as the German partners had access to funding, while the Peruvian partners did not, the financial imbalance parallelly enforced the distinction between the German partners and the one of developing countries and emerging economies, instead of contributing to a joint identification with a common goal. Pre-existing stereotypical patterns were thereby reinforced.

The informal hierarchies stemming from the inequality of resources caused dissatisfaction among many participants from partner countries, who often felt that the German partners neglected their ideas, demands or suggestions (fieldnotes LiWa, 01.08.-30.09.12, fieldnotes IWAS Brazil, 01.10.-30.11.12). In addition, partners in many projects had to cope with a mindset of the German partners that further enhanced stereotypes of colonial inkling: "Some people felt that in the end they just had the role to provide samples. They felt they weren't really part of the project but were doing services for the project." (PP19)

Project participants within the partner countries felt degraded to data deliverers and recipients of knowledge. This practice of *knowledge extraction* was often linked to perceiving the partner country's reality as a research *subject.* In addition, the practice of unilateral analysis of data perpetuated old patterns of thinking: A superior, more knowledgeable Western experts providing people from developing countries and emerging economies with lacking knowledge. As one project participant put it, knowledge transfer was a one-way street from Germany to the partner countries. Instead of a joint knowledge creation, German partners sometimes ignored the capacities within the partner countries; and partners in developing countries and emerging economies therefore perceived them to be patronizing. The mindset among many Germans still had not adapted to balanced types of cooperation beyond knowledge transfer, as project participants noticed in different projects. This statement of a project participant from the IWRM project Isfahan illustrates the case: "There is a mental gap. Partners are not seen as equal. Although the Germans say that they are partners, they always feel like providers, never like recipients of knowledge. And if the others don't want to be the recipients of their knowledge, they are stupid." (PP10)

A partner of the Megacities project in Casablanca argued that continuous awareness raising among both sides of the consortium was essential to overcome patterns of colonial thinking: "Cooperation on eyelevel is not easily done. Transfer

thinking was the established mindset for too long on both sides. We repeated like a mantra that the Germans do not bring along ready-made knowledge for the cities of tomorrow, but that we have to generate that knowledge together." (PP38)

The concentration of resources in the hands of the German partners; the power over the project's direction, the imbalances in view of available time as well as the inequalities in view of the type of partners in many projects thereby reinforced *patterns of thinking and social typifications* reminiscent of colonial times and a model of cooperation that the BMBF's discourse of cooperation on eyelevel had originally tried to overcome, including binaries such as rich vs. poor, expert vs. lay person, master vs. servant, modern vs. to-be-developed, donors vs. recipients. Although this might not have been an intended consequence of the BMBF's policy discourse, the accompanying practices thus served to maintain a specific order of reality (Keller 2013).

Beyond these perpetuations of obsolete, disrespectful mindsets, the project practices also had consequences on the potential effects. If transdisciplinary, participatory research is key to implementation, ownership may arise not only through supplying own funds, but also through the level of involvement in the project, the feeling of being an active contributor of valuable work and knowledge. As a partner of the Megacities project in Peru stated, who was simultaneously involved in an EU-funded FP7 project that funded the Peruvian partners as well:

> "In the EU-project, we are more involved because there we do the research ourselves, and we coordinate a work package. This is more horizontal and equal. We are all investigators. The community people are investigators – all types of knowledge are considered valid. All partners have the same budget" (PP01).

In the end, enabling joint knowledge creation seems more important for ownership and cooperation on eyelevel than the source of funding. For a balanced partnership, the endowment of partners with equitable funds, whichever source these may stem from – the BMBF, third parties or the partner country's government – thus seems to be key.

9.3 High expectations, low conceptualisation

Although the ministry raised high expectations in view of creating impact through the research projects, the BMBF's level of conceptualisation of how projects cause impacts, its theory of innovation, was rather low. As chapter 9.2 shows, transdisciplinarity and cooperation on eyelevel were conceptualized as modes of research cooperation conducive to producing the outcomes desired. Next to applying these principles of cooperation, no further ex-ante criteria for creating effects were available to the projects. Mechanistic and simplistic ideas of how innovations developed

and succeeded as results of the projects funded seemed prevailing. A member of the Megacities advisory board illustrated his impression that the BMBF clung to a linear notion of innovation, without taking into account the barriers hindering their implementation in context coined by different interests and systemic resistance to change:

> "You have got a problem, look at it really well, find a solution, and then the problem is solved? Well, no! [...] Technical solutions are one part. But in introducing them into a system, if they concern deeper change, then you deal with economic interests and political influence [...] Real change is always met with massive opposition. Change processes have to be designed and accompanied, that is different from developing a solution. Which is important, as well. But the idea for a solution does not lead to its implementation." (EE06)

In the BMBF's conceptualisation as stated in FONA, innovation fails because the financial risk to make use of promising research results is too high for the business partners involved, which therefore require additional funding:

> "[E]ven promising research and development findings often lead to a dead end: many a solution that is technically feasible is not actually put into practice. This is due to the high entrepreneurial risk, combined with the necessary increase in scale from the laboratory or technical centre to the pilot and demonstration scale." (BMBF 2015e: 7)

This is a quite simplistic explanation which lacks reflection about other systemic factors determining successful innovation or transformation. The lack of reflection on impact, innovation and implementation harshly contrasts with high expectations of outcomes as impact of the projects (ch. 9.1, 10.2). In their emphasis of producing outcomes, the BMBF especially pushed for visibility. Different BMBF employees, involved in IWRM as well as in the Megacities funding initiative, stressed their expectations of touchable, physical results, as this quote illustrates: "I met all IWRM projects in Leipzig and strongly emphasized that we want to see results. Not just publications and travelling, but tangible results." (PA14)

I maintain that the focus on visible, physically observable outcomes and solutions enabled the BMBF to better demonstrate that their funding measures had an impact. The tendency to favour visible, easily graspable results over more complex solutions can be explained as a result from previous policies for cooperation with developing countries and emerging economies which produced irrelevant data and research results, useful only for the careers of the German scientists involved – a form of research cooperation that had been criticized by development practitioners in the past (interview with PT01). In consequence, favouring visible results also was used as a strategy to prove that public money was spent effectively. Especially on the background of the BMBF's competition with other ministries (ch. 8), being

able to highlight policy successes, showing proofs of investing public money wisely, is perceived as crucial.

Focusing on solving concrete technical problems and solutions through its research projects – rather than addressing systemic issues of sustainable development in partner countries or fostering these may be a consequence of the need to show policy success as well. At the same time, accentuating visibility further favours technical solutions and thus re-enforces the BMBF core discourse. Social, non-technical solutions, such as governance schemes – let alone effects on other systemic levels, such as sustainable innovation systems abroad – are often more complex and not as easily visible or understandable as a technical, physical solution, such as a waste water plant. Additionally, the effects of non-technical solutions are more difficult to measure, and their impact is often harder to trace. As has been argued in view of the adverse effects of performance measurement in development cooperation, a strong focus on a specific issue – such as visible results in the BMBF's case – often causes tunnel vision among the projects as an adverse effect. Issues that are measured, or in the BMBF's case strongly emphasized, are focused on at the expense of aspects attributed with less importance (Holzapfel 2016: 7). The strong push for traceable, visible outcomes consequently influenced the type of solutions searched within the projects (ch. 10).

The focus on results caused a high pressure on the projects to succeed in view of the implementation of solutions created in the earlier stages of the projects. While stressing impact, a reflection about the potential factors conducive to or impeding impact was not encouraged. Even in the Megacities initiative, which in comparison to IWRM was open towards any type of output and encouraged a transferability of results, the BMBF did not expect deeper scientific reflections about the conditions and context of impact as a type of transformation knowledge but emphasized transformative research (on differences between transformation and transformative research, see WBGU 2011). Instead of turning the implementation of results, the innovation or transformation process into research questions, concrete results were to be implemented. This affected the type of knowledge production within the projects substantially (ch. 10).

The strong emphasis of producing technical results also touches some deeper questions about applied research (funding). What does it imply for the nature of science if a failure to produce an innovation is seen as a failure of a research project? If so, what distinguishes it from implementation-oriented projects of development cooperation? Should science, especially in view of the freedom of science, be shaped into an instrument of technological solutions? And what consequences would this have for the ability of the science system as such to cope with global challenges of all kinds, including complex, non-technological problems?

Beyond these philosophical questions touching the nature of science, neglecting the potentials of reflecting about innovation as well as about failures of pro-

ducing innovation also forfeits a big potential to generate transferable transformation knowledge for global sustainability. Reflections about implementation and innovation processes; about enabling conditions and reasons for failures, about researchers' roles in facilitating innovations and implementation should turn into research questions of funded projects, instead of conceptualizing success exclusively as a visible innovation.

10 Policy effects – coining realities

Discourses have different power effects on different scales. In the previous chapters, some power effects of the BMBF's policy discourse have become clear: A first power effect is to be found in its ability to shape the general policy direction. In the chapters on policy processes and external actors in policy making (ch. 6, 7), I have demonstrated the ministry's power in orienting the contents of the policy discourse by including selected actors and knowledge into the coalition or excluding alternative discursive assumptions.

Maintaining its steering capacity and power over the discourse contents furthermore requires monitoring the research projects in their implementation. As a type of translation of discourse contents to a further level, any implementation process of policies bear risks of re-orientations. The BMBF therefore makes use of a specific dispositive, thus of a strategic infrastructure of practices and institutions which are aimed at creating and monitoring the external effects of discourse (on the theoretical premises, ch. 3). This dispositive includes measures aimed at implementing the specific policy direction envisaged, and thus ranges from explicit criteria of selection within the calls for proposals to controlling instances such as selection committees, to the project management agencies working on the BMBF's behalf in supervising projects and controlling funds, to accompanying projects, etc. While the dispositive contributes to the self-reinforcement of the policy discourse, I argue that through the dispositive, the BMBF also seizes its power over maintaining the status quo of the institutional arrangement among actors as a strategy of discourse stabilisation (ch. 10.1).

A further power effect of policy discourse become relevant in view of the specific discourse on research cooperation with developing countries and emerging economies in sustainability research. The underlying conceptualisations of the effects envisaged, embedded in the specific funding initiatives as most concrete policy levels, coin a specific reality in the projects. The discourse as such thus exerts influence on projects – a fact that is not surprising. As argued in chapter 9, public policy is inherently aimed at causing effects on the real world. However, projects still seized niches for agency, thereby re-interpreting the policy discourse and actualizing it based on their ideas (ch. 10.2). The effects that a funding initiative as a

specific science policy creates therefore rely on both the policy frame as well as the translation into practice by the research projects.

10.1   Effects of policy on projects: Monitoring as a strategy for stabilizing discourse

Most fields of public policy cause effects through laws and regulations, through incentivizing certain behaviour or through preventing others. Science policy as in the case of the BMBF, in contrast, aims at effects at different levels, I'd like to maintain. Science policy aims to shape science and through science: Policies aim to foster science as such and to shape the science system. But at the same time, the BMBF also targets further objectives beyond science. The funded research projects thereby turn into *mediators* of policy objectives. Although not a primary aim, attributing a mediator role of specific policy objectives to the research projects also influences and shapes the science system in the long run.

From the perspective of policy, the existence of this added layer of producing policy effects is important: On the one hand, expected policy effects may get lost in transmission – projects may use their room for agency to reinterpret and adapt the policy discourse. Therefore, policy makers, interested in creating the effects envisaged, monitor projects. On the other hand, the added level of research projects enables the ministry to shift any perceived burden of proving effects, impact or success from the *policy level* to the *project implementation level*. Instead of expecting success of a policy as such, projects can be controlled and supervised in view of their performance. Requesting impact of projects thereby turns into a double-layered strategy of discourse stabilisation and institutional stabilisation used by the BMBF: Impact is conceptualized as a responsibility of the *projects*, which are accordingly scrutinized in view of their results. The role that the funding initiative plays in guiding, enabling and restricting the projects' practices is not part of regular scrutiny and therefore left untouchable to potential criticism. While projects may be blamed for any failure, such as not reaching envisaged objectives, any positive outcomes, such as visible results, can still be attributed to the BMBF and cited as a policy initiative's success story. In a perceived atmosphere of harsh competition between ministerial units, departments and among ministries, this is vital (ch. 7.1, 8.4, 9.2).

The BMBF's objectives and expectations of impact are revealed in the calls for proposals for new funding initiatives. In addition, the ministry's assumptions of how projects achieve effects encourage a specific mode of conducting research within the funded projects (ch. 9). After selecting projects based on these criteria, the BMBF undertakes efforts to further guide the direction of projects and to monitor their implementation. During the implementation phase of selected projects,

the alignment of projects to the BMBF's objectives and expectations is constantly reviewed by making use of a dispositive. This dispositive consists of the instruments and institutions of monitoring aimed at ensuring that projects stay in line with the objectives of funding, thus to make sure that the policy discourse is transmitted to the level of project practice.[1] The project management agencies took over supervising and controlling tasks on behalf of the BMBF until the projects end, requiring a documentation in final reports as a last self-assessment (interviews with PA11, PT06).[2]

Both in the Megacities initiative as well as in the IWRM initiative, project funding was split into subsequent phases of funding, with projects required to report on their progress interim in order to receive continued financial support. The ministry thus was in power to end projects by withdrawing resources from projects that did not meet policy expectations. While a premature ending of funding was not a common practice in the main phases of funding initiatives, with the thematic re-orientation of the Megacities funding initiative, some Megacities projects indeed ran out as they did not match the renewed focus of funding (interviews with PT07, PT09). In line with their mandate, the BMBF possesses the power over distributing financial resources, and with it a powerful dispositive of transmitting and stabilizing policy discourse on the project level.

Next to interim reporting, the projects had to present their results in so-called *status seminars*, which took place regularly in both funding initiatives. In case of the Megacities initiative, an interviewee stated that:

> "Status seminars aim at enhancing exchange between the projects, and they are helpful for the project management agencies and the BMBF to observe how far along they are, if goals are achievable or have to be adjusted. It's a sort of self-disciplining for the individual projects to stick to milestones. Although they have been granted a budget for five years, they have to present their status regularly, and show which results they have produced, in which direction they proceed." (PA03)

The advisory boards of the funding initiatives as well as crosscutting accompanying projects of the funding initiatives fulfilled further roles within a dispositive aimed at reinforcing effects: The advisory boards of the Megacities as well as the IWRM funding initiative both rather aimed at monitoring projects than at advising the

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1 In chapters 6 and 8, I analyze the larger institutional structures of the BMBF as part of the dispositive of its main policy discourse.

2 According to an interview with PA11, the BMBF assessed a project's success based on the criteria and expectations included within the original call for proposals. In case of IWRM, the standard forms also included a section on the utilisation of results, that (contradictory to the funding initiative's objectives stated elsewhere) only inquired about the economic utilisation of research results, such as market potentials of solutions. Asking merely for the economic viability of results is yet another manifestation of the BMBF's core discourse and technological history.

ministry in view of the policy frame. The BMBF did not consult members of the advisory boards regarding the strategic direction of the programme, did not have a steering function and did not influence changes: "The advisory board was no scientific advisory council for the programme, thus for the programme design, but it was a panel of experts that evaluated the individual projects in view of their work progress." (EE06)

To support projects within the CLIENT and IWRM funding initiatives, the BMBF additionally commissioned an accompanying project titled Assistance for Implementation (AIM), carried out by the International Bureau. Primarily, AIM assisted projects in establishing contacts to development banks and other relevant stakeholders to ensure the upscaling of technological pilot measures that had been developed within the projects (interviews with PA02, PA06, PP06). While officially meant as a support to the projects, many IWRM projects perceived AIM as a controlling agent and felt insecure if AIM recommendations were optional or prescriptive. While AIM itself stated to be purely advisory, feedback reports of the project management agencies critically noted if projects did not follow AIM recommendations (PP40).[3]

Within the Megacities initiative, the crosscutting accompanying initiative supported reflection over implementation activities in later stages of the funding initiative (Future Megacities Support Team 2012). In the prephase, projects were to reflect about potential impact based on a log frame matrix, a tool widely used by the GIZ: "The idea was to support and evaluate the projects in the sense of a service form them. As a self-evaluation." (PT07) According to interviewees, many Megacities projects contested the idea to transfer a monitoring instrument of development cooperation to research projects, questioning its suitability for research as an open-ended process of knowledge generation. At the same time, projects were insecure whether not complying would have negative consequences (interview with PT07, fieldnotes LiWa, 01.08.-31.09.12).

In case of both AIM as well as the GIZ self-evaluation, it was left unclear to projects if the accompanying instruments for reflection on impacts were merely advisory or would also be used for project controlling with negative consequences. The existence of the instruments, of the dispositive in the SKAD sense, had power

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3 The existence of AIM demonstrates a few further points. First, AIM proves the BMBF's awareness of its high expectations in view of impact, which, as one interviewee admitted, proved too high for researchers to fulfil who were not able to adequately cope with the task to research and implement or upscale solutions at the same time. Second, AIM also reveals a linearity in the conceptualisation of impact underneath its requirements for transdisciplinarity. If projects were set up in partnership with stakeholders from the beginning, there would not have been any need for AIM. Third, AIM also points to the BMBF's technological discourse. The accompanying measure was purely aimed at assisting with the financing of large-scale technological solutions.

effects, as projects were hesitant not to fulfil potential demands. As has been observed for other instances of evaluation, due to the insecurity about negative drawbacks arising from honest reflections, the projects rather presented their results in the best way possible, hiding underlying problems of implementation from the project management agencies and the BMBF (interview with PT07). In the critical light that constructivist policy research sheds on policy evaluation (Box 10-1), this is not a surprising finding.

Box 10-1: Policy evaluation

Despite the importance attributed to the impact of the projects funded and the apparatus of project monitoring and surveillance, external evaluations about the impact and effects of neither projects nor of the policy initiatives as such were a common practice in the BMBF at the time of field research. The BMBF-funded project Optionen shall be mentioned here as an exception. The project gathered best practices among projects of two previous BMBF funding initiatives for international cooperation in sustainability research in order to present options for improving project set ups and consequently the impacts of inter- and transdisciplinary projects (Lange and Fuest 2015). While the results are relevant for both project implementation as well as policy level, future will tell whether these will be integrated into the design of new funding initiatives.

Interviewees attributed the lack of missing project evaluations – apart from the final self-evaluations – to the ministry's fear of obtaining mediocre results and not being able to expose project results as programme success (interview with PP27).

From a constructivist perspective, the absence of evaluations of the policy as such is not a shortcoming, either. Since Pressman and Wildavsky's seminal work on policy implementation (1984), social scientists have reflected about the inherent complexity of translating policy expectations into specific effects and challenged the explanatory validity of impact evaluations of policy (Jann and Wegrich 2006). Difficulties of establishing causal relations between a specific policy, research funded within its frame, and a phenomenon in the real world are widely acknowledged (Douthwaite et al. 2007; Pregernig 2007; Sumner et al. 2009; Martin 2011; Bornmann 2013; Ely and Oxley 2014).

However, the fact that no regular evaluations of policy effects were carried out within the BMBF at the time of empirical research is telling. Reality contrasts with conceptions of an idealtype policy process, in which policymakers continuously reflect and evaluate their actions and programmes, adjusting methods, envisaged impacts, and objectives, thus changing directions whenever necessary in order to improve policy effects (Wildavsky 2007 [1979]; Jann and Wegrich 2009). Evaluations potentially point at needs to change practices and institutions and thus may come with organ-

isational costs attached. Yet, bureaucracies such as ministerial administrations are rather interested in stabilizing their status quo than encouraging change as a result of evaluations (Weingart 2006; Wildavsky 2007 [1979]; Jann and Wegrich 2009). Not evaluating policies is thus a strategy of discourse stabilisation, I put forward.

The endeavour to evaluate science policy can also be challenged in view of the possibility to produce meaningful results. If evaluations are done, their framing and outcomes depend on the social actors involved in the previous policy process, interdependencies, such as stakes of the usual addressees of a certain policy (Wildavsky 2007 [1979]; Jann and Wegrich 2009). Framing evaluations according to the own needs is therefore a further strategy of reiterating discursive directions. This inherently normative and political nature of evaluations is illustrated by one of the exceptional instances in which BMBF funding initiatives were indeed reviewed. Before designing FONA3, the BMBF selected a few funding initiatives out of FONA2 to be assessed, among them the Megacities funding initiative. In the audit, project coordinators were to present their project results in front of a panel of external reviewers as well as BMBF and project management agency staff (email exchange with PP05, interview with PT09). The projects input on their systemic orientation, transdisciplinary set up and their innovations developed were then summarized in a conclusive report. Although the audit was not aimed at assessing individual projects, but at lessons learnt of the programme as such, projects did not dare to address any critical issues about the funding frame and rather pointed at successes than at difficulties. In addition, the audit also demonstrated the self-interest of the ministry as well as the project management agencies involved in funding. Admitting a programme's failure could potentially have negative institutional consequences, such as not receiving further public budget for similar funding initiatives. An interviewee of one of the project management agencies acknowledged:

"Well, it wasn't a real evaluation. It was more of a dry run, and a sample. And only those funding initiatives were chosen that had a transdisciplinary approach already, while there are still many additional ones that don't. And of course, Unit 723 [the Global Change Unit] hopes, and so do we, that next year there will be a further research programme on urbanisation. We pushed for that." (PT09)

At the same time, the projects interviewed also stated that the BMBF was not keen on receiving any feedback in view of the funding conditions or the structure of the funding initiatives as such, either. No structured feedback loops between the ministry and funded projects existed. Different project participants as well as advisory board members voiced that the BMBF was not interested in learning about their experience regarding project set up, structural issues or country expertise (interviews with PP25, PP27, EE6), an impression that participant observation at a status

conference of the Megacities initiative and a FONA forum re-affirmed (fieldnotes on FONA Forum, 09.-11.09.13, fieldnotes on Megacities conference, 14.-16.05.13).

From a SKAD perspective, I argue that the BMBF's disinterest in integrating project knowledge into policy is a strategy of maintaining authority about the policy discourse by minimizing potentials for discourse actualisation. Researchers in BMBF-funded projects are addressees of the BMBF discourse on cooperation, while in carrying out projects, at the same time they contribute to stabilizing the discourse through their practice. Enabling them to frame problems from their own perspective might endanger the BMBF's powerful position and contribute to the transformation of discourse. The BMBF therefore only superficially grants room for reflection and feedback. This adds to the pronounced tendencies of discourse stabilisation – instead of discursive change – through discourse coalitions described in chapters 6 and 7.

10.2   Projects between the influence of policy and rooms of adaptation

10.2.1   Intended effects, side effects and their representation

After looking at the means of creating policy effects, of stabilizing discourse in the process of transmitting policy to the implementation level, this section focuses on the effects as such. Policies aim to coin realities and accordingly set a frame to the projects. The funding initiatives on Megacities and on IWRM did so in different ways and therefore provide an interesting contrast. They left different scopes of agency and interpretation for the funded projects – which substantially influenced the type of output that projects designed and implemented. The funding initiatives on the policy level thus enabled the projects to have certain effects on the real world and restricted others.

Whether denominating them as outcomes, results, products, innovations or as different types of knowledge: The projects in the Megacities as well as the IWRM funding initiatives produced a large variety of outputs targeted at science as well as in society. Appendices B-3a and B-3b give an overview over the different kinds of project outputs obtained in both funding initiatives – as perceived by the projects. It is important to mention this as a caveat: The overview mirrors the way in which projects *represented* their outputs in projects briefs, in the Megacities projects' case, and in IWRM information material, in the IWRM projects' case as well as in interviews, rather than giving an objective overview of project output. Practices of social construction of reality come into play in the representation of project outputs, too: The tables reflect only those types of outcomes which the projects perceived as important enough to be included in brochures and project briefs. These mirror the BMBF's expectations from the projects' perspective and display the policy

discourse. In the overview, blank spaces such as in case of output targeting individuals/households do not necessarily signify that projects were not engaged in that area, but rather that they did not perceive it as representable enough. Furthermore, the overview based on the projects' and funding initiatives' self-descriptions does not reveal to what extends the output developed turned into real innovations – thus if they were used, continued, put into practice or scaled up. Box 10-2 gives an impression of the external conditions of innovation from the projects' perspective. I assume that most projects produced additional outputs at different scales. This includes tacit types of knowledge, which due to its nature is less depictable; tangible types of knowledge not fitting into the categories, and output beyond traceable knowledge, such as trust, for example. Last, any interventions in the real world may also have unintended or unexpected side-effects on society, economy or the environment, both negative as well as positive ones.

Next to the explicit policy expectations, thus of the policy discourse on a content level, the BMBF's *practices* of discourse production affected the projects in their practice as well – especially the lack of including partner countries and other ministries in the agenda setting of the funding initiatives (ch. 7.2, 9.4.2). As a side effect of this mode of agenda setting, the lack of coordination among ministries – and thus of parallel, but incongruent discourses within development cooperation and research cooperation policies, determined the implementation, outcomes and effect of projects to a large extend in case of the IWRM call. Although the official call for proposals stated that the predefined model regions had been selected in view of the results of previous BMBF as well as BMZ activities (BMBF 2004a), the BMBF selected and funded projects in countries that were not priority countries of German development cooperation in the water sector. This led to the paradox situation that although research projects successfully adapted technologies in pilot plants or developed IWRM schemes for their project countries, German developmental donors could neither finance nor carry out any upscaling or implementation, as they had other thematic priorities in development cooperation and were bound to these through international conventions. The resulting difficulties in finding follow up funding for pilot projects eventually was also counter-intuitive to the impact that the BMBF envisaged as a result of the projects. Additionally, interviewees stated that the fact of not having a coherent German policy approach to cooperation led to confusion and irritation – among the team members of partner countries, as well as on higher governmental level (fieldnotes LiWa, 01.08.-30.09.12, fieldnotes IWAS Brazil, 01.10.-30.11.12; interviews with EE08, EE09, EE12, EE13).

Box 10-2: External conditions of innovation

Most projects of both funding initiatives developed one or more types of knowledge embedded in products, plans, solutions etc. on the level of administration or policy making. Next to the researchers' agency and the policy frame setting the conditions right, external factors play a decisive role in turning outputs into innovations.

Especially in view of outputs aimed at the governance level, the production of knowledge (or other types of results) relevant for the corresponding stakeholders in administration was emphasized. Otherwise, plans, strategies and software would merely fill bookshelves and desk drawers – instead of achieving further-reaching effects. Project participants perceived the inclusion of participants from the specific institutions as a first step towards the latter usage of the products, thus endorsed transdisciplinary project set-ups as a suitable mode of cooperation for solution-oriented research.

However, despite the involvement of administrative and policy stakeholders in the projects, the process of transferring results to practice was often a tenacious process. The stakeholders' institutions often lacked the capacities to process the jointly generated knowledge, to further follow up and accompany the implementation of plans, strategies or decision-making tools. In Peru, for example, frequent changes among personnel within the municipal administration, policy making, but also among stakeholders such as the water provider company were a barrier for institutional learning and continuity. With each new employee, decisions were revised, and information was lost, as knowledge was not adequately transferred and anchored on the institutional level. Therefore, project partners feared that effects of the projects would vanish after the project ended. Similar observations were shared by participants in other projects of the Megacities as well as IWRM funding initiatives (interviews with PP03, PP25). Coming up with results relevant for decision making thus did not necessarily mean that these were followed by implementation, even if the targeted administrative level had participated in the projects. The persons directly involved in the projects often were – or had already been – sensitive to topics of sustainable management, had acquired a holistic perspective on problems. On the institutional level, in contrast, sustainability had not yet turned into an encompassing discourse, a technical view persisted, which in turn led to decisions favouring less sustainable but cheaper, less complex, simpler solutions. Next to the commitment of individuals to the project goals, embedding the objective on the institutional level were pictured as essential for different institutional contexts across the partner countries (interviews with PP12, PP03, PP40, PP23). This, however, would require shifts in mindsets, political stability as well as capacity development on the institutional level, including processes and governance – tasks of a scope too big for individual research projects to tackle.

Being aware of the general sensitivity of the projects in view of perceived evaluation, I underline that in describing the outputs obtained and the effects intended by projects, I do not attach any valuation to projects based on their results. By enlisting different project results and by establishing categories, I rather wish to point at the *types* of outputs and effects emerging from the projects and not at their quality. I consider the types of outputs as *effects of the policy discourse* on the one hand, and the *room for agency* left to the projects on the other. My focus is thus *not* on appraising projects, but on exhibiting the enabling or restricting characteristics of the policy discourse; thus on the influence of the policy level on the projects and the room of manoeuvre of the project participants.

10.2.2   Effects on the real world as outcome of both funding initiatives

The Megacities funding initiative

As analyzed in chapter 9, the Megacities funding initiative enabled the research projects to research and find solutions on different scales and entry points. No type of solutions was prescribed. As stated in the call for proposals, project participants affirmed that the Megacities initiative left spaces for different solutions and levels of implementation: "I had the impression we were quite free in project design. [...] The BMBF just specified the requirements in the document in the beginning, which detailed that we had to do research for megacities, not about megacities. And all projects stuck to that." (PP05) This impression was seconded by other participants in other projects of the Megacities funding initiative, who felt that there was room to creatively use and extend the initiative's frame (PP38).

Due to the initial openness of the Megacities funding initiative in view of solutions, the policy frame thus allowed a large degree of agency of the project participants to orient their research to their interests and to the needs of the Megacities in focus. Moreover, the openness empowered the projects to start with a systemic analysis of the problem and to scrutinize all possible solutions adequate to the local situation and the problem at stake. The overview about the *types of outputs* stemming from Megacities research projects (Appendix B-3b) mirrors the high diversity of knowledge, topics, approaches and solutions developed in the context of sustainability in and for megacities, both within the individual projects as well as among them.

For example, LiWa, a project focused at sustainable water management in Lima, Peru, assessed the problem of water scarcity in in Lima from different angles. Research included integrative scenario development, climate and water balance modelling, macro modelling and simulation, inclusive governance processes, training and capacity development as well as water pricing. At a later stage, urban planning was included as an additional work package (LiWa 2012). Project partners on the German side were mainly scientists, while the Peruvian

side consisted of a broad range of stakeholders, including the water provider company, municipal institutions, NGOs, and only a few research institutions. After the initial systemic analysis, solutions were developed in the last stages of LiWa. LiWa research showed that waste water plants and other technologies already existed. However, they didn't work properly due to lacking capacities and high maintenance costs (field notes LiWa, 01.08-30.09.12). Thus, solutions were developed on the level of *management* rather than at a level of water supply or treatment technologies. They included new governance schemes, a modelling tool for decision support, as well as plans for water sensitive urban design including exemplary green areas as pilot studies. In participatory processes, promising measures for reducing water consumption and awareness raising on different levels were defined.

The Megacities project in Addis Ababa illustrates a different focus and approach. The project combined solutions to solid waste management with pro-poor innovations to empower local waste collectors, while also developing waste management planning tools for the municipal administrative authorities and implementing pilot projects on waste recycling. Yet another focus was chosen in the project in Hefei, which focused on transportation and traffic and targeted the administrative level. The project developed management concepts, traffic monitoring technologies as well as finance strategies and developed proposals for pedestrian-friendly city development.

Appendix B-3b also demonstrates that the innovations of the different Megacities projects targeted different levels, ranging from individual or household levels to innovations in governance and to the larger public. On all levels, a variety of technological as well as non-technological innovations were developed. Projects also included the adaptation and development of high-tech options, such as in case of the Hefei project's traffic management system, based on floating car data, video detection and digital audio broadcasting; or the multiple modelling, monitoring and simulation tools for decision support which projects developed for Lima, Hyderabad, Casablanca, or Urumqi.

Non-technical innovations ranged from designing strategies and concepts, which indeed were products of most projects, to institutional innovations, such as in case of the energy office, which the Megacities project established in Gauteng/Johannesburg, or in case of the inclusive and participatory processes for water management implemented in Lima. In contrast to the openness of earlier stages, after about five years of the initiative, the ministry, via the project management agency, began to push for an implementation of visible results and granted additional funds for implementing pilot projects (field notes LiWa, 01.08-30.09.12). In case of some projects, who had focused on *non-visible results*, this led to an adaptation of the projects. In LiWa, new German partners joined the consortium in order to add a planning focus to the original project scope. A concept for an

ecological park was developed and the park was to be promptly implemented. In contrast to the project management agency's or the BMBF's focus on visible, presentable results, however, within the project team the shift was rather felt to be an add-on, which the consortium agreed to in order to fulfil the demands, rather than a *necessary* innovation for the city's context – or for the project's main focus. In view of many project participants, the primary, more substantial impacts of the project were the less visible and less representable innovations of a participatory governance platform for water management, as well as in the decision support tool. They felt that the BMBF or the project management agency did not appreciate these as much as physical results, however (field notes LiWa, 01.08-30.09.12).

Participants in other Megacities projects similarly felt that towards the end of the funding initiative, the project management agency began to push for presentable results. Diverse project participants perceived the implementation of the accompanying project at a very late stage of the funding initiative in the context of the sudden focus on visibility, which they sensed to be a marketing activity to highlight the programme's success – and not as an instance of reflection about crosscutting programme results.

IWAS: A special case of a project framed as IWRM

The IWAS initiative was counted as an IWRM project in the scope of FONA, although it originated from a thematically open initiative on excellence in research and innovation in the new federal states (*Spitzenforschung und Innovation in den Neuen Ländern*) funded through a different ministerial department (ch. 5). The IWAS subprojects were not thematically adjusted when shifting into the responsibilities of the Sustainability Subdepartment. In contrast to the projects emerging directly from the IWRM call, the researchers in IWAS had a sort of *carte blanche* to design their project according to their conceptions. No specific expectations in view of the project direction were added (interviews with PT03, PP22, PP30, PA02, fieldnotes IWAS status colloquium, 06.12.2012).

Nevertheless, in view of the BMBF's expectations, IWAS tried to fulfil both the criteria of producing excellence in research as well as meeting the criteria of the IWRM funding initiative – which some project participants experienced as an internal conflict (interviews with PP22, PP29). In its first phase, IWAS focused on five model regions in Brazil, Ukraine, Mongolia, Vietnam, Oman/Saudi Arabia, in the second phase reduced to three regions (Brazil, Ukraine, Oman/Saudi Arabia). Instead of developing complete IWRM schemes for each region, IWAS focused on specific aspects of IWRM or water related problems and chose the model regions accordingly. The projects within the model regions chose different were thus planned to be complementary rather than comparative. While in some subprojects, research focused on water quality and analysis, others developed water or land use

models, looked at governance issues or emphasized capacity development, while others developed technologies. IWAS thereby targeted to come up with *building blocks* as contributions to IWRM concepts for regions of different climate and water profiles. Results of each regional subproject were to be fed into a crosscutting scenario and system analysis of hydrological cycles and linked natural and social systems (IWAS-Initiative 2012; Krebs and Borchardt 2012; Deppe 2013). As a result of not stemming from the IWRM call, IWAS as a whole was bigger in scope than a single IWRM project out of the original IWRM funding initiative, financially as well as thematically. However, each regional IWAS subproject was smaller and less holistic than a single IWRM project from the IWRM call (interview with PP30). As crosscutting issues, capacity development, scenario and system analysis, implementation, and governance were addressed in crosscutting working groups across different subprojects (fieldnotes IWAS status colloquium, 06.12.2012)

IWAS Brazil focused on different environmental influences on water availability, such as regional climate models, land use change, hydrology, water quality. Further work streams aimed at the development of pilot technologies for water treatment. On both the German and the Brazilian side, partners from research were strongly represented, while only the Brazilian water provider as well as the drainage provider were involved as stakeholders. IWAS Brazil did not include any social scientists and accordingly did not address questions of water governance, institutions, finance, participation[4] (field notes IWAS Brazil, 01.10-30.11.12).

While the implementation of the pilot plant for water treatment was the objective of the respective working group, including the water provider company, within the other working groups, no strategy of implementing results existed. Many researchers in IWAS Brazil were mainly interested in producing scientific outcomes and the implementation of results was not seen as a priority. This focus on scientific results is not a point of critique – the IWAS initiative did not have a prescribed applied focus, in contrast to the IWRM projects. Not concentrating on implementation therefore points to the researchers' interest in more basic types of science and the lack of a policy framing that encouraged application.

In the original project plan, a work package focused on integrating the results of the different work packages in a decision support system for IWRM. However, knowledge integration between the different work packages was not pushed for according to many project participants, and therefore the integration of the different results did not seem plausible anymore towards the project's end. With different institutions of water governance, such as the regional water agency, miss-

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4 Most project participants did not perceive the missing social sciences as a loss: "A project in a foreign country requires social competences of all people involved. You don't need social scientists. It's no use if one partner is a social scientist but the others behave like a bull in a china shop." (PP28)

ing in the consortium, it is questionable, however, if a decision support system would have been implemented by the stakeholders anyway (field notes IWAS Brazil, 01.10-30.11.12, interviews with PP07, PP17, PP19, PP21, EE26 and others).

In view of the interaction with the other regional projects of IWAS, a project participant stated:

> "I didn't have the impression to work within a larger IWAS frame. In the beginning I was confused… We met with the other IWAS teams and were told that we have to do excellent research and should integrate the results. Integration was central, with an IWAS tool box etc. At the large IWAS meetings, the original IWRM approach was present and people lived it. And then there was the harsh reality in Brazil as a complete contrast." (PP07)

Other interviewees from IWAS Brazil similarly stated that the overall approach of IWAS, to develop IWRM as an integrative concept, contradicted the focus of IWAS Brazil on basic sciences. Despite the contradiction between the overall application aims of IWAS, and the multidisciplinary focus of IWAS Brazil as a subproject, the Brazilian partners stressed that IWAS Brazil in the end had positive effects. Next to technologies tested, manifold scientific results were produced, and capacities developed in form of master students and doctoral candidates completing their degrees on project topics. In addition, the interaction among the Brazilian institutions involved in the project improved among different academic disciplines of water-related research, between the university and the research institutions involved, as well as with the water provider (interviews with PP17, PP19, PP21, PP43, PP48, PP49, PP50, and others).

In view of the transmission of discourse from policy to the implementation level, IWAS Brazil shows that the combination of a focus on excellent, non-applied research, as stated in the original call for proposals of PROSIN, with the focus on applied IWRM research may lead to contradictory tensions within the projects and may also lead to frustration and unfulfilled expectation among some project partners. On a different note, giving researchers a carte blanche in view of implementation, which was not target of the original call for proposals, grants spaces for *not* focusing on the application of research results. Thus, those researchers who joined the project with an underlying motivation of scientific excellence used their room of agency to focus purely on scientific output.

The IWRM funding initiative

As shown in chapter 9, the IWRM initiative expected a technological focus of the solutions developed in the projects. Nevertheless, the funding initiative was perceived to have left more room for non-technological innovations than the subsequent CLIENT call, which some of the IWRM projects later applied to (interview

with PP25). Project participants conceded to the technology-orientation of the policy objectives:

> "With our focus on technologies we reacted to the requirements. You can set up projects in many different ways. In that case, it was a multi-technology mix. We reacted to the High-tech Strategy and supported German technology providers. The project could have looked different, we could have moved towards resources management, decision support systems. Other things would have been possible. The funding conditions set a clear strategic frame and exert influence. In our case they pushed technologies, a transdisciplinary approach and IWRM. And overarching, sustainable development." (PP12)

Acknowledging that different, non-technology focused approaches would have been equally possible, projects followed the policy objectives in order to receive funding. This can be interpreted as a successful instance of discourse transmission from the policy level to the project level, on the one hand. On the other hand, the quote also illustrates that for the specific problem context, different solutions might have potentially more adequate. Participants from other IWRM projects similarly stated that the high-tech expectations of the BMBF were not compatible with the partner countries' realities, even in those partner countries counted as emerging economies (interviews with PP03, PP4, PP25).

Other interviewees seconded the perception that the technology focus did not match the requirements of IWRM on the ground, as "[i]n Germany, there is a very one-sided view of IWRM as technology. But that is not all to it [...]. Concepts and plans are underrepresented in BMBF funding" (PP25).

In addition, some project participants pictured the expectations of German high-tech exports as a contradiction to the overarching goal of sustainable water management, as in case of some technological solutions, which the project had identified as suitable for adaptation, no German business partners were to be found and were thus not further followed up (interview with PP12). Other project participants in the IWRM funding initiative voiced that fulfilling multiple expectations within one funding initiative, ranging from business development to problem solving for sustainability, to excellence in science was difficult, as the objectives were sometimes contradictory – especially in view of the overall goal of sustainability (fieldnotes FONA Forum, 09.-11.09.13).

Although funded as transdisciplinary research projects – insinuating an analysis of the problem context before developing a solution – projects felt urged towards rapid implementation of results and had to contest the BMBF's hush for setting up pilot technologies in the first project phase at the expense of problem analysis and discussions about solutions with stakeholders (interviews with PP04, PP12). The parallel expectation of transdisciplinarity and technology implementation turned into a paradox. In interviews, project participants voiced that the objec-

tive of fostering German business interests was pushed strongly and inadequately for projects of applied research. For them, this had conflictive consequences:

> "The project management agency expects the scientists to support sales of German products, which sometimes leads to conflicts. Pilot plants shall be upscaled and multiplied as fast as possible, but from a scientific point of view they are still in a pilot phase. They would have to run stable for two or three years until I can give a sound scientific judgement about them. And then, I would have to consider changing conditions and how to ensure that the technology is adequate." (PP03)

Project participants thus felt pushed towards rapid decisions and up-scaled implementation of new technologies which they had not yet tested sufficiently, and which they were not able to accompany further after the projects' end. At the same time, they were not sure if the partners in the country had adequate capacities to continue testing and managing the technologies on their own (interviews with PP03, PP04).

Many projects perceived the BMBF's requirement to include business partners in the consortia from the first project phase onwards as a contradiction to an open systemic analysis: "The participation of SME nails you down to a specific technological solution pathway. You cannot really say we considered the option, but it doesn't fit – good bye. They are project partners and want to implement their technology. You have to be careful there." (PP41)

In contrast to critical assessment of some research partners in the projects who pointed at the problems linked to combining technology sales with research – and their doubts about it in terms of research ethics – other interviewees rather stressed the benefits of the model for gaining access to new markets and at minimized financial risk (interviews with PP10, EE17). Interestingly, some business partners themselves did not perceive the participation in projects at early stages as a beneficial, either. The lack of determination and commitment to a specific technology as well as the oftentimes missing expertise of the researchers about the project context meant high risks of failing revenues for them (interview with PP9). While the BMBF had not undertaken any evaluations of business success in their model of involving SME into applied research projects, interviewees in the project management agencies stated doubts about the concept's success as such (interview with PT03).

As in case of the last phase of the Megacities funding initiative, projects felt that the BMBF favoured visible innovations – or rather, project results – over other types of innovation. The visibility of innovations thus seemed more essential than producing long term effects, both for the BMBF and the project management agencies:

> "I have the impression that we have to provide results which are nicely pre-sentable. For the BMBF and the project management agency, it doesn't really matter if they help the partner country. What matters is public representability, something that gives the impression that something great is happening, through Germany, through the BMBF." (PP03)

An interviewee involved in two IWRM projects, of which one had a focus on large scale technologies while the other focused on modelling, stated in a similar line:

> "We notice that our project is a model project, a showcase, because there is some-thing to see […]. The other project had a more scientific orientation, it was about modelling, without comparably visible impacts. Exchange of scientists etc took place, but you can't really present that on-site." (PP36)

The bias towards visibility and technology as results to show a policy's success (ch. 9.3) is not only characteristic of BMBF policies in the Megacities and IWRM fund-ing. Project participants stated that the BMBF's preference of presentable tech-nological results was matched by the partner countries' administration and pol-icy makers as well (interviews with PP03, PP12, PP25, PP31, PP36). Often, mind-sets were coined by sectoral thinking, and questions of sustainability and systemic thinking were not common among stakeholders yet. However, the partner coun-tries' expectations of visible, high-tech innovations also can be seen in light of the different symbolic functions. In contrast to low-tech solutions, high-tech solutions symbolize a country's developmental progress and therefore contribute to a pos-itive self-image. Visible new technologies also prove governmental action, impor-tant in partner countries with often inefficient bureaucracies and high degrees of institutional change. In case of elections, visible results demonstrate deeds better than improved processes or management. In addition, conceptualizing water as a technical problem, not as an intersectoral management problem also depoliti-cizes the issue. Technological interventions do not instantly require any changes of the institutional set up, whereas looking at IWRM from a management perspec-tive might involve inclusive decision-making processes, which take into account the needs and demands of different water users and other stakeholders, or might point at institutional misfits, and thus potentially endanger the current status quo within and among different groups of actors.

Despite the policy focus on technologies and visible results, the IWRM projects in practice delivered a variety of different results and turned them into innovations. Appendix B-3a gives an overview about the range of different types of output. The vast majority of the projects, in congruence with the BMBF's and the partner coun-tries' expectations, developed a type of large-scale technology and implemented pi-lot plants, ranging from water pumping systems in Indonesia, to waste water treat-

ment technologies (e.g. Mongolia, Israel/Jordan/Palestine), drinking water treatment (e.g. Vietnam) or ground water desalination technologies (Namibia).

Next to these large-scale technology options, many projects developed innovations on a non-technical or low-tech level, such as dry toilets (Mongolia), innovations in agricultural practices, such as irrigation schemes (Uzbekistan), or small-scale rain water collection (Namibia). The overview also shows that all projects developed innovations aimed at management processes, most of them in form of models, analysis and scenario analysis for decision support and monitoring, some projects including software development for the task. For example, IWRM Olifants, South Africa, purely engaged with water management innovations. The project had detected deficient water management as a root cause for lacking water availability. Necessary treatment technologies already existed, but financing proved problematic. Instead of developing large scale pilot technologies, the project developed models for private sector participation in water management. Other projects contributed to a change of legislation, such as laws or policies, towards a more sustainable water management.

Consequently, I argue that although the IWRM call for proposals left less room for agency than the call for proposals of the Megacities funding initiative, the IWRM projects used their agency to focus on those aspects of IWRM that they deemed important next to the technology development specified by the BMBF. The projects' interest in non-technological issues of IWRM also became apparent in the crosscutting working groups, which focused on governance, capacity development, decision-making support and participation, and whose topics had been identified in a discussion project among all IWRM projects (interview with PP06).

10.3   Project practice: Subversion or compliance?

In chapter 7, I have traced the imbalances in power between research community, project management agency and the BMBF in discourse production. Imbalances in the distribution of power over decisions and resources also coined their interaction in implementing research projects in the Megacities as well as the IWRM funding initiatives, observable in the project participants' common practice of withholding any open criticism directed towards the ministry and of preventing to demonstrate any potential weak spots themselves. In this line, window-dressing was observable throughout all instances of project representation. Optimized self-representation was common in formal contexts, such as reporting to the BMBF or the project management agencies on behalf of the ministry; as well as in more informal contexts, e.g. in the survey carried out by the IWRM accompanying project on application of results (Ibisch and Borchardt 2014).

The tendency to hide any underlying problems and to withhold criticism extended to the interviews conducted, too. While some projects reflected openly about challenges, in other projects I observed that things said deviated from the practices I observed during participant observation. Some project coordinators refused to be interviewed at all or only agreed to be interviewed anonymously – out of fear that I would use the data for a project evaluation or that criticism would be used against them. In instances of participant observation, I regularly noted a sensitivity towards any kind of perceived evaluation, which had never been my intention (field notes LiWa, 01.08.-30.09.12; field notes IWAS Brazil, 1.10.-30.11.12).

An interviewee involved in one of the accompanying projects mentioned that "[t]he projects give us feedback on programme design based on their experiences. Some things are really problematic. But the projects don't revolt. There are no revolutionary tendencies, they are too dependent and don't want to risk future projects." (PP27)

A similar precaution characterized the behaviour of the project management agencies' employees, who seemed caught in a difficult position between the ministry and the projects. Some project management agency employees refused to be interviewed or requested anonymisation. Being financially dependent on the BMBF and expected to fulfil the BMBF's demands themselves, the project management agencies had to act as a mediator for partially contradictory expectations towards the projects' impact, to control projects and to advise them at the same time. In an informal conversation during the 2013 FONA Forum, a project management employee, who refused to be officially interviewed, stated that the project management agencies could criticize projects, but never the BMBF itself. According to the person, fear was omnipresent and led to show events entailing only honey-covered flatteries, as any (self-)criticism could be potentially dangerous (fieldnotes on FONA Forum, 09.-11.09.13).

The wish to be anonymized as well as the choice of some project participants or project management agency employees not to be interviewed may thus be interpreted as general statements about the system of (perceived) dependence, power distribution and fear among project participants, employees within the project management agencies and the BMBF. From a perspective of discourse stabilisation, the researchers' reluctance or even fear of voicing criticism was certainly convenient for the BMBF. However, the ministry was certainly *not* engaged in conscious practices of actively silencing researchers. Despite the imbalance in power, the researchers participating in funded projects as well as the project management agencies played an important role in maintaining the equilibrium within the social constellation by accepting the BMBF's powerful position and voluntarily complying with it: The project participants practiced a type of self-censorship.

The empirical material collected does not entail any data pointing to actual negative consequences for researchers who openly contested the BMBF. Nevertheless,

the project participants' anticipatory obedience suggests that they assumed that negative consequences were likely. Projects and project management agencies had internalized the power constellation to a degree that led to re-enacting it without questioning it. Without having to discipline the deviation of ideas from the BMBF's policy discourse, the BMBF was able to prevent open contestation (ch. 3.2). Next to those researchers who shared the BMBF's discursive stance and subscribed to it unreservedly (and who are necessary actors within the equilibrium of research and policy interests, ch. 7.4), many researchers complied with the BMBF ostensibly and continued to apply for project funding, even if off the record they were critical of the policy direction, the process of agenda setting, the BMBF's push for fast implementation, etc.

Two arguments may explain their compliance. First, BMBF programmes are attractive enough and in a unique selling position: Obtaining third party funding becomes increasingly important in the German research landscape (ch. 5). In this scenery, the access to funding for large-scale projects, including funds for post-doc and doctoral student positions, appears to be an incentive large enough even for senior scientists, such as professors with permanent positions, to sign up for it. Additionally, the BMBF's funding initiatives offer non-financial rewards such as access to international networks and opportunities for empirical research, which are funded much less by other funding institutions. The project participants' reluctance to admit any type of problems encountered and their fear to voice open criticism in instances I observed during fieldwork needs to be seen in the context of perceived dependence from the ministry as main founder of applied research in Germany and its power over current and future resources (ch. 7.4). Even if researchers did not completely agree to the policy discourse expressed within the funding initiatives, the incentives were large enough to apply for funding.

In addition, I argue that the room for agency within the funding initiatives was big enough to allow for a type of *passive resistance* (Scott 1990). Projects funded in both the Megacities as well as the IWRM funding initiatives used the rooms for agency in adapting policy expectations.

Even though mediated through the projects' self-descriptions and likely mirroring their perceptions of BMBF expectations, the overview about the manifold project (intentional) outputs in both initiatives are telling in light of the contrast between policy expectations and actual outputs – not in a quantitative sense, but in view of the type of results. Despite of the BMBF's diverging expectations, projects in both funding initiatives developed a wide range of knowledge, products, and/or solutions, as exposed in chapter 10.2. Neither did projects within the technology-oriented IWRM initiative produce only and purely technological results, nor did the more holistic starting point in the Megacities initiative produce only non-technological solutions. Even though the demand for high-tech solutions and involvement of German business partners was not as prominent in the Megacities funding ini-

tiative, the projects came up with high-tech solutions such as software tools or monitoring systems. Turning a holistic system analysis into an entry point of the funding initiative enabled the projects to consider manifold approaches to applied research and look into a variety of different innovations on individual level, in public administration as well as for a larger public (Appendix B-3b). The projects funded within the IWRM initiative, in turn, were officially bound to a technology-oriented funding frame, but nevertheless seized different rooms of agency to complement technical and non-technical innovations on different levels.

While projects in both funding initiatives developed solutions for individuals (such as energy efficiency in housing) as well as innovations for a broader public benefit (such as waste water treatment at a larger scale), and despite of the different policy framings and approaches, in both funding initiatives the projects' main efforts targeted the level of public administration and policy making. The tangible outputs that were developed and the innovations that were implemented included high-tech solutions, such as tools and software developed for IWRM decision support, or traffic monitoring systems on the one hand. On the other hand, projects in both initiatives came up with non-technical products, such as strategies and plans, or innovations in governance processes, such as stakeholder participation in decision making. This concentration of solutions targeting policy and administration developed in both funding initiatives suggests that the projects considered the level of public governance and administration as a crucial entry point of transformation towards sustainability. The projects' emphasis on solutions aimed at the governance level challenges the BMBF focus on visible results at the expense of invisible – but potentially more needed – ones.

Despite the projects' endeavours of reinterpretation and modification of the policy discourse, the BMBF successfully transmitted their original discourse from the policy level to projects. The intended orientation of the projects, such as the orientation towards the application of German technologies in case of IWRM, was never abandoned, but merely complemented by additional facets of applied research – as well as critical social science research in some cases. Nevertheless, the variety of different outputs in both funding initiatives suggests that in both funding initiatives, project participants made use of street-level policy making, or, in SKAD terms, they were able to re-interpret the policy discourse, to expand it and to include alternative discursive ideas into the practice of their doing. They were thereby able to adapt the BMBF's policy frame to their research interests as well as the partner country's necessities.

While one the one hand, the deviation of the types of outcomes from the originally narrow policy frame reflects the adaptation of the main policy discourse and therefore may be portrayed as a subversion, on the other hand, the room for deviation from the BMBF's policy discourse on a smaller scale also contributes to its overall stability. Next to the funds and the political back up in international re-

search projects, the space for agency below the tight shell of policy discourse seems to be one of the decisive incentives for researchers to apply for BMBF projects. I argue that only because a certain degree of deviation, a room for agency, is permitted within the funding initiatives, the number of researchers applying for calls for proposals is large enough for the BMBF to select projects according to the ministry's quality standards.

Although in power over the distribution of resources, the BMBF depends on the research community's interest in the topics proposed as well as the quality of the research proposals handed in. The room for deviation inscribed in the funding initiatives ensures higher numbers of applicants and thus enables the BMBF to continue with its policies. Informal deviation – or at least expansion – of the main policy discourse on the smaller scale of projects is then not necessarily a practice that leads to a long-term destabilisation of the policy discourse from within, as has been observed in other occasions (Hornidge et al. 2013). I argue that rather than leading to an overall discursive change, the practices of the adaptation of the policy discourse within the projects rather contribute to the stability of the policy discourse. Instead of open contestation, those parts of the science community critical of the discourse direction seize hidden spaces of agency within the funding initiatives instead.

11   Conclusions

In this book, I have analyzed German science policy for cooperation with developing countries and emerging economies in the field of sustainability research, its institutional embeddings and production processes through the lens of the Sociology of Knowledge Approach to Discourse (SKAD), complemented with insights from constructivist policy analysis. The combination of both enabled me to conceptualize and explain science policy as a specific type of discourse, including a) the actors involved in perpetuating and renewing the policy discourse, b) the processes of discourse production in a policy setting, c) the contents of the policy discourse, and d) the effects of policy on implemented projects in a meaningful way.

In my analysis, the combination of SKAD and constructivist approaches to policy processes enabled me to shed light on various empirical aspects of policy making and to reflect on theories of policy processes through a perspective of knowledge sociology. SKAD proved as a highly suitable conceptual frame for the analysis of policy. I considered policies as a specific discourse with specific rules for discourse creation, discourse stabilisation and actualisation. The practices of creating new policies – from issuing a new call for proposals, to the funding of research projects and to creating policy programmes and strategies – accordingly were conceptualized as instances of discourse reproduction. Viewing policy as discourse enabled me to expose the interconnections between ideas and structures which contribute to the stability of policy ideas and which prevent discursive change.

In this final chapter, I would like to draw some conclusions in view of the BMBF's science policy for cooperation with developing countries and emerging economies in the field of sustainability research and its relevance for society. I argue that in its current shape, it is not fulfilling its role of fostering a preventative science for global sustainability satisfactorily. Based on my empirical findings, I maintain that *first*, the direction of science policy in the Sustainability Subdepartment is coined by a high level of discourse stability which makes a continuation of policy more likely than policy change (ch. 11.1). *Second*, the discursive direction taken does not adequately enable the German research community to engage in a type of science adequate for dealing with global sustainability challenges (ch. 11.2). *Third*, I suggest a type of science policy that fosters the production of essential

transformation knowledge for global sustainable development (ch. 11.3). Further research questions are then exposed in chapter 11.4.

While in my empirical analysis, I intensively focused on Megacities and IWRM funding initiatives as exemplary funding initiatives, I also compared the findings to further funding initiatives for international cooperation in the BMBF's Sustainability Subdepartment. My findings thus reflect insights on the policy processes and policy discourse within the Sustainability Subdepartment's funding initiatives for cooperation with developing countries and emerging economies. As argued in chapter 4, I postulate that my findings are generalizable beyond the individual interviewees for the discursive perspective on science policy for cooperation with developing countries and emerging economies in sustainability research. In view of my findings on the core discourse of the BMBF's science policy as well as the subordinate role of sustainability (ch. 8), I also put forward that findings are valid for the entire ministry. As a qualitative social science, discourse analysis cannot claim to obtain findings transferable to other contexts. However, additional interviews carried out with project participants and BMBF staff in other funding initiatives within and outside of FONA allow for a careful assumption that my findings in view of policy processes might be transferable to further policy and implementation contexts. Yet, scientifically sound generalisations would require further research.

11.1   Discourse stability and discourse change

Through the lens of SKAD, I examined why the policy discourse takes a certain direction, while other discursive pathways are *not* taken up and actively excluded. Throughout the book, I have exposed several factors that contribute to the specific orientation of science policy towards a predominantly economy-oriented rationale. Thus, I also dealt with the question of discourse *dominance*: What stabilizes the current policy discourse, which aspects potentially lead to change? In this conclusion, I highlight the main factors and point to the consequences in view of sustainable development.

The policies of the BMBF are characterized by a high degree of discursive stability. I have demonstrated that although within the structures of the BMBF, there is large room for agency, it is not seized (ch. 6, 7, 10). Formally, there are little restrictions for decisions to deviate from or remain true to strategies and programmes in issuing calls for funding. Heads of unit often could, but rather don't change the discourse – policy continuation is more likely than policy change, due to the embeddedness of discourse in the institutional structures, the redundancies in policy processes, as well as the distribution of power which fosters the exclusion of alternative discourse.

11.1.1 Discourse stability

Structural embeddedness: Dispositives in the policy setting

The main policy discourse as well as the subdiscourse on research cooperation with developing countries and emerging economies in sustainability research are embedded in previous social conditions, thus depending on and further influencing both the production of accepted knowledge as well as the institutions (re)producing knowledge (Keller 2001; 2013). In the policy setting investigated empirically, the BMBF's Sustainability Subdepartment, I therefore consider the arguments used, decisions taken, choices made in view of the direction and scope of policies as well as the deeper rationale of science policy to be embedded in a *dispositive*, which includes the organisational structures, the formal responsibilities, actor constellations, the budgetary distributions among departments, rules and institutions, etc.

Due to the dominance of economy-focused innovation for German prosperity as a leitmotif of science policy, high tech lies at the heart of entire thematic departments. In contrast, globally encompassing sustainable development is *not* a core part of the BMBF rationale – and especially not those aspects of sustainable development that are political in the sense that they would require overcoming conflicts of goals with economy-oriented innovation for Germany.

Sustainability research is limited to the Sustainability Subdepartment's endeavours, which are rather oriented towards environmental issues (ch. 8). As a consequence of the missing institutionalisation of a science policy discourse on global, encompassing development, no dispositive in form of funding structures or strategies exist for further, but equally crucial aspects of sustainable development, such as research on global inequalities, for example. Research for sustainable development in a global, encompassing sense thus may be termed an *orphan issue* of German science policy, which lacks structures (such as a working unit within the BMBF) as well as speaker positions to bring the topic up on the agenda (such as an independent lobby advocating the global common interest included within the policy process). The prevalent policy conceptualisation of sustainable development hence has a power effect in coining the institutions of its reproduction in agenda-setting processes.

In addition, and equally important, policies aim at specific effects on the real world, thus aim at further power effects. The BMBF's practices of transmitting policies into funding practices rely on additional structures and practices as a dispositive. As a type of translation of discourse contents to a further level, any implementation process of policies bears risks of re-orientations. The BMBF demonstrates its interest in controlling external effects and ensuring a discourse reiteration rather than a reinterpretation. It makes use of a *dispositive* aimed at monitoring projects

in their implementation, and thus relies on a strategic infrastructure of practices and institutions aimed at creating and monitoring the external effects of discourse. In seizing small spaces of agency, the projects are able to reinterpret and adapt the policy discourse, however. In doing so, instead of openly contesting and thereby changing the policy discourse as such, spaces of agency within project implementation lead to a discourse continuation and stabilisation rather than to discursive change. Allowing degrees of reinterpretation and adaptation of the policy discourse on the scale of project implementation may be an (unconscious) strategy of discourse stabilisation (ch. 10).

Redundancies in strategies and practices of policy making

Pre-existing political strategies and programmes embody structures as well as ideas of discourse and thereby potentially guide further discourse production. They are both containers of contents as well as crystallisation points of the norms and rules underlying discourse production. The interdependence of different strategic levels as well as practices of funding was a further factor of discourse stability. The BMBF policies for cooperation with developing countries and emerging economies in sustainability research generally follow previous lines of thematic policy discourse: Strategies and programmes, which officially are designed to function as guide of future activities, often use past funding initiatives and past strategies as building blocks. While theories of the policy cycle postulate that through the practice of funding, policies of a higher conceptual level, such as strategies are transmitted from the level of *ideas* to the level of *action*, I demonstrate that the relation between strategies, programmes and concrete funding initiatives is complex, redundant and reciprocal. The analysis of the concepts used to legitimize international cooperation initiatives in sustainability research enhance the idea. Analysis shows that the arguments chosen and lines of thinking followed in strategies and programmes are based on previous policies, including funding activities. At the same time, newer funding initiatives, as concrete manifestations of the policy discourse, draw upon pre-existing strategies as well. The interrelation of programmes, strategies and activities is thus circular, leading to discourse stabilisation.

Excluding alternatives and shaping directions: Power issues in discourse production

Instances of discourse actualisation, such as in agenda setting for new funding initiatives or in transmitting policies into funding practice, further contribute to discursive stability. In case of the BMBF's science policy for cooperation with developing countries and emerging economies, the ministry is in power over the discourse direction, which is closely linked to the BMBF's power over the institutional

arrangement and its power over the distribution of resources. While the science community is potentially free to choose research subjects according to their own interests, they voluntarily sign up to the BMBF's funding system. Underlying reasons are an increasing dependency on third party funding in applied sustainability research and a lack of alternatives. At the same time, the BMBF's power also depends on the back up of large parts of the research community, who either find their research interests well-represented in the opportunities offered – or who seize the spaces of agency to adjust and creatively adapt the research carried out within the implementation of the research projects funded by the BMBF.

In their perceived dependency, the researchers signing up for BMBF funding sustain the power constellation by attributing power over the discourse direction to the ministry and not questioning it. In a similar line, other external actors with perceived or existing dependencies, such as the project management agencies, contribute to discourse stabilisation. Power over the direction of discourse encompasses instances of agenda setting (ch. 6, 7) as well as of transmission of policy objectives into project implementation (ch. 9, 10).

The empirical data gathered on German science policy for cooperation with developing countries and emerging economies in sustainability research allow some deeper reflections on the concept of discourse coalitions. Discourse coalitions are a strategy of discourse stabilisation (Keller 2011), and indeed fulfil this function in instances of designing new funding initiatives, thus instances of discourse actualisation. While the term *coalition* implies joint knowledge production between actors sharing a similar discursive storyline, the present case of policy making is coined by unequal power distributions: The interaction with external actors in actualizing the policy discourse is shaped by and further stabilizes the distribution of power among the actors involved. Two general tendencies can be observed in the interaction with different external actors: Rivalries, with a clear demarcation of boundaries, on the one hand, and coalition building on the other. As such, external bearers of alternative discourse – such as ministries with different policy objectives – who question directions of science policy, are rarely invited to take part in agenda-setting processes. Due to lacking regulations regarding the agenda-setting process, the BMBF is in power to in- or exclude advisors according to the own needs and interests. Involving only those actors in designing new policy initiatives who stabilized previous policy discourse fulfils a dual function. It adds legitimacy, but at the same time the BMBF also maintains its power over the further discourse production, its direction, the further distribution of resources as well as its own institutional status quo. Power is thus a central element in the case of coalition building scrutinized here.

As a consequence of the stability and the dominance of the BMBF's core discourse on German prosperity through technology-oriented research, the dominant discourse also predefines ways of thinking and acting and thereby prevents certain

things to be thought or said. This is illustrated through some interviewees inability to perceive water management from a more systemic point of view and their insistence that technology solutions are essential. At the same time, spaces for contrary opinions narrow and speaker positions are limited. Actors within the ministry who deviate from the standard focus of science policy aimed at economic innovation are rather pictured as troublemakers, which illustrates how the dominance of a specific discursive orientation may lead to discrediting the bearers of alternatives and their exclusion.

11.1.2   Change of discourse orientation

Changes in the overall discursive direction of science policy – such as introducing sustainability as a novel frame for previously environmental research or designing policy initiatives deviating from the core discourse – occur but are less common than the discursive reiteration in instances of discourse actualisation due to the reasons exposed in chapter 11.1. Changes rely mainly on *individual change agents* within the ministry, who introduce new external discourses – such as the sustainability concept – and institutionalize these in niches, which slowly inspire new strategies, programmes or funding initiatives.

FONA as a new programme for sustainability research illustrates this. A combination of multiple factors helped the new sustainability discourse in turning into the discursive frame for environmental research funding, culminating in the emergence of FONA and the corresponding departmental structures. Change in political leadership created a receptive environment for individual actors within the ministry to act as change agents and bearers of the new discourse. In addition, sustainability as a discourse did not appear out of nowhere, but individuals within the BMBF drew on politically opportune ideas which had already begun to institutionalize themselves elsewhere, such as in international political agreements. Moreover, sustainability had established itself as a concept in international public debates and there was a public demand for research on sustainability that policy makers took up. In the process of adapting sustainability to the BMBF's focus, the concept was depoliticized and adjusted to the core discourse of the BMBF (ch. 11.2).

On the scale of funding initiatives, the Megacities funding initiative and the African RSSCs, originating in the Sustainability Subdepartment's Global Change Unit, point at the potential of deviation from the standard focus of the BMBF on technological development and German economic interest. The existence of project funding outside of the discursive norm shows that spaces of deviance and alternative discourses exist. A precondition for policy actors to renew discourse by using spaces of agency within processes of discourse actualisation is the encompassing inclusion of diverse argumentative strands in policy strategies and programmes, such as FONA and the Internationalisation Strategy. The fact that strategies in-

clude a broad spectrum of diverging rationales allows for the deviation of specific funding initiatives from the main storyline of policy. I establish that in designing funding initiatives, the responsible BMBF staff reinterprets strategies and picks out arguments selectively. The strategies thus rather function as a *pool of various arguments* than as a strict, narrow guiding frame. The spectrum of different rationales, legitimations and objectives within the BMBF strategies allows for a deviation from the main policy discourse, and thus enables discursive renewal on the level of funding initiatives. Without transgressing the discursive boundaries of FONA, the High-tech Strategy or the Internationalisation Strategy, the scope of objectives pursued by individual funding initiatives is therefore *potentially* large. Even initiatives such as the Megacities funding initiative, which deviated from the BMBF's policy core discourse (ch. 8.1) and aim at a holistic type of research and cooperation for sustainable development, do completely abandon the frame of strategies, but rather draw on different, less prominent lines of argumentation included in the strategies. This can be seen as a way of drawing on legitimations stemming from *accepted sources*, as deviation from the standard discourse is met with resistance.

Alternative discourse institutionalizes itself first within smaller institutional structures, such as the Global Change Unit, as a niche which enables divergence. Nevertheless, next to these external factors, change in discourse also relies on the individual change agents' willingness to stand up against dominant perceptions. The changes in the underlying ideas and in the practice of policy making in cases, such as the diverging focus of funding in the African RSSCs and the Megacities initiative, or the changes in practices in agenda setting towards including partner countries' governments in case of the CLIENT initiative, bear a potential of turning into the seeds for larger changes of policy discourse. I argue that this change from *within* the ministry may have more influence on discourse than the reinterpretation of policy discourse through projects in their implementation.

Figure 11-1 summarizes the factors contributing to discourse stability on the one hand, and those who increase the likeliness of discursive re-interpretation on the other. In conclusion, I argue that the high level of discourse stability depends on the following factors: First, the embeddedness of discourse in institutional structures as a dispositive; second, the redundancies in policymaking; third, shaped mindsets; fourth, the exclusion of discursive alternatives; and fifth, perceived dependencies of project management agencies as well as research projects from the BMBF; which all pave the way for a reiteration of discourse within processes of discourse actualisation. The likeliness of discourse change, on the other hand, is enabled by first, the room for agency in policy making which willing individuals seize as change agents. Second, it increases through the existence of external discourses surging in public. Third, niches of resistance enable divergence to the dominant policy discourse. Fourth, in case of the BMBF's Sustainability Subdepartment, in-

novative funding initiatives are also enabled by a property of political programmes and strategies: These functioned as a pool of arguments, enabling deviation instead of providing a narrow frame.

Figure 11-1: Factors of stability and change in the policy discourse
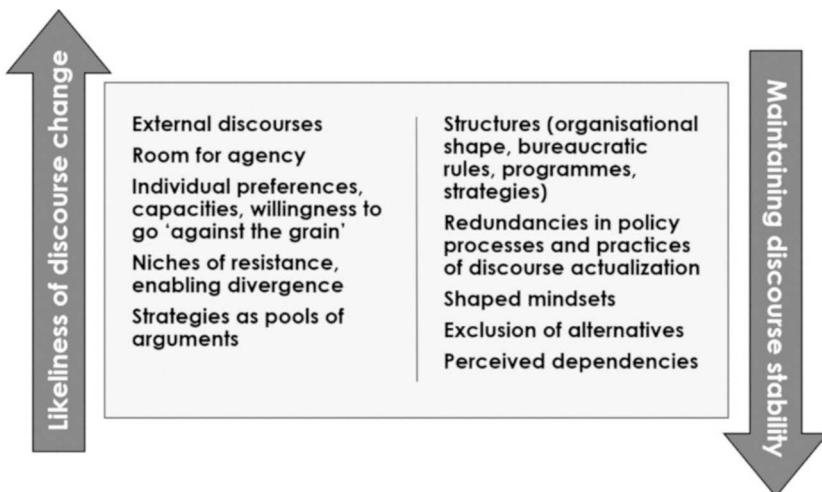
Source: Own elaboration

11.2   The BMBF's sustainability concept vs. global sustainable development

The core ideas of German science policy, i.e. fostering German prosperity through science, technology, and innovation, guide the BMBF in its main discursive direction, including subdiscourses such as research cooperation in sustainability research. Congruent to the leitmotif of BMBF policy, benefits for the German partners motivate international cooperation in sustainability-oriented research. German interests and benefits are conceptualized as both economic interests, such as access to future markets, as well as research interest, such as access to partners or topics. Other argumentative strands are rarely taken up as legitimisation of international cooperation within BMBF. Research cooperation funded by the BMBF is hardly ever put into the context of conflict prevention, while the German Foreign Affairs Ministry explicitly draws on peace-building arguments in its initiative on external science policy (Auswärtiges Amt 2013). Similarly, the BMBF tries to set itself off from any rationales believed to be development-related. I have argued that

this is a strategy of demarcating boundaries for securing institutional and discursive stability.

Sustainability is not a part of the ministry's core identity and not an overall guiding frame for its thinking and action, even though subprogrammes such as SÖF[1] or funding initiatives such Megacities represent an orientation towards sustainability objectives. In adopting the concept of sustainability, the BMBF adapted it to its needs. In the BMBF's conceptualisation, sustainability, especially in its relation to international cooperation, experiences a conceptual reduction to environmental aspects on the one hand, and to problems requiring technological solutions on the other, which entails a depoliticisation of the concept of sustainability. Following, BMBF science policy and funding initiatives for cooperation with developing countries in sustainability research are not primarily dedicated to fostering sustainable development in partner countries. On the contrary, the ministry explicitly states that a primal motivation of its cooperation activities is to strengthen the German science and innovation system as well as the German economy. The dominant policy discourse hence influences the BMBF's conceptualisation of sustainability and its policies in the field. Even if policy initiatives are framed as research for sustainable development, such as in case of the IWRM initiative or the Megacities Initiative, *global* sustainable development, which encompasses aspects of global justice or social equality, are not always targeted.

11.2.1   Rationales of the IWRM and Megacities funding initiatives

In its funding initiatives for sustainability-oriented research, the BMBF commonly couples a rationale of sustainability with further funding rationales. Sustainable development is not the exclusive motivation for funding in neither funding initiative examined here. In view the concept of sustainable development employed in each funding initiative, Megacities funding and IWRM funding can be contrasted: The funding initiatives are motivated by different rationales, use different sets of

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1 SÖF is often referred to as evidence for the BMBF's encompassing and inclusive orientation of sustainability research. However, I argue that SÖF funding, even though it plays an important role in fostering transdisciplinary sustainability-oriented research in Germany, remains a niche and does not reflect the BMBF's core discourse. This is mirrored by the amount of funding for social-ecological research. Between the years 2000 and 2015, SÖF received a total budget of EUR 120 Mio, less than 10 Mio per year (BMBF 2015h). Even though annual funding for SÖF increased from EUR 13,3 million in 2012 to a planned EUR 20 million budget for 2019 (BMF 2014; 2019), the overall budget remains only a small part of the overall budget for FONA – which amounted to almost EUR 2 billion from 2010-2014 (BMBF 2019a). Furthermore, SÖF as a funding priority is not aimed at international research cooperation as such. While in some SÖF related funding, such as the junior research groups, international cooperation is possible, it is not a crucial element of SÖF. The main funding for international cooperation in FONA takes place in the subareas of Global Change and Resources and Sustainability (BMBF 2009a).

arguments, aim at different objectives, envisage differing types of impact and propose different potential solutions (ch. 9). In the IWRM initiative, the BMBF set the stage for technological solutions in water management, based on the underlying rationale of contributing to German economic prosperity through technology exports, next to the further rationale of contributing to IWRM abroad. In doing so, with IWRM the BMBF followed a tradition of eco-modernism – concentrating on technical solutions of environmental problems, on cost of a holistic concept of sustainability.

In contrast to the IWRM initiative, the BMBF took a more open-ended approach in the Megacities initiative. The primary objective was to contribute to sustainable urban development and to jointly solve problems in the city chosen as site of research. Even though in the Megacities initiatives, the participation of German business partners was encouraged as well, the BMBF insisted less on their inclusion; and the overall objective was *not* chosen based on German technologies as pre-existing instruments to prescribe a type of solution – the rationale of contributing to German economic welfare was less prominently transmitted in this funding initiative. The BMBF enabled the funded projects to carry out a systematic analysis of the problem context in their first stages to search for adequate types of solutions at different entry points of the urban landscape.

In both funding initiatives, the BMBF rather focused on concrete problem-solving through the research projects funded rather than addressing systemic issues of sustainable development in partner countries or on a global scale. Solutions on a smaller scale – even if potentially transferable to other contexts – were in the focus of both funding initiatives, not sustainable development in the bigger picture. However, the focus of the IWRM initiative on economically viable solutions and German benefit was perceived as difficult and even counteracting local sustainable development processes. Project participants pointed at the difficulties of projects to fulfil the demands for technology implementation in a meaningful way, adapted to and adequate for the context of the partner countries. Here, the room of agency for researchers to modify the funding initiatives' objectives in putting them into practice was seized to adapt the policy expectations towards more sustainable pathways.

The analysis of the Megacities initiative and the IWRM initiative illustrates how the BMBF adopts the concept of sustainability and reinterprets it according to its own discursive needs – to prevent conflicts with the BMBF's core rationale of economic prosperity. While the original concept of sustainable development as well as most discursive reinterpretations of the concept include social and economic aspects such as global solidarity, social responsibility or global equity, these are not conceptually integrated into any BMBF funding initiative for cooperation with developing countries and emerging economies analyzed. Most funding initiatives of the Sustainability Subdepartment address ecological problems and consequently

frame research cooperation as a provider of (often technical) solutions to these. So-cial or economic sustainable development at a systemic level in partner countries was not primal objective of research cooperation. Targeting German technology ex-ports instead of an open-ended search process for the best potential solution in the IWRM initiative even may have *reinforced* pre-existing global financial power struc-tures, instead of redistributing economic benefits. Systemic dependencies and in-equalities, part of the sustainability concept as global inner-generational justice, were not addressed neither as research topic nor as an effect of research in any of the funding initiatives. Similarly, no discursive storylines evolved around con-tributing to an own view on problems in partner countries, to decolonisation or emancipation of developing countries and emerging economies.

11.2.2 Consequences for the German science system

In contrast to the BMBF's conception, many scholars challenge the idea that sus-tainability in all its dimensions is achievable without systemic changes and perceive the combination of sustainability and economic growth as a paradox, a conflict of goals (Robinson 2004; Hopwood et al. 2005; Redclift 2005; Wright and Kurian 2010; Hugé et al. 2013; Jessop 2012; Göpel 2016). Enabled through the ambiguity of the term, the BMBF reinterprets sustainability to continue established practices. Through its reinterpretation of sustainability to a depoliticized issue, tackled best through economy-driven, technical solutions, the ministry is able to evade ques-tions of profound institutional or systemic change in order to reconcile economic growth and objectives of sustainability. Table 11-1 gives an overview about the main differences between the narrow concept of sustainability in the BMBF's conception and a more encompassing concept of global sustainable development.

  In the IWRM funding initiative very prominently, in the Megacities funding initiative much less so, the BMBF turned sustainability research into an instru-ment of fulfilling German interests, often reduced further to economic interest (ch. 8). From a critical point of view, acknowledging the natural boundaries of the planet, as well as the global social and economic interdependencies, however, Ger-man interest should be extended to adequately cover global sustainable develop-ment. Reducing sustainable development issues to German interest is problematic on this normative basis. Tackling grand challenges requires joint problem solving and a more holistic conception of sustainability as a common global project. I argue that taking sustainable development seriously as an objective of research funding requires abandoning the current duality of goals – thus of aiming at sustainable development through/while exporting or adapting German technologies. From the perspective of development research, the practice of technology export through re-

search cooperation might be classified as *informal tied aid*[2], which scholars perceive as potentially harmful and as a *hinderance* to sustainable development in developing countries (Carbone 2014). From the perspective of sustainable development, global interests should be as prominent as German interests in policy, or, put differently, global sustainability – as a collective benefit – should be a genuinely German interest.

Table 11- 1: Narrow vs. encompassing understanding of sustainable development

	The BMBF's narrow concept of sustainable development	*Encompassing concept of global sustainable development*
Geographic focus	Place-specific, local interventions in the partner countries (developing countries/emerging economies); possibly transferable to other contexts	Universal agenda for *all* countries, interconnected issues, common responsibility; global scale
Conceptualisation of sustainable development	As a predominantly environmental concept	As a social, economic, environmental concept
Getting there through	Modernisation, green growth; no substantial system change	Systemic transformation, shift of dominant paradigm
Research	Understanding issues of environmental change; developing solutions	Understanding issues of environmental change; understanding necessary processes of social transformation; developing solutions
Solutions	Visible, technical solutions	All entry points for solutions

Source: Adapted and further developed from Horner and Hulme 2017: 40

I put forward that interpreting research for sustainable development as a means for providing mainly technological, economically viable solutions to environmental problems has negative consequences for the German science system's ability to cope with global challenges. Adaptation and mitigation of climate change, as well as solving other complex problems of larger scale do not only require technological approaches, but they also require critical reflection. Focusing on technologies may provide solutions to specific problems, but for coping with complex problems, considering the social and essentially political aspects of sustainable development is crucial. Denying the socio-political side of sustainable

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2 Informal tied aid occurs "when, for example, donors choose to fund only projects in sectors for which their firms have a competitive advantage" (Carbone 2014: 104).

development, and not adequately fostering the critical sciences necessary to investigate the conflicts of goals and interests, the trade-offs between different dimensions of sustainability, decreases not only the capacities of the German science system to cope with global change, but also puts at risk finding suitable coping strategies for humankind as a whole. Continuing with the eco-modernist, technocratic solution orientation of German science policy may thus compromise the German contribution to protecting our world, which would require assuming responsibility for safeguarding the planetary carrying capacities. At the moment, the BMBF's policies for sustainability research do not adequately foster this role of science in its funding practice, even if global responsibility surges as a buzz word in its political strategies.

The depoliticisation of sustainability and its interpretation as mainly technological problem influence the science system in the long run, if instead of multiple disciplines only capacities in those disciplines are fostered that are economically conducive. However, future-proofing Germany entails society as a whole. *Not* respecting planetary boundaries in the end would negatively affect any efforts for economic prosperity, as well. Turning an encompassing concept of sustainable development into the core discourse of science policy instead of economy-oriented innovation would therefore be advisable.

11.3   Global development as opportunity for German science policy

Perceiving sustainable development as *global* development shifts the focus of the concept from sustainable development on the local level towards the global interrelations and responsibilities. Additionally, the previous emphasis on necessary change in so-called developing countries shifts towards an emphasis on the needs of transformation in *all* countries (Horner and Hulme 2017). This discursive reinterpretation of sustainable development is already reflected in the Agenda 2030 and the SDGs and, I argue, should turn into a discursive framing of BMBF policies for research cooperation with developing countries and emerging economies as well.

Considering all nations as developing countries in certain aspects of social, economic, or ecological development, also may be pictured as a *potential* of research cooperation on eyelevel between different international partners that lives up to its name. Specific topics of sustainable development which affect partners on both sides could present starting points for comparative research in international teams. Issues such as social inequality on different scales, carbon-neutral development, sustainable urban development or sustainable production and consumption present challenges in most countries (WBGU 2011; 2016; Horner and Hulme 2017).

Research cooperation on these topics might enhance mutual learning instead of repeating traditional patterns of cooperation; jointly developing pathways might enable sustainable development in partner countries as well as in Germany – thus not catch-up development in the partner countries, but leap-frogging and transformation towards sustainable development. On this basis, the following section suggests some alterations of BMBF policies for cooperation with developing countries and emerging economies. Based on the empirical insights presented in this book, the Megacities initiative and the IWRM initiative function as entry points for policy recommendations. Table 11-2 summarizes the recommendations in view of the mode of cooperation, scale of research as well as level of reflections.

11.3.1 Reflexivity in project set up and knowledge generation

Research into the IWRM and Megacities initiatives shows that the BMBF relied on inter- and transdisciplinary project set up as well as well as cooperation on eyelevel as means of securing effects of the projects, and the funding initiatives in extension. In the light of sustainable development, projects should be further encouraged to reflect about any intended or unintended consequences of their research, including the implications for social, economic and environmental justice:

- Who benefits from the solution proposed?
- For whom is impact created?
- Which larger effects on policy, society or the environment can be foreseen?

An emphasis on process and critical transformation knowledge within research projects for sustainable development is necessary. Framing outputs in a more encompassing way as a part of an ex-ante analysis of potential effects would extend the research projects' scope with a systemic dimension beyond mere problem solving on a local level – and thus would more adequately cover all dimensions of sustainable development.

Projects in both IWRM as well as Megacities funding initiatives delivered a variety of results, including technological as well as non-technological solutions. Capacity development on different levels was part of both funding initiatives and envisaged as a type of impact next to problem solutions. No project participants interviewed in any funding initiative voiced any anti-technology feelings. However, business partners as well as researchers favoured an inclusion at a later project stage in order to ensure that solutions proposed match local realities. From a normative stance of sustainable development, I second this recommendation. A later inclusion of business partners allows projects to carry out a systemic analysis of all potential pathways to solutions in the first project phase without being pressured

into a preset technological direction. For the business partners, later involvement lowers investment risks.

Research projects should continue their reflections about impact pathways at all stages. These reflections should be integrated into the projects as social science research questions. Directed at maximizing the public benefits stemming from publicly funded research, research projects should target outputs and innovations at different levels. Adding this dimension to research project would answer questions of benefits and potential disadvantages of the projects' interventions in a more holistic way. Next to different types of innovations as positive outcomes of research projects, as intended consequences, projects should also take into careful consideration which negative side-effects might arise from intended outcomes. Good ideas sometimes have unintended negative effects – or might equally have positive side-effects. Thinking these through would increase research projects positive impacts on the one hand while diminishing negative consequences on the other.

Questions of *reflexive transformation research* include, but are not limited, to the following:

- Which knowledge about the change-process was generated?
- Which hurdles for innovation and transformation were detected, which enabling factors?
- Which knowledge, methods or innovations have potential to be adjusted to/transferred to other contexts; has this already been done?
- Which insights on transdisciplinary research, cooperation methods, and stakeholder processes?

Transformation research should become an integral part of *transformative research*. In doing so, transferable insights would be generated which help to understand change processes towards sustainability, thus further increasing public benefits. Interventions, such as innovations, on lower level of leverage – such as tackling *outcomes* of unsustainable behaviour, end-of-pipe solutions etc – rarely produce change on systemic levels (Meadows 1999; Göpel 2016). Research projects should therefore aim at understanding processes of environmental, economic and social change in the context of sustainability, as well as the systemic barriers which prevent it. Research should thus not only address sustainable development at a local level, but also scrutinize the bigger systemic picture.

It is likely that researchers in past funding initiatives produced transformative and transformation knowledge that the BMBF could have made better use of. Interviews hint at the existence of (implicit) knowledge created in projects in the IWRM initiative as well as in Megacities initiative, including insights about transdisciplinary methods and challenges, and other crosscutting issues. However, so far, the

BMBF did not systematize, edit or publish any insights into these fields of knowledge. For example, the online database generated based on results of the Megacities projects was discontinued shortly after the initiative ran out. Systematically assessing and securing results in longer-lasting formats, relevant to further research, would therefore be recommendable as a research-based activity across projects. Transferable results and transformation knowledge might even best be secured as scientific publications. Encouraging researchers involved in funded projects to reflect and publish their reflections on transferable knowledge and transformation knowledge in scientific journals would be advisable in future funding initiatives.

While academic capacity development continues to be considered as essential, more recently, the idea of unilateral capacity development has been confronted with the idea of *mutual learning* (Bradley 2007; Arocena and Sutz 2010; Upreti 2011; Stöckli et al. 2012). Reasons for reconceptualizing capacity development as mutual learning instead of one-way learning are based on the idea of a mutual partnership. Cooperation on topics of global sustainability provide an ideal opportunity of knowledge exchange in both directions, as partners in all countries are in need of transformative and transformation knowledge for sustainable development.

At the same time, the policy and funding frame should be flexible enough to adequately react to changing realities or unexpected results. Even if research is aimed at application, it should be conceptualized as an open-ended process. New knowledge – transformative as well as transformation knowledge, on local conditions as well as global developments – should be integrated into the funding frame.

Table 11- 2: Reflexive set up of projects and funding initiatives

Mode of cooperation	Scale	Reflections on
Involvement of relevant stakeholders; Involvement of relevant scientific disciplines for systemic analysis; Respectful international partnership and common ownership; Mutual learning	Local and global level; Transformative research *and* generation of transformation knowledge; Problem-specific and systemic entry points	Potential transferability; Effects (negative or positive) of research; Conditions of transformation and innovation

Source: Own elaboration

11.3.2   Making all types of output count

In addition to the capacities developed among all partners as well as the knowledge on transformation processes generated in research projects, transformative research should produce solutions suitable to specific issues of sustainable devel-

opment. Table 11-3 abstracts the main types of outputs, or innovations, on different levels, based on the overview of results from the Megacities funding initiative and the IWRM funding initiative (App. B-3a, b). Although the BMBF raised different expectations in view of results to be produced, the projects funded in the IWRM initiative as well as in the Megacities initiatives developed a wide range of results and solutions, including technological as well as social and other types of solutions.

The categories of results, as shown in table 11-3, are idealtypes which overlap in reality. For example, management concepts for public administration might lead to benefits for the public or for individuals later; some practices, such as water-saving irrigation methods, are carried out by individuals but the public is a general beneficiary of increased water availability, etc. Even so, the categories of different results in table 11-3 illustrate that the BMBF's focus on visible, often large-scale technical innovations is very limiting. Applied research produces meaningful knowledge and innovations on a variety of levels that are not routinely in the policy focus and go by unnoticed, even though they bear potential for transformative change. Encouraging a reflection about *all* potential types of knowledge, innovations and other effects of research would be conducive for sustainability-oriented research in its global dimension. Additionally, and this might turn into an incentive in the policy setting coined by rivalries, bringing other types of impacts into the spotlight would also add to the visibility of the BMBF's funding initiatives. Different effects of research projects, on different scales and at different entry points should be visualized and exposed publicly in order to establish them as legitimate objectives of science policy.

The agency of the projects, their power of street-level policy alterations, is an important lever of change towards sustainable practices as well. In SKAD terms, they re-interpreted the policy discourse in order to adapt the BMBF's policy frame to their research interests as well as the partner country's necessities. This presents an opportunity in favour of a global sustainable development, even if discursive stability hinders major changes on the policy level.

Table 11- 3: Potential types of outputs, knowledge and innovations

Outputs for individuals	Outputs for public administration and policy making	Outputs for the larger public
Technology-based: Technological innovations for individual use (e.g. solar-powered lamps, rain water collection plants, energy-efficient buildings)	*Technology-based:* Decision-support systems, models, (e.g. tools, software); Monitoring systems	*Technology-based:* Large-scale technological innovations (e.g. waste/water treatment plants); Infrastructural innovations (e.g. transportation systems)
Non-technological: Social innovations (e.g. new business practices, new irrigation schemes; Capacity development for a specific technology, vocational training; Capacity development in research, science administration and among university staff	*Non-technological:* Innovations in processes and methods (e.g. participative methods, governance schemes); Institutional innovations (e.g. regulations, laws); Organisational innovations (e.g. establishment of new administration units); Capacity development on individual and institutional level	*Non-technological:* New practices (e.g. waste separation); Institutional innovations (e.g. information offices, environmental protection areas); Capacity development and awareness raising in public, shifting mindsets (e.g. towards sustainable practices)

Source: Own elaboration

11.3.3 Enhancing potentials of discourse change in policy processes

The direction of science policy is not a given fact. Favouring a certain discursive conceptualisation of sustainable development instead of another is debatable. As argued in chapter 11.2, the current policy discourse does not sufficiently enable the German science system to assume its precautionary responsibilities for dealing with global change. Therefore, the current orientation of science policy for sustainability research should be challenged.

Overcoming the policy skew towards economy-oriented, technical innovation in sustainability research requires changes in the processes of discourse actualisation in policy making – in order to overcome the current discourse's stability, which among other factors depends on the exclusion of alternative discourse in discourse production (ch. 11.1). A potential entry point for change is located in the processes of discourse production at different stages of the policy process.

Scholars of different disciplines (ranging from perspectives of democratic accountability to environmental sustainability to social inequality) suggest more de-

liberative, inclusive and democratic approaches to policy making through citizen participation and call for the inclusion of different stakeholders in decision making, which should become a standard practice in reflexive science policy processes. In doing so, potential pitfalls have to be considered, such as the political nature of participation itself, which underlies different interests and power constellations (among others Jasanoff 2003; Fischer 2006; Kersting 2008; Stirling 2009; STEPS Centre 2010; Leach et al. 2010; Arocena and Sutz 2012; van Oudheusden 2014). For the sake of a more encompassing discourse of science for sustainable development, I would like to second these authors and argue for the inclusion of wider spectrum of alternative discourses in science policy making.

If the BMBF takes global responsibilities seriously, as stated in FONA, it should therefore continue its reflections about participatory processes. Yet, it is questionable if the BMBF is genuinely interested in opening agenda processes, and thus potentially allowing discourse change, given the current tendencies that favour discourse stability. The actors within the alternative discourse coalition (Box 7-1) therefore play an important role. In the past, change within the ministry was often triggered as a reaction to public discourse. If actors within the alternative discourse coalition raise public awareness about the importance of science policy processes for future proofing our society, the BMBF might feel incentivized to change.

Although the participatory FONA Fora can be considered as a first step towards opening agenda setting towards actors outside of the usual scope, real processes of opening up would require a willingness to transfer *decision-making power* to those actors involved in the agenda-setting process as a prerequisite (ch. 7.3.3). Reflecting on past participatory processes, the format of neither the FONA Fora nor of the audit of selected funding initiatives before FONA3 were appropriate. In the FONA Forum 2013, the range of participants was not balanced, and the preset format, based on pre-established topics, rather contributed to reify and stabilize the past policy discourse than to inspire change (ch. 7). In case of the FONA audit (ch. 10), the actors, all of them in perceived or actual dependency from the BMBF, adjusted their self-representation and withheld critique out of fear of negative consequences. It is unlikely that outcomes of the agenda processes, self-evaluations and audits as in the past will be critical of the status quo of the Sustainability Subdepartment's policies. Different forms of evaluation and feedback would be more conducive: Participants in agenda-setting and feedback activities need to be sure about the absence of any negative consequences in case of critique – through anonymized participation or other mechanisms that sufficiently inspire trust. However, this would require interest in *obtaining* critical feedback or in learning about alternative discursive assumptions in the first place.

In addition to participatory processes on the level of agenda setting for research *programmes*, opening up policy processes on the level of designing concrete *funding initiatives* is equally necessary. As analyzed in chapter 7.3, decisions on pro-

grammes and funding initiatives take place independently on different levels. In view of funding initiatives for research cooperation with developing countries and emerging economies in sustainability research, I would like to endorse the routine involvement of *actors from other policy fields*, such as of BMU or BMZ, as well. Empirical data has shown that the lack of connection and cooperation of science policy funding initiatives with those of other policy fields, such as environmental and development policy, as well as the lack of involvement of partner countries, had negative consequences for the implementation of research projects as well as their effects (ch. 10).

In view of funding initiatives for research cooperation with developing countries and emerging economies, the BMBF's recent practice of designing *bilateral* (or multilateral) initiatives instead of unilateral initiatives, as still was the case in IWRM and Megacities funding, is a very positive development in view of a balanced, respectful cooperation with partner countries. This is a necessary turn away from a mode of agenda setting exclusively within Germany. Abandoning paternalistic patterns of cooperation means basing cooperation on jointly defined agendas and topics of interest. This *mutual ownership*, and not necessarily a financial contribution, should turn into the basis of *cooperation on eyelevel*. A cooperation on eyelevel with partner countries, to speak with the BMBF's terms, begins at the policy level, not at the project level. Joint policy making – starting with the joint definition of research topics for cooperation, is thus necessary.

Jointly pursuing a science for sustainable development in cooperation with others may trigger further *ethical* questions. If partners from developing countries and emerging economies are enabled to prioritize research problems independently of German priorities, the German side may have to learn to deal with diverging agendas, different pathways and solutions, and different problem framings. While allowing such a diversification would be desirable from a normative standpoint favouring global equality and post-colonial cooperation patterns, partners might attribute less importance to questions of sustainable development and prioritize other issues of cooperation. In view of reaching an overall goal of global sustainability, negotiating objectives and solutions and sensitizing all partners for global sustainable development may thus become necessary.

11.4   Further research questions

In empirically dealing with the research questions that guided the PhD thesis as a basis of this book, further research topics emerged, which could not be covered in its frame, but which pose interesting subjects of further research. Further research questions emerged in the following areas. *First*, further research should address the distribution of roles within research cooperation between Germans and inter-

national partners. Role distributions could be studied from a practical, management-oriented perspective: Which responsibilities, roles, functional distributions, practices, conditions etc. contribute to successful international transdisciplinary research?

From the perspective of SKAD, as well as from a psychological perspective, it would be interesting to scrutinize the roles in the consortia, as well: In how far are roles and responsibilities based on the subject positions offered through discourses on cooperation? How do hierarchies between partners and disciplines emerge, how do they manifest? How exactly is knowledge generated within projects? Does the distribution of roles affect the impact of projects? Comparative research on cooperation with industrialized countries might contribute interesting contrasts.

Additionally, research cooperation could also be addressed from a post-colonial standpoint. Understanding the roles und patterns of cooperation as well as analyzing scientific knowledge production would be worthwhile from a post-colonial perspective: How do pre-existing global power constellations influence knowledge generation, how can imbalances be overcome? How is the scientific corpus of knowledge created in developing countries and emerging economies integrated into the projects? Which non-Western concepts of sustainable development could serve as models for transformation? How can research cooperation further serve as a model of balanced cooperation in other fields of international cooperation?

A *second* interesting cluster of further research questions deals with the motivation of researchers applying for funding as well as of policy makers to follow or deviate from a specific discourse. How far does the individual researchers' preference influence the projects' scope? I have shown that the researchers' scope for agency is large, but there is still room for investigation on how preferences are shaped. Similarly, in how far are researchers able and willing to adjust to research topics that are set through the funding frame? Does the willingness to deal with an unpopular topic rise in times of increasing dependency of third-party funding? The perceived dependency and reluctance of criticism of research community and project management agencies towards the BMBF are striking. In this light, it would be worthwhile to further investigate which elements maintain the equilibrium of power and thereby stabilize discourse production. On a similar note, which social and psychological conditions have to apply to turn an individual actor within the BMBF into an agent of change, willing to contest a dominant discourse? How can niches of resistance be fostered?

A *third* complex of further questions emerges from the intersections of science policy with other policy fields. From a political economy perspective, it is highly astonishing that no analysis exists yet in view of the suitability of research funding as an instrument of technology export. Interviewees had different stances on the issue, but studies on the success of incorporating business partners into consortia

are still missing. No evaluations on financial returns or the success of research cooperation as door-opener for SMEs to foreign markets seem to exist yet.

In view of development policy, a recurring question arose in view of the interconnections of development cooperation and research cooperation. Where do development cooperation and research cooperation overlap, where are the boundaries between research cooperation and the subsequent implementation of results? How could both forms of cooperation ideally interact in practice, how could barriers among different policy fields be overcome to facilitate interaction? What could science policy learn from existing policy instruments of development cooperation to make sure that the impacts of projects do not vanish after cooperation ends? Questions of policy coherence, often posed in view of development oriented policies, should include science policy aimed at cooperation with developing countries and emerging economies, as well.

Appendices

Appendix A-1: Overview of data collected in interviews and from participant observation

I conducted a total number of 103 semi-structured interviews for this PhD project. I classified interview partners into four categories as external experts, policy makers/administrative staff, project management agency staff and project participants from Germany and partner countries. Of a total of 26 interviewees involved with policy making, 17 worked directly within the BMBF or other German ministries, 9 worked on behalf of the BMBF at project management agencies. Additionally, I interviewed 27 external experts based on their knowledge and institutional background in the context of research funding and science policy.

Further data on discourse production in a policy setting was collected at instances of interaction between science, society and policymaking. I attended the 1. Symposium Sustainability in Science, which took place on 23.04.2013 in Berlin and took fieldnotes on the observations and conversations around perceptions of sustainability and science policy for sustainability. The 10th BMBF forum for sustainability, the *BMBF-Forum für Nachhaltigkeit*, or *FONA Forum*, 9. – 11.09.2013, Leipzig, provided me with an additional opportunity to conduct informal interviews with policy-makers, project-management-agency staff and project participants, as well as a chance of participant observation of the BMBF's approach to participatory agenda setting in the context of research for development. The observations and informal conversations were documented in fieldnotes.

In order to collect data on projects, a total of 51 project participants were interviewed, 18 of those from partner countries, 33 from Germany. Project participants interviewed were involved in 11 different projects from the IWRM funding priority, 3 projects from the Megacities initiative, and the 2 projects funded as African Climate Science Service Centers, WASCAL and SASSCAL.

In view of the Megacities funding initiative, data was obtained mainly through fieldwork as an intern at the LIWA project office, Lima, Peru, from 01.08.2012 to 30.09.2012. The research stay included participant observation, interviews, informal conversations, participation in project activities and insights into different types of project documents. These insights were recorded as fieldnotes and tran-

scripts, which produced substantial amounts of data on the Lima project, but even more so on the Megacities initiative as such. In order to triangulate data on the Megacities initiative, I attended the Second International Conference on Future Megacities in Action on May 14 – 16, 2013, in Hamburg. During the event, I conducted different informal interviews with project participants, observed the interaction of ministerial representatives, project management agency staff and project participants, documented in field notes.

Insights into the IWRM initiative were to be generated in an internship at IWAS Brazil, from 01.10. to 31.11.2012. However, participant observation, informal conversations and insights into project documents (documented in fieldnotes, transcripts, and logfile) soon revealed that IWAS Brazil deviated from the projects within the original IWRM call for funding. Participant observation and informal conversations at the IWAS status colloquium, 6.12.2012, in Magdeburg enhanced this impression. Thus, in order to gain insights comparable to the depths in the Megacities Initiative, data on further projects within the IWRM funding initiative was generated in semi-structured interviews.

Appendix A-2: Overview of interview partners

Overview of interview partners

Code	category	field of expertise	institutional background	origin	date of interview
EE01	External expert	Funding for African Climate Service Centers	Development Bank (KfW)	Germany	05.03.13
EE02	External expert	Funding African Climate Service Centers	Development Bank (KfW)	Germany	18.04.13
EE03	External expert	Funding Health Re-search Partnerships	Development Bank (KfW)	Germany	18.04.13
EE04	External expert	Funding devel-opment-oriented agricultural research	Development Cooperation Agency (GIZ)	Germany	23.05.13
EE05	External expert	Pan-African University	Development Cooperation Agency (GIZ)	Germany	17.06.13
EE06	External expert	Advisory Board Megacities	Development Cooperation Agency (GIZ)	Germany	04.07.13
EE07	External expert	Research for sustain-able development	Swiss Commis-sion for Research Partnerships with Developing Countries	Switzer-land	15.08.13
EE08	External expert	Science policy and funding in Brazil	Ministry for Sci-ence, Technology, Innovation	Brazil	08.11.12
EE09	External expert	Science policy and funding in Brazil	Ministry of Foreign Affairs	Brazil	21.11.12
EE10	External expert	Science policies for sustainable development	NGO	Germany	19.02.13
EE11	External expert	Research and science policies for sustainable development	NGO	Germany	18.02.13
EE12	External expert	Science policy and funding in Peru	Research Council	Peru	14.09.12

Code	category	field of expertise	institutional back-ground	origin	date of interview
EE13	External expert	Science policy and funding in Brazil	Research Funding Agency (CNPq)	Brazil	13.11.12
EE14	External expert	Funding international research cooperation	Research Funding Agency (DFG)	Germany	19.04.13
EE15	External expert	Funding research coop-eration with developing countries/emerging economies	German Academic Exchange Service (DAAD)	Germany	07.06.13
EE16	External expert	Development-oriented research	Research institute	Germany	10.07.12
EE17	External expert	IWAS Advisory Board	Research institute	Germany	14.12.12
EE18	External expert	Policy processes, SÖF programme committee	Research institute	German	24.04.13
EE19	External expert	Research for sustain-able development	Institute for devel-opment research (IRD)	France	11.09.12
EE20	External expert	Sustainable develop-ment	Scientific Advisory Council (WBGU)	German	21.02.13
EE21	External expert	Sustainable develop-ment	Scientific Advisory Council (WBGU)	Germany	21.02.13
EE22	External expert	Sustainable develop-ment	Scientific Advisory Council (WBGU)	Germany	24.04.13
EE23	External expert	Sustainable develop-ment	Scientific Advisory Council (WBGU)	Germany	28.06.13
EE24	External expert	Development-oriented research	University	Peru	18.09.12
EE25	External expert	Member of Advisory Board Megacities	University	Germany	20.03.13
EE26	External expert	IWRM; interaction of institutions in water management in Brazil	Water agency	Brazil	19.11.12
PA01	Policy maker	International research cooperation	BMBF	Germany	16.07.12
PA02	Policy maker	Sustainability research funding	BMBF	Germany	25.07.12
PA03	Policy maker	Sustainability research funding	BMBF	Germany	30.07.12

Code	category	field of expertise	institutional background	origin	date of interview
PA04	Policy maker	Sustainability research funding	BMBF	Germany	13.03.13
PA05	Policy maker	Sustainability research funding	BMBF	Germany	13.03.13
PA06	Policy maker	Sustainability research funding	BMBF	Germany	20.03.13
PA07	Policy maker	International research cooperation	BMBF	Germany	26.03.13
PA08	Policy maker	International research cooperation	BMBF	Germany	19.04.13
PA09	Policy maker	International research cooperation	BMBF	Germany	02.05.13
PA10	Policy maker	Sustainability research funding	BMBF	Germany	03.05.13
PA11	Policy maker	Sustainability research funding	BMBF	Germany	03.05.13
PA12	Policy maker	Sustainability research funding	BMBF	Germany	24.06.13
PA13	Policy maker	Other research policy	BMBF	Germany	25.06.13
PA14	Policy maker	Sustainability research funding	BMBF	Germany	12.07.12 and 26.07.12
PA15	Policy maker	International research cooperation, interministerial cooperation	BMUB	Germany	07.08.13
PA16	Policy maker	International research cooperation, interministerial cooperation	BMZ	Germany	02.04.13
PA17	Policy maker	International research cooperation, interministerial cooperation	BMZ	Germany	02.04.13
PP01	Project participant	Megacities research initiative	NGO	Partner Country	28.09.12
PP02	Project participant	Megacities research initiative	NGO	Partner Country	11.09.12
PP03	Project participant	IWRM research initiative	Research institute	Germany	19.06.12
PP04	Project participant	IWRM research initiative	Research institute	Germany	19.06.12

Code	category	field of expertise	institutional background	origin	date of interview
PP05	Project partic-ipant	Megacities re-search initiative	Research institute	Germany	05.12.12
PP06	Project partic-ipant	IWRM research initiative	Research institute	Germany	06.12.12
PP07	Project partic-ipant	IWRM research initiative	Research institute	German	17.12.12
PP08	Project partic-ipant	IWRM research initiative	Research institute	Germany	13.02.13
PP09	Project partic-ipant	IWRM research initiative	Research institute	Germany	13.02.13
PP10	Project partic-ipant	IWRM research initiative	Research institute	Germany	22.02.13
PP11	Project partic-ipant	IWRM research initiative	Research institute	Germany	25.04.13
PP12	Project partic-ipant	IWRM research initiative; African Climate Science Service Centers	Research institute	Germany	04.07.13
PP13	Project partic-ipant	IWRM research initiative	Research institute	Partner Country	01.11.12
PP14	Project partic-ipant	IWRM research initiative	Research institute	Partner Country	14.11.12
PP15	Project partic-ipant	Megacities re-search initiative	University	Partner Country	13.09.12
PP16	Project partic-ipant	IWRM research initiative	University	Partner Country	06.11.12
PP17	Project partic-ipant	IWRM research initiative	University	Partner Country	08.11.12
PP18	Project partic-ipant	IWRM research initiative	University	Partner Country	09.11.12
PP19	Project partic-ipant	IWRM research initiative	University	Partner Country	12.11.12
PP20	Project partic-ipant	IWRM research initiative	University	Partner Country	12.11.12
PP21	Project partic-ipant	IWRM research initiative	University	Partner Country	12.11.12
PP22	Project partic-ipant	IWRM research initiative	University	German	20.12.12

Code	category	field of expertise	institutional background	origin	date of interview
PP23	Project partic-ipant	Megacities re-search initiative	University	Germany	13.01.13
PP24	Project partic-ipant	IWRM research initiative	University	Germany	29.01.13
PP25	Project partic-ipant	IWRM research initiative	University	Germany	14.02.13
PP26	Project partic-ipant	IWRM research initiative	University	Germany	14.02.13
PP27	Project partic-ipant	Megacities re-search initiative	University	Germany	22.02.13
PP28	Project partic-ipant	IWRM research initiative	University	Germany	25.04.13
PP29	Project partic-ipant	IWRM research initiative	University	Germany	26.04.13
PP30	Project partic-ipant	IWRM research initiative	University	Germany	30.04.13
PP31	Project partic-ipant	IWRM research initiative	University	Germany	06.05.13
PP32	Project partic-ipant	IWRM research initiative	University	Germany	06.05.13
PP33	Project partic-ipant	IWRM research initiative	University	Germany	06.05.13
PP34	Project partic-ipant	IWRM research initiative	University	Germany	06.05.13
PP35	Project partic-ipant	IWRM research initiative	University	Germany	06.05.13
PP36	Project partic-ipant	IWRM research initiative	University	Germany	06.05.13
PP37	Project partic-ipant	African Climate Science Service Centers	University	Germany	08.05.13
PP38	Project partic-ipant	Megacities re-search initiative	University	Germany	25.06.13
PP39	Project partic-ipant	Megacities re-search initiative	University	Germany	28.08.12
PP40	Project partic-ipant	Megacities re-search initiative	University	Germany	27.09.12

Code	category	field of expertise	institutional background	origin	date of interview
PP41	Project participant	IWRM research initiative	University	Germany	14.02.13
PP42	Project participant	African Climate Science Service Centers	University	Germany	06.06.13
PP43	Project participant	IWRM research initiative	Drainage agency	Partner Country	19.11.12
PP44	Project participant	Megacities research initiative	Water and drainage provider	Partner Country	23.08.12
PP45	Project participant	Megacities research initiative	Water and drainage provider	Partner Country	23.08.12
PP46	Project participant	Megacities research initiative	Water and drainage provider	Partner Country	23.08.12
PP47	Project participant	Megacities research initiative	Water and drainage provider	Partner Country	23.08.12
PP48	Project participant	IWRM research initiative	Water provider	Partner Country	06.11.12
PP49	Project participant	IWRM research initiative	Water provider	Partner Country	20.11.12
PP50	Project participant	IWRM research initiative	Water provider	Partner Country	20.11.12
PP51	Project participant	IWRM research initiative	Water and drainage provider	Germany	29.04.13
PT01	Project management agency	African Climate Service Centers	Project management agency	Germany	16.04.13
PT02	Project management agency	IWRM research initiative	Project management agency	Germany	30.04.13
PT03	Project management agency	IWRM research initiative	Project management agency	Germany	30.04.13
PT04	Project management agency	Cooperation with developing countries/ emerging economies	Project management agency	Germany	03.05.13
PT05	Project management agency	Cooperation with developing countries/ emerging economies	Project management agency	Germany	03.05.13

Code	category	field of expertise	institutional background	origin	date of interview
PT06	Project management agency	IWRM research initiative	Project management agency	Germany	06.05.13
PT07	Project management agency	Megacities research initiative	Project management agency	Germany	18.06.13
PT08	Project management agency	Cooperation with developing countries/ emerging economies in other thematic area	Project management agency	Germany	01.07.13
PT09	Project management agency	Megacities research initiative	Project management agency	Germany	13.06.14

Source: Own elaboration

Appendix A-3: Example of guidelines used for a semi-structured interview

Interviewleitfaden zum Thema Kooperation mit Entwicklungs- und Schwellenländern in FONA

A. Grundgedanken hinter der Wissenschaftskooperation mit Entwicklungs- und Schwellenländern

- Welche Ziele verfolgt das BMBF, wenn es Forschungskooperationen zwischen Deutschland und Entwicklungs- und Schwellenländern fördert? Auf welche Weise nutzen diese Kooperationen den Entwicklungsländern, und welchen Nutzen hat Deutschland?
- Welche Erwartungen hat das BMBF bezüglich der Auswirkungen von Forschungsprojekten in Kooperation mit Entwicklungs- und Schwellenländern?

B. Strategische Prioritätensetzung und Förderung von Kooperationsprojekten mit Entwicklungs- und Schwellenländern

- Das BMBF fördert eine Vielzahl von internationalen Projekten in FONA. Woher stammt das große Interesse des BMBF an der internationalen Kooperation im Umweltbereich?
- Mit welchen Partnerländern unter den Entwicklungs- und Schwellenländern kooperiert die Abt. 7? Welche Kriterien zur Auswahl der Partnerländer gibt es?
- Gibt es standardisierte Grundprinzipien zur Förderung von Projekten mit Entwicklungs- und Schwellenländern?
- Sind spezifische Förderbekanntmachungen zur Kooperation mit Entwicklungs- und Schwellenländern anders gestaltet als Ausschreibungen zur Kooperation mit „entwickelten" Ländern?
- Haben sich Fokus und Rahmenbedingungen von Förderprogrammen im Laufe der Zeit geändert?
- Gibt es Überlegungen hin zu einem „Standardförderinstrument" zur Kooperation mit Entwicklungs- und Schwellenländern?
- Fließen Erfahrungen aus geförderten Projekten in neue BMBF-Programme ein (z.B. im Sinne von „lessons learnt" in der angewandten Forschung)?
- Gibt es eine Zusammenarbeit mit Institutionen der Entwicklungszusammenarbeit, wie GIZ oder KfW hinsichtlich der Umsetzung von Ergebnissen, Capacity Development, o.ä.?
- Gibt es ein Standardprozedere zur Findung von neuen thematischen Förderschwerpunkten innerhalb von FONA?

- Welche BMBF-externe Akteure sind in die Entstehung von Programmen zur Kooperation mit Entwicklungs- und Schwellenländern einbezogen?
- Aufgrund welcher Kriterien werden wissenschaftliche Berater gewählt?
- Werden die Ministerien der Partnerländer in die Entwicklung von Programmen und Förderbekanntmachungen einbezogen?
- Werden andere deutsche Ministerien (BMZ, BMU) einbezogen?
- Auf welchen Kriterien basiert die Auswahl der Projekte? Wer begutachtet?
- Wie reagieren Sie auf Kritik (z.B. seitens der Initiative „forschungswende" oder auf dem „Sustainability in Science" Symposium), die Prioritätensetzung und der Auswahlprozess sei nicht transparent genug, es müsste mehr zivilgesellschaftliche Partizipationsmöglichkeiten geben?

C. Übergeordnete Fragen

- Inwiefern stehen sich die Ziele des FONA-Rahmenprogramms und der Hightech Strategie entgegen?
- Wieso wird die sozial-ökologische Forschung in einer getrennten Linie gefördert?

Appendix A-4: Example of coverpage and first page of transcription of a semi-structured interview

Interview with   xxxxxxxxxxxxxxxxxxxxx

Coverpage data
Memo date   29.9.14
Interviewee   xxxxxxxxxxxxxxxxxxxxx
Date of interview   May 2013
Interview duration   50 min
Location of interview   BMBF
Medium/filename audiofile
Language   German

Context data
Age   xxx
Sex   xx
Organisation   BMBF
Position   x
Academic title   x
Disciplinary background   x
Links w/other interviewees
Access to interviewee   Mail

Observations
Xxxxxxxxxxxxxxxxxxxxxx

What is the data screaming at me?
„Ab jetzt ist alles anders, wir machen transparente Agendaprozesse und TD". Kooperation auf Augenhöhe als Abgrenzung zur EZ: vielleicht auch ein veraltetes Bild von der EZ im Kopf, das eigentlich nicht mehr zur Kategorienbildung taugt.

Transcript/detailed notes of interview
A: [eröffnende Worte zu Leitfaden].
x: Also wenn es um die Ziele geht, die das BMBF verfolgt, und um die Forschungskooperation zwischen DE und EWL/SL, und den HG, dann kann man klipp und klar sagen dass die Bestandteil des FONA-Programm sind, und zwar der Hauptlinie Globale Verantwortung/Internationale Vernetzung. D.h. es gibt in diesem Rahmenprogramm eine entsprechende Grundstruktur auf die wir aufsetzen. Wenn wir ehrlich sind, dann ist die Historie der Projekte die, dass wir erst mal angefangen haben, auf wissenschaftlicher Ebene zusammenzuarbeiten,

also da kann man gleich auch noch was zu den Afrika-Zentren sagen, denn das war auch die Grundlage dafür. Und dann geht man eben ein paar Schritte weiter, dann gibt es eben ganz konkrete Dinge, die wir eben in der Problemlösung sehen, was den globalen Wandel angeht, was die Nachhaltigkeit international angeht, da geht es ja nicht nur um Klimawandel, sondern auch um Bevölkerungswachstum, Wasser, Ernährung, und alles was damit zusammenhängt. Und das kann man eben nur gesamtheitlich im Prinzip betrachten. Hätten wir in Deutschland im Prinzip auch keine Bezugsfälle, weil wir eine abnehmende Bevölkerung haben, also grundlegend unterschiedliche Ansätze haben.

(2:04) Weil man aber eben sieht, dass bis 2050 70% der Weltbevölkerung in Megacities leben, müssen wir uns damit aus globaler Verantwortung auseinandersetzen. Und auch in die Regionen hineingehen. Das gilt für Wasserprojekte, für das Tsunamifrühwarnsystem, das gilt für viele Dinge, die konkret aufgesetzt werden. Auch Wasserprojekte im Rahmen IWRM, die Sie sich angeguckt haben, auch das sind interessante Ansatzpunkte. Aber wir gehen eben immer noch einen Schritt weiter. Das sind diese Klimacenter in Afrika. Da gab es langjährige Projekte, mit Laufzeiten von 10 Jahren, im Wasser-, Landmanagement, Umweltbereich, im Biodiversitätsbereich. Und was wir immer wieder festgestellt haben ist, dass wir da mit den afrikanischen Partnern mehr oder weniger kooperiert haben, das war für uns interessant. Wo liegt der Nutzen – wir wollten natürlich auch wissenschaftliche Erkenntnisse schöpfen die man bei uns nicht schöpfen kann. Jedenfalls nicht unter den Bedingungen, die wir hier haben, da müssen wir ins Ausland gehen. Und wir wollten natürlich, und das war auch das Anliegen der Forscher, der Region helfen. Und daraus ist dann die Idee entstanden, ziemlich ambitioniert, zu sagen wir schaffen eine Forschungsinfrastruktur. Wir schaffen wissenschaftliche Kapazitäten in der Region, im Westen und Süden, um den Leuten langfristig eine Beratung im nachhaltigen Landmanagement, in der Bewältigung der Klimafolgen, und anderen Dingen zu geben. Und da gehört auch CD zu, deshalb gibt es graduate schools, eine zentrale Forschungseinrichtung, und in den einzelnen Regionen. Und um das hinzukriegen, das lässt sich der deutsche Steuerzahler 100 Millionen Euro in den nächsten 5 bis 6 Jahren kosten. Da sind wir auch gut unterwegs.

(3:55) Jetzt in diesem Jahr werden wir alle diese Institutionen institutionell auf die Beine stellen können. Also die Graduate school liefen schon bevor die Gebäude errichtet wurden. Und auch die Forschungsprojekte unter deutscher Beteiligung liefen schon vorher. Die deutschen Forscher haben den Vorteil in den Regionen, mit Wissenschaftlern mit Forschern aus Afrika forschen zu können. Also jetzt kommt der institutionelle Teil, in dessen Rahmen sich die Süd- und Westafrikaner verpflichten müssen, bestimmte Kosten mit zu übernehmen. Und das Ganze soll in 5-10 Jahren zu einer Einrichtung oder Einrichtungen entwickelt werden, die dann selbst tragend sind. D.h. da geht es um die konkrete Bewältigung von Prob-

lemen in der Region, die signifikant anders sind als in Deutschland. Das muss man eindeutig sehen. Und da muss man auch eine Verantwortung übernehmen. Denn wir tragen erheblich zum CO2-Ausstoß bei, und werden, und das ist der Treppenwitz der Geschichte, am geringsten davon betroffen sein, wenn man sich die Modelle mal ansieht. Und bei denen wird es zu einer Existenzfrage, insbesondere in der Korrelation mit der demographischen Entwicklung. Da können wir uns nicht wegducken. Die Afrikazentren sind auch auf einer anderen Ebene hochinteressant. Und zwar weil wir da auf Augenhöhe mit den Afrikanern agieren. D.h. wir sind nicht die Entwicklungshelfer, wir sind auch nicht die großen, die denen mal beibringen, wie sie das zu machen haben, sondern wir sind die, die mit am Tisch sitzen.

Appendix A-5: Exemplary page of fieldnotes
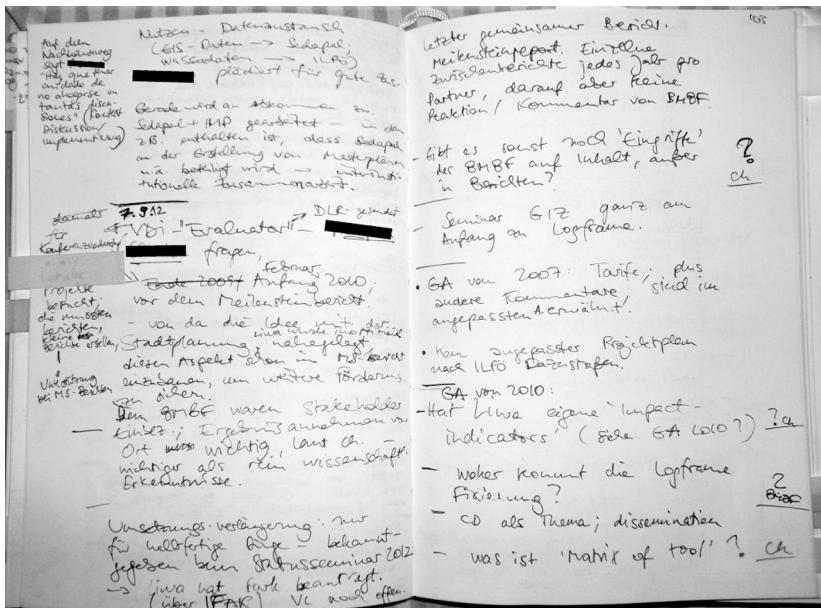
Appendix A-6: Extract from list of codes

724 vs 723
AA
Abgrenzung TZ-WTZ
Actors_PT
Actors_external
Agency in BMBF: individuals as change agents
Aufgabe der Forschung
Aufgabe der Forschung: Selbstverständnis
BMBF Struktur
BMBF objectives outside science
BMBF rationale
BMBF structure: Abt 2_kein Geld
BMBF vs. BMZ
BMBF vs. EU
BMBF vs andere Ministerien
BMBF – PT relation
Begleitprojekt
Begleitprojekt: AIM
Brasilien
Definition EWL/SL
Definition nachhaltige Entwicklung
Definition Forschung für Entwicklung
EWL vs. SL
Evaluation of science
FONA
FONA as HTS
Fona vs. HTS
Forschung und EZ
Forschung und EZ: different frame
Forschung und Umsetzung
GIZ_Hochschulsektoraktivitäten
Hightech Strategie
Hochschulkooperation vs. Forschung
ID/TD: Problematisierung

Appendix B-1: Developing countries and emerging economies with bilateral science, technology and innovation cooperation agreements with Germany

Argentina
Armenia*
Azerbaijan *
Belarus*
Brazil
Chile
China
Colombia*
Egypt
Georgia*
India
Indonesia
Jordan*
Kazakhstan *
Kyrgyzstan *
Malaysia*
Mexico

Moldova *
Mongolia*
Morocco*
Peru*
Philippines*
Russia
Singapore*
South Africa
(Sub-Saharan) Africa**
Tajikistan*
Thailand*
Tunis*
Turkey
Turkmenistan*
Ukraine
Uzbekistan*
Vietnam

* no bilateral agreement, but cooperation priority country; ** Africa is listed as a continent, no details of specific countries (but reference to Africa Strategy); Partner countries at the time of research, source: own elaboration based on BMBF 2014s, International Bureau 2014

Appendix B-2: Overview of main BMBF funding measures for cooperation with developing countries and emerging economies

BMBF Department	Funding measure	Details
International Department	Exploratory activities, preparation of projects, feasibility studies, pilot investigations in international cooperation	Only countries with a cooperation agreement or other cooperation countries, topics of strategic BMBF interest, application possible continuously; Via International Bureau/PT-DLR; Ongoing at time of research
	Bilateral mobility projects for international cooperation → mobility costs	Repeated bilateral calls with partner countries in areas of mutual interest; Cofunded by partner country; Via International Bureau/PT-DLR; Ongoing at time of research
	In the scope of international science years: funding for activities which enhance visibility of bilateral cooperation, additional funding for cooperation	Science years (2007-2014), cofunded by partner country: Germany-Turkey 2014, Germany-South Africa 2012/13; Germany-Russia 2011/12; Germany-Brazil 2010/11; Germany-China 2009/10; Germany-Israel 2008; Germany-Egypt 2007;
Life Sciences Department (Bioeconomy)	Global food security ("GlobE")	Call in 2011, programme ran from 2012-2018; Programme endowed with EUR 45 million; German-African cooperative projects; In the frame of the BioEconomy Strategy; Via PT-J; Ongoing at time of research
	Bioeconomy international	Calls in 2013, 2014, 2015, 2017; Coordinated calls with partner countries such as Argentina, Malaysia, Thailand and other emerging economies; Programme endowed with 46,2 Millionen Euro; Via PT-J; Ongoing at time of research
Life Sciences Department (Health Research)	German-African cooperative product development partnerships for prevention, diagnosis and treatment of neglected and poverty-related diseases	Call in 2011; In the frame of the Research funding concept on neglected and poverty-related diseases; Endowed with EUR 20 million; Via PT-DLR and KfW; Ongoing at time of research
	German-African health networks	Call in 2013; In the frame of the Research funding concept on neglected and poverty-related diseases; Via PT-DLR; Ongoing at time of research

BMBF Department	Funding measure	Details
Department for Basic and Sustainability Research (Unit 723/Global Change)	Past programmes	
	Research on global hydrological cycles and development of integrated water management strategies at the regional level ("GLoWa")	Programme from 2000 and 2012; Endowed with EUR 75 million; Projects focused on Germany, Africa and the Middle East region; Via PT-DLR
	Biodiversity and Global Change – ("BIOLOG")	Programme between 2000 and 2011; Endowed with EUR 80 million; Funding focus on Africa (BIOTA), and Europe; Aimed at an improved understanding of the role of biodiversity in ecosystems; Via PT-DLR
	Biosphere research – Integrative and applied modelling projects ("BIOTEAM")	Programme endowed with EUR 9 million between 2002 and 2009; Open to all model regions in developing countries.; Via PT-DLR
	Mata Atlantica – Biodiversity research in coastal forests of Brazil	Programme endowed with app. EUR 11.5 million from 2002-2010; Cofunded by Brazil (CNPq); 4 German-Brazilian projects funded in total; Via PT-DLR
	Ongoing programmes (at the time of data collection 2012-2014)	
	Research for Sustainable Development of the Megacities of Tomorrow ("Megacities")	In the frame of FONA (and HTS); Endowed with EUR 50 million; No predefined regions in the call, nine projects selected in developing countries/emerging economies in Asia, Africa and Latin America; Refocus on climate change mitigation/adaptation and energy efficiency in the main programme phase; Via PT-DLR
	Regional Science Service Centres in Africa	Initiative launched in 2010; In the frame of FONA; Endowed with EUR 100 million; Two centres (WASCAL and SASSCAL) in partner regions of Southern and West Africa; Cofunded by partner regions; Funding for research, capacity development and infrastructure; Via PT-DLR and KfW
	Sustainable Land Management (Module A/international cooperation on interactions between land management, climate change and ecosystem services)	Programme in the frame of FONA, HTS; Endowed with EUR 70 million from 2010-2016; Partner countries defined through scientific interest in the region, e.g. southern Africa, Brazil, China; Via PT-DLR
	Science Partnerships for the Assessment of Complex Earth System Processes ("SPACES")	Bilateral call between Germany and Namibia/South Africa, launched 2012

BMBF Department	Funding measure	Details
Department for Basic and Sustainability Research (Unit 724 / Resources and Sustainability)	Past programmes	
	Decentral water supply and disposal systems	Programme ran from 2002-2012; 13 Projects funded with Brazil, Ghana, Algeria, South Africa, Vietnam, Turkey
	Ongoing programmes (at the time of data collection 2012-2014)	
	Programme for funding initiative for excellence in research and innovation in the new federal states, Spitzenforschung und Innovation in den Neuen Ländern ("PROSIN")	Special case: PROSIN programme originated in the BMBF Strategy Department (Unit 114/Regional Innovation initiatives; New federal states) in 2008; IWAS funded in PROSIN but thematically attached to funding priority IWRM/administered in Unit 724; IWAS endowed with EUR 13.3 million from 2008-2013; IWAS focused on IWRM in model regions – Brazil, Ukraine, Mongolia, Vietnam, Oman/Saudi Arabia; Via PT-KA
	Integrated Water Resource Management ("IWRM")	IWRM call in 2004, project started between 2006 and 2010, programme ended in 2015, ongoing during research; Funding priority also including further projects, endowed with EUR 120 million; Suggested cooperation regions in call: Central and South East Asia, Sub-Saharan Africa, Near East; In the frame of FONA and HTS; Via International Bureau, PT-KA, PT-J
	International Partnerships for Sustainable Technologies and Services for Climate Protection and the Environment ("CLIENT")	Endowed with EUR 60 million; Research cooperation with BRICS countries and Vietnam, development and application of technologies and services in the field of climate protection, resource efficiency, land/water management; Cofunded by partner countries; Via PT-DLR (International Bureau and PT-Umwelt); Programme from 2010-2015

Source: own elaboration based on BMBF 1999; BMBF 2001; BMBF 2003a; BMBF 2003b; BMBF 2005b; BMBF 2005c; BMBF 2008b; BMBF 2010b; BMBF 2010e; BMBF 2011d; BMBF 2011c; BMBF 2011e; BMBF 2013h; PT-DLR 2013; Deppe 2013; PT-DLR 2014b; BMBF 2014n; BMBF 2014t; BMBF 2014u; BMBF 2017, PT-J 2019 as well as own interviews with BMBF staff

Appendix B-3a: Overview over types of applied project outcomes in the IWRM funding priority

Project	Approach / Topic	Outcomes for individuals / households	Outcomes for public administration and policy making	Outcomes for larger public	Capacity Development (CD)	Transformation knowledge; transferability
Guanting, China (added to IWRM priority)	Sustainable land and water use from climate, ecology, economy perspective		Modelling and scenario analysis for DS*		CD for technology use, science	[1]
Miyun / Peking, China (added to IWRM priority)	Water supply from Miyun reservoir	Pilot project: sanitary concept / ecosan toilets for village	Monitoring and modelling for DS	Demonstration project: small-scale waste water treatment for rural areas	CD in administration	[1]
IWRM Shandong, China	IWRM as a complex topic in need of integration		DS system software; Monitoring technology; Modelling	Pilot plant for water saving and reuse	CD for use of technology	[1]
IWRM Kidul, Indonesia	Technology-focused project aimed at water supply; socio-economic analysis and technology assessment	Energy and gas generation for individual households	Web-based geo-information system	Adapted water pumping system; Water treatment technology; Technology for concrete reconditioning in cisterns; Renovation / optimisation of water pipes	CD for use of technology, on good governance, awareness raising	[1]
IWRM Mongolia	IWRM with focus on management, CD, governance and pilot technologies	Dry / composting toilets	Monitoring concept for IWRM	Pilot plants water treatment	CD for technology use, in science, in primary schools	[1]
German-Uzbek Khorezm project (added to IWRM priority)	Water scarcity as an ecological, economic and social problem	Innovations in agricultural irrigation practices; Alternative land-use practices	Modelling and analysis for DS; Strengthening water users' associations and decision processes; Influence on agricultural policy	Diversification of agricultural systems for sustainability	CD in science, on technology use, awareness raising, institutional CD	"Follow the Innovation" as td-method* for successful innovation, [1]

Project	Approach / Topic	Outcomes for individuals / households	Outcomes for public administration and policy making	Outcomes for larger public	Capacity Development (CD)	Transformation knowledge; transferability
AKIZ, Vietnam (added to IWRM priority)	Industrial waste water management and technologies		Monitoring and analysis; Management concept for industrial zones; Influence on legislation	Industrial waste water treatment technologies	CD for use of technology	[1]
IWRM Vietnam	IWRM as an integrated concept, focus on governance, institutions, systems analysis		Planning and DS tools; Pilot measure GIS quality monitoring	Pilot plant drinking water treatment and supply	CD for use of technology	[1]
WISDOM, Vietnam (added to IWRM priority)	Sustainable development of water and land use		Water and land information system; Establishment of a German-Vietnamese water office		CD in science, on technology use, awareness raising in public	Transfer of information system to North Vietnam; [1]
IWRM SUMAR, Dead Sea Region	Interdisciplinary approach to overcome water scarcity		Water quantity monitoring stations; Modelling / analysis-based information for DS; Management concept			[1]
IWRM SMART, Israel/ Jordan/ Palestine	IWRM as an integrated concept, complex issue, focus on CD, participation, governance, pilot technologies		Knowledge management /data/ information system for DS; Cost-benefit analysis for alternative management practices; Establishment of a national implementation committee in Jordan	Desalination pilot plant; Decentralized wastewater treatment and reuse pilot plant	Encompassing CD – in science, for school teachers, students	Reflections about institutional and administrative barriers to innovation, [1]

Project	Approach / Topic	Outcomes for individuals / households	Outcomes for public administration and policy making	Outcomes for larger public	Capacity Development (CD)	Transformation knowledge; transferability
IWRM Isfahan, Iran	Water from holistic perspective; incl. needs of different sectors; participation / integration as principles		Simulation-based water management tool; DS system; Monitoring system; Institution building (data commission)	Innovations in the agricultural sector (water efficiency); Pilot projects reduction of leakage, patterns of water consumption	CD on technology use, awareness raising in public	Reflections about knowledge integration, participation, [1]
IWRM CuveWaters, Namibia	Adapted multi-technology mix; participation as principle	Pilot for floodwater storage, combined w/ drip irrigation; for rainwater collection on household level	Institution building	Sanitation concept involving water reuse, wastewater treatment and energy generation; Pilot for ground water desalinisation	CD for use of technologies, science	Accompanying research on implementing technologies, [1]
IWRM Olifants, South Africa	Sustainable IWRM approach based on financial value creation in water		Water management concept based on water franchise model; Private sector participation in management			[1]
IWRM Volga / Rhine	IWRM for basins with different water usages		DS system; Web-based geo-information system for environmental monitoring	Pilot for renovation of water constructions		[1]
IWAS (added to IWRM priority)	IWRM concept for different model regions, incl. scenario/system analysis, technology dev./ implementation, governance; CD		Modelling, analysis for DS; Management concept, IWAS toolbox; Recommendations for governance structures	Pilot plants for sewage treatment and drinking water processing; Prototype for detection of pathogens	CD on financing, technologies, in science; e-learning	[1]

Source: own elaboration based on BMBF 2014v; Ibisch et al. 2013 and interviews with project participants. – * DS: decision support, td: transdisciplinarity – [1] The IWRM accompanying project worked on crosscutting aspects of governance; capacity development, decision-support, participation and institutional analysis; AIM worked on financing large-scale technology innovations.

Appendix B-3b: Overview over types of applied project outcomes in the Megacities funding initiative

Project	Approach/ Topic	Outcomes for individuals / households	Outcomes for public administration and policy making	Outcomes for larger public	Capacity Development (CD)	Transformation knowledge; transferability
Megacities project Casablanca, Morocco	Urban agriculture		Action plan for integrating urban agriculture into the urban development process; Weather/ climate models for DS*	Design solutions for multifunctional space systems; Experimental plants for industrial waste-water treatment / re-use; Concepts for peri-urban tourism; Approaches for healthy food production; Urban agriculture in informal settle-ments	Awareness-raising and dissemination strategy, [2]	Reflections about td-methods*; action research; systemic change, [3]
Megacities project Ad-dis Ababa, Ethiopia	Solid waste man-agement, poverty reduction, improved sanitation	Business options for paper-recy-cling; Market studies and business guidelines	Model-based strategic planning for sustainable solid waste management; Adapted occupational safety and health standards / solutions	Pilot projects for separate collection at source, biogas facility, charcoal briquettes from organic wastes, composting, school biogas-latrine; Closing material cycles by using biogas sludge for erosion-preven-tion, energy crop production	CD in science, city; administration, among people working in pilot projects, [2]	Obstacle-based transfer analy-sis methodology for technologies or methods, [3]

Project	Approach/ Topic	Outcomes for individuals / households	Outcomes for public administration and policy making	Outcomes for larger public	Capacity Development (CD)	Transformation knowledge; transferability
Megacities project Hefei, China	Trans-portation manage-ment		Traffic management system; Traffic assessment model for DS; Guidelines for traffic management, transport planning and urban block design; Finance options for sustainable transport; Strategic design proposal for pedestrian-friendly cities		CD in urban / transport planning, [2]	[3]
Megacities project Urumqi, China	Resource efficiency in building/ housing	Construction of the first passive house in western China; Low-energy renovation of buildings	Waste management software; Hydrological modelling; Advice on efficient water use / water information management for DS		CD for a soil moisture-based measurement methodology, [2]	[3]
Megacities project Tehran-Karaj, Iran	Energy efficient new town develop-ment	'New quality building' w/ 16 housing units; Conceptual designs for energy-efficient residential/ commercial buildings	Master plan for a 35 ha. pilot area Manuals for climate-responsive / sustainable urban development; integrated urban planning in semi-arid / arid regions; Concepts for public transport; Wastewater ecological assessment model	Implementation of environmental compensation areas	Vocational education and training for construction workers, [2]	[3]
Megacities project Lima, Peru	Water manage-ment		Simulations / macro-modelling of water availability for DS; Governance solutions for the water sector; Water-pricing / tariff options; Integrated urban planning strategies	Ecological park; Experimental treatment plant pilot project	E-learning academy, CD for use of technology, [2]	Participatory methods, decision support tools, [3]

Project	Approach/ Topic	Outcomes for individuals / households	Outcomes for public administration and policy making	Outcomes for larger public	Capacity Development (CD)	Transformation knowledge; transferability
Megacities project Ho Chi Minh-City, Vietnam	Adaptation planning		Urban climate map for DS; Urban water balance modelling / planning recommendations; Handbook for land-use planning; Adaptation strategies for HCMC to climate change; Handbooks for urban design; communi-ty-based adaptation	Handbook green buildings (targeting middle class)	[2]	[3]
Megacities project Hyderabad, India	Gover-nance for sustain-ability	Cooperative / technical solutions for energy efficiency in irrigation	Climate assessment tool; Strategic transport planning tool	Collective action for fuel transition among the urban poor; Street food-safe-ty manual to strengthen a climate-friendly urban food-sup-ply system; Solar powered schools; Community radio	CD among all stakeholders, for sustainable lifestyles, on-site training street food, [2]	[3]
Megacities project Gauteng / Johannes-burg, South Africa	Energy and climate protection		Implementation of energy office; Energy / emission model for assessing energy performance of buildings; Establishment of long-term perspec-tive working group on governance; Transport emission inventory for mobility planning; Energy technology handbook; CDM emission trade evaluation tool; Energy / cost-effi-cient settlements for the poor / holistic housing approach	Installation of solar panels in schools	CD in schools, training and CD on outcomes, [2]	[3]

Source: own elaboration based on Ehlers et al. 2010; Koch-Kraft et al. 2013; BMBF 2013g and interviews with project participants — * DS: decision support, td: transdisciplinarity — [2] The Megacities accompanying project identified energy, mobility, governance, resources, planning and capacities as crosscutting issues of the research projects. — [3] Capacity development on the scientific level was part of all Megacities projects; funded through an accompanying PhD scholarship programme

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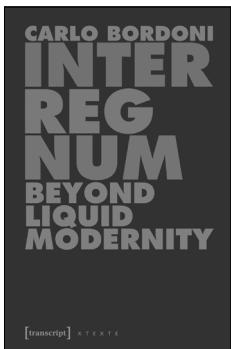
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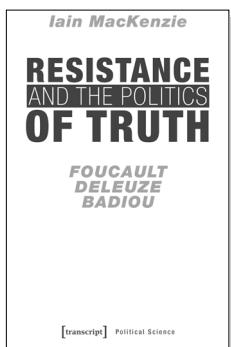
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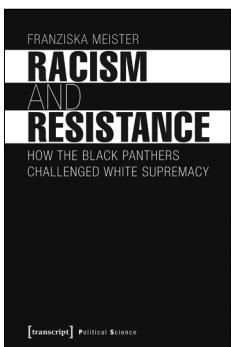
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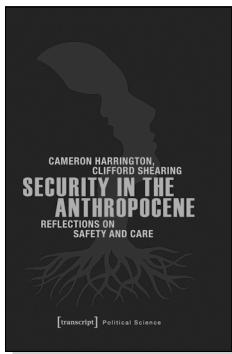
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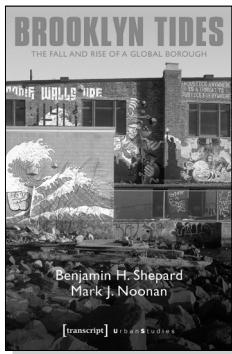
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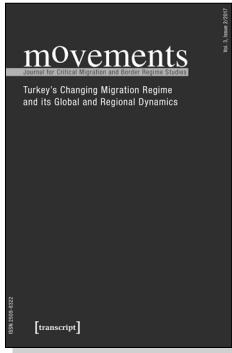
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