The Politics of Governance Experiments

Constructing the Clean Development Mechanism

vorgelegt von
Fabian Schroth, M.A.
geb. in Berlin

von der Fakultät VI – Planen Bauen Umwelt
der Technischen Universität Berlin
zur Erlangung des akademischen Grades

Doktor der Philosophie

– Dr. phil. –

genehmigte Dissertation

Promotionsausschuss:

Vorsitzender: Prof. Dr. Arnold Windeler
Gutachter: Prof. Dr. Jan-Peter Voß
Gutachter Prof. Dr. Markus Lederer

Tag der wissenschaftlichen Aussprache: 12. Februar 2016

Berlin 2016

Contents

Illustrations **v**

Acknowledgments **vi**

Acronyms **vii**

1 Introduction 9

Research Question and delineation of my empirical case **11**

Theoretical contribution: constructing governance arrangements in secluded experiments **13**

Outline: the politics of governance experiments in the CDM **17**

PART I: AN ANALYTICAL MODEL OF GOVERNANCE EXPERIMENTS **20**

2 Theoretical perspectives on climate governance – actors, discourses and sociotechnical arrangements 21

Actors in climate governance: International relations, global governance and political economy **22**

Climate governance embedded in orders of discourse: governmentality **25**

Climate governance as a sociotechnical arrangement: Performativity of economics and governance **30**

Performing carbon markets 30

Market as a sociotechnical arrangement 31

Theory of performativity of economics 32

Studies on carbon markets: situated construction of an economic frame 34

Performing governance arrangements 37

Governance as multiple sociotechnical arrangements 37

Politics of performative governance: shaping reality 40

Performing reality in governance: actors and technical issues 43

Conclusion: a performativity perspective of climate governance along three dimensions **46**

3 Analyzing governance experiments 50

Experiments in governance **51**

Towards an analysis of performative governance experiments **56**

The experiment in natural sciences: producing knowledge, constructing reality 56

Experiments in economy: in-vivo construction of reality 60

Performative experiments: translating the world into experiments and back 65

Conclusion: a conceptual framework to analyze secluded governance experiments **69**

4 Research approach: interpretative case study of governance experiments 73

Case study design 73

Interpretative analysis 75

Data collection and analysis 76

Limitations 79

PART II: THE CONSTRUCTION OF THE CLEAN DEVELOPMENT MECHANISM BETWEEN 1988 AND 2001 81

5 Reducing climate change to governance experiments: developing Joint Implementation 82

Context: developing a global climate change convention 82

Reducing climate change in-vitro: economic simulations of global climate governance 84
Economic simulations 84
Contesting simulations: the conflict over eco-colonialism 87

Reducing climate change in-vivo: carbon offset projects in Latin America 89
Privately induced carbon offset experiment in Guatemala 89
Publicly induced carbon funding experiment in Mexico 92

Reducing climate change in negotiations: towards a pilot phase of Joint Implementation 94
Policy proposal for a cost-efficient governance arrangement 94
JI in the international negotiations: conflicts and a pilot phase 97

Conclusion 106

6 Constructing governance experiments: USIJI, AIJ and an emerging experimental constituency 108

Assembling an experimental constituency and constructing a rationality 108
An experimental constituency emerges 108
Secluded construction of reality in in-vitro experiments 113

Secluded construction of a governance experiment: The US Initiative on Joint Implementation 117
Constructing the experiment in its material dimension 117
Constructing facts 122

Constructing a global climate governance experiment in-vivo: The Activities Implemented Jointly pilot phase 124

Conclusion 128

7 Expanding the Experiment: Developing the CDM between Kyoto 1997 and Marrakesh 2001 130

Expanding the experiment discursively: International negotiations after Kyoto 131
The Clean Development Mechanism 131
Developing the CDM into a private investor market 132

Expanding the experiment in its material and actor dimension 137

International organizations developing methodologies 137
The World Bank Prototype Carbon Fund (PCF) – expanding governance arrangement through alliances with private investors 142

Conclusion **147**

8 Conclusion: A Theory of Governance Experiments 149

Elements of a theory of experiments **151**
Reducing the world 151
Constructing the governance arrangement in secluded experiments 152
Expanding the governance arrangement 153

Discussion **154**
Seclusion and the politics of governance experiments 155
Contribution to Theory 157
Empirical limitation of my model and further research 160

Responsible governance experiments **162**

Appendix 166
References 169

Illustrations

Tables

Table 1: Interpretations of Joint Implementation 111

Figures

Figure 1: The translation process. Source: (Callon et al., 2009, page 69) 68
Figure 2: Secluded experimentation in climate governance 72
Figure 3: marginal abatement cost of joint implementation (Pearce, 1995, page 5) 113

Acknowledgments

This study would have never been accomplished without the support of a number of people to whom I am indebted. I am particularly indebted to my supervisor Jan-Peter Voß for the inspiring discussions and the time and support he gave me throughout the project. I am indebted also to my second supervisor, Markus Lederer, who read various chapters and provided valuable comments which undoubtedly improved my work. I am thankful to the graduate school "Innovation society today: the reflexive creation of novelty" at which this study was conducted. Without the inspiring atmosphere, the intense discussions at colloquia, workshops and over lunch, this study would have been impossible. Without the funding of the DFG this study would have never been accomplished.

I am particularly grateful to Nina Amelung, Dzifa Ametowobla, Miira Hill, Uli Meyer and Julian Stubbe who read parts of my study and provided useful comments and ideas. Ideas of this study and first versions of some chapters were presented at conferences in Grenoble, Magdeburg and Helsinki and discussed at workshops and summer schools with Raghu Garud, Susanna Borras and Julia Black. I am also thankful to the comments I got there.

Finally, this study would have never seen the light of day without my parents, friends and Elisa who continuously supported me. Thank you.

Acronyms

AES	Applied Energy Services
AGBM	Ad-hoc Group on the Berlin Mandate
AIJ	Activities Implemented Jointly
AIXG	Annex-1 Research Group
AOSIS	Alliance of Small Island States
BCSD	Business Council for Sustainable Development
CARE	Cooperative for Assistance and Relieve Everywhere
CCAP	Center for Clean Air Policy
CDF	Clean Development Fund
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CFC	Chlorofluorocarbons
CICERO	Center for International Climate and Environmental Research Oslo
CO_2	Carbon Dioxide
COP	Conference of the Parties to the Convention
CSDA	Center for Sustainable Development in the Americas
EDF	Environmental Defense Fund
ET	Emissions Trading
EU	European Union
G77	The Group of 77 at the United Nations
GEF	Global Environment Facility
GHG	Greenhouse Gas
IEA	International Energy Agency
IIEC	International Institute for Energy Conservation
ILUMEX	High-Efficiency Lighting Pilot Project in Mexico
INC	Intergovernmental Negotiating Committee
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
JIA6	Joint Implementation of Article 6 of the Kyoto Protocol
NGO	Non-governmental Organization
OECD	Organization for Economic Co-operation and Development
PCF	World Bank's Prototype Carbon Fund
RSWG	IPCC's Response Strategies Working Group
SB	Subsidiary Bodies
SBSTA	Subsidiary Body for Scientific and Technological Advice
STS	Science and Technology Studies

TERI	The Energy and Resources Institute
UNCED	United Nations Conference on Environment and Development
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
US AID	United States Agency for International Development
US EPA	United States Environmental Protection Agency
USA	United States of America
USIJI	United States Initiative on Joint Implementation
WRI	World Resources Institute

1
Introduction

In December 2014, heads and delegations of 194 states met in Lima, Peru, to prepare the ground for a new climate deal to be expected by December 2015 at the 21st Conference of the Parties (COP21) to the UN Framework Convention on Climate Change (UNFCCC) in Paris. One issue they discussed was a review of the Clean Development Mechanism, an instrument to respond to climate change they had adopted in the Kyoto Protocol 1997. In this Protocol, they decided to reduce greenhouse gas emissions globally by 5.2 % and created three flexible market mechanisms to achieve this goal: an emission trading system, the Clean Development Mechanism (CDM) and Joint Implementation (JI). These mechanisms were hallmarks of a new governance arrangement which was characterized by discussions framed mostly in economic terms and cost-benefit analysis (Fischer, 2009, page 176; Oels, 2005, page 197). They implemented a political response to climate change that rendered emission reductions as a matter of costs, and not of ethical or moral issues (Oels, 2005, page 199).

As one of the three flexible instruments in the Kyoto Protocol, the CDM allows parties to reduce their CO_2 emissions abroad. Greenhouse gas (GHG) emissions that resulted mainly from developed countries could be reduced in developing countries. The argument goes that it would be cheaper to implement basic environmental standards in countries where they are not implemented at all, than to improve facilities in developed countries where they are already subject of environmental regulations. The achievement of emission reductions is supposed to come with the instalment of new, green technology.

We can find CDM projects in various sectors, such as renewable energy, energy efficiency, hydropower, as well as waste handling, industrial gas abatement, mining and afforestation. The emission reductions of these projects are determined through a comparison of the real emissions with a counterfactual baseline. If a CDM project emits less emission than would have occurred anyway, that is, if the emissions are lower than the baseline, the difference between both scenarios counts as the emission reductions the project would generate. For the reduced emissions, the projects obtain credits, each representing one ton of reduced CO_2-equivalent emission. These credits can be traded, and countries and companies in OECD countries can buy them and offset their own emissions (Olsen, 2007, page 61). To make this instrument work, throughout the years a complex administrative and technical apparatus was developed at UN level consisting of several sub-organizations, standards and technical guidance. The UN Framework Convention on Climate Change (UNFCCC) is the regulatory framework, the Conference of the Parties to the convention (COP) the supreme decision-making body, the Executive Board and a secretariat the day-to-day operators, whose work is backed by advice from several scientific and technological advisory bodies. Detailed rules and procedures – which are continuously refined – define and determine which projects are eligible, how much greenhouse gas (GHG) emissions a project reduce, and how they are measured, monitored and verified.

The CDM has been in operation since 2001, the first projects began in 2004 and the first trading was in 2005. It will be operational until 2020. The CDM is now no longer the only offset mechanism. Several new systems have been installed throughout the last decade, for which the CDM has been a reference point in terms of its operational procedure (CDM Policy Dialogue, 2012, page 33), voluntary markets, local and regional compliance markets. In economic terms, so far it has been a success. In October 2012, it crossed the threshold of 1 billion credits generated, thus representing more than 1 billion tons of CO_2 emission reductions – more than the annual amount of Germany's emissions (BMWi, 2012). This has been possible due to a widespread support of both public and private actors. To reduce emissions, the project-based offsetting mechanism rests for large parts on private regulatory bodies (Dyck, 2011). It needs private project partners to submit projects, standardization and accounting bodies to validate and monitor the projects, practitioners and scientists to discuss and submit new governance procedures, governments to allow for projects in their countries, and last but not least buyers of the credits.

The CDM is, in short, a political order in which the climate has shifted from a natural, to a governable, object. The climate change issue has turned into an issue of carbon offset units that can be traded between private and public actors around the world.

In the late 1980s and early 1990s, the situation was different: "at the start of international climate negotiations in early 1991, it was far from obvious that the global response would be constructed around what are now called carbon markets" (Paterson, 2011, page 615) and which matured into what is now the "centerpiece of climate change policy" (Paterson et al., 2014, page 420). At that time on the national level, some industrialized countries had started to adopt unilateral targets and policies to address climate change, but at the international negotiations, climate change had only just recently found its way onto the agenda of international politics, with the first high-level conference taking place in 1988 in Toronto. Here, it was concluded that it is a "common concern of mankind" (Bodansky, 2001, page 25). The Intergovernmental Panel on Climate Change (IPCC) stated in its first assessment report in 1990 that "they were certain that some global warming would occur due to human activities, should existing emissions trends continue" (Paterson, 1996, page 9). International negotiations on a formal agreement to address climate change began in February 1991, which led to the signing of the UNFCCC at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992.

The main concern in the negotiations leading up to the Rio earth summit concerned the responsibilities countries have for climate change, as well as the regulatory nature of national approaches, be they more mandatory with targets and timetables or more flexible based on voluntary activities and qualitative goals. Most European countries included quantitative limitations of national emission levels, while primarily the United States, followed by Japan and the former Soviet Union questioned targets and timetables. Developing countries had pressed to view climate change not simply as an environmental issue but also as an development issue (Bodansky, 2001, pages 28–30) and urged that it should be dealt with in the context of the UN, and not in the "comparatively technical, narrow confines of the IPCC" (ibid.). They feared that climate change could become a new form of colonialism,

limiting the potential for developing countries to develop economically (Agarwal and Narain, 1991). Different alternatives to mitigate climate change were discussed in politics and science. We can find first concrete policy proposals to establish a global market for emissions in the US (Stavins, 1988); several European countries had introduced a tax on carbon (Haugland, 1993) and discussion abound on the introduction of a global carbon tax. Governments from the global South opposed such economic framing and supported forms of governance that would rest on historical responsibility and per capita emissions (Liverman, 2009, page 290).

This short comparison of the two situations of international climate governance reveals two aspects: first, while the scene was set for the development of climate governance at international level in the early 1990s, the trajectory this development would take was not at all determined. The political order that characterized the CDM in the 2000s was not at all visible yet. Actors tried to make sense of climate change and tried to turn it into a political program. It was not yet decided who would be authorized to govern the climate, what governing would look like and how climate could be turned into a governable object. Second, already in the late 1980s and early 1990s, the response to climate change was characterized by a close relation between politics and science. Science had identified climate change as a challenge for humankind and was able to put it on the agenda of international politics (Bodansky, 2001, pages 26–27); governments had established a global scientific-governmental body, the Intergovernmental Panel on Climate Change (IPCC), which was supposed to "conduct a comprehensive review of the issue and make recommendations comprising 'elements for inclusion in a possible future international convention on climate'" (World Meteorological Organization in: Miller, 2004, page 53); and the discourse whether climate change should be understood as a scientific-technical issue or a political issue spurred already intense debate. In the early 2000s, science and technology became even more central to the new political order. Power plants, renewable energies, and waste treatments were the technologies that emitted GHGs; experts monitored with the help of scientific models and instruments how much projects emitted, calculated baselines to determine a counterfactual future and the global warming potential of GHGs. Scientific experts were authorities in the political process, illustrated by the different technical and scientific advisory bodies which the Executive Board of the CDM and the UNFCCC secretariat consulted.

Research Question and delineation of the empirical case

The purpose of this study is to analyze how this new global climate governance order was constructed. It is guided by the interest in how the relatively open situation of the late 1980s/early 1990s was narrowed down and a then stable order emerged, as well as the question of how this process was affected by what Jasanoff (2004a) calls the co-production of science and social order. The study thus connects to a strand of research that looks at the role science and technology plays in the evolution of social order and particularly the connection between science and technology and politics in setting up new political order (Callon et al., 2009; Jasanoff, 2004a; MacKenzie, 2009; Miller, 2007). Jasanoff (2004a, page 14) states:

> it is through systematic engagement with the natural world and the manufactured, physical environment that modern polities define and refine the meanings of citizenship and civic responsibility, the solidarities of nationhood and interest groups, the boundaries of the public and the private, the possibilities of freedom and the necessity for control.

In modernity, she argues, science and technology are the central element that defines and produces social and political order. They "cease to be a thing apart from other forms of social activity, but are integrated instead as indispensable elements in the process of societal evolution" (Jasanoff, 2004a, page 17). Science is an integral part of society and of the construction of political and social order. Taking this diagnosis as the starting point for my study, I will focus on how science and politics interact in the process of constructing a new global political order.

In this study, I want to analyze one particular case of constructing a global political order: the process, which led to the climate governance arrangement the CDM became in 2001. As a governance arrangement, I understand an arrangement of rationality, governing agents and technologies, as I will explain in chapter 2. The CDM arrangement in 2001 can be characterized as being guided by a rationality of cost-efficiency, by private as well as public governing agents in developed and developing countries, as well as by emission reducing technologies and accounting technologies as the means to govern climate change.

To understand this process I will look at the period 1988 to 2001. In this period, a problematization and framing of climate governance under the principle of cost-effectiveness took place, which culminated in the idea to leave emission reductions to market forces and the investments of primarily private actors. An idea of a market-based governance system was developed and resulted in a new governance arrangement in which private investors and scientific and technical experts played a key role. The CDM is a carbon offset project mechanism that is based on the claim that it is cheaper to achieve emission reductions in developing countries than in developed countries.

The CDM is a carbon market based on a baseline-and-credit system. To determine the emission reductions of a CDM project, one distinguishes between the emissions a project actually emits and a fictional scenario of project emissions. This fictional scenario is a baseline that is calculated when the project starts. The difference in emissions between the actual and the hypothetical scenario defines the credits a project generates. The CDM thus works without a national, local or regional cap of emissions; any nation state – irrespective of whether it has imposed a national emission target or not – can participate in this scheme. Thus, in contrast to emissions trading, the CDM and its predecessors Joint Implementation (JI) and Activities Implemented Jointly (AIJ) are global carbon markets that are not just restricted to developed countries.

Theoretical contribution: constructing governance arrangements in secluded experiments

The CDM has been the object of a wide range of evaluative and theoretical literature (Paulsson, 2009). However, as with climate change in general, it is approached primarily within managerial and technical literature, which perceives the current approach to climate change as given (Wittneben et al., 2012). The development of a new political order and the role of science and technology, the issues I addressed above, have only been recently considered in literature on climate governance.

Participating in and observing the international negotiations, Wittneben (2007) identified a shift in what she calls 'institution', the rationality that guides the transfer of resources and technology within the UNFCCC. In the Rio convention, nation states agreed on common, but differentiated, responsibility, meaning that developed countries would take the lead in mitigating the climate. A central aspect of this principle was that developed countries provided developing countries with funding for new climate-friendly technologies. They were responsible for most emissions, and thus it was their duty to help developing countries to develop sustainably. They ultimately donated money so that developing countries could leapfrog fossil fuel-based technologies (Wittneben, 2007, page 29). But with the maturation of the global climate regime, the funding mechanism for climate friendly technologies changed. Once the Kyoto Protocol came into being, the global South began to be perceived as a site for investment. Projects in the South became a means for developed countries to get around reducing their emissions at home (Wittneben, 2007, page 35). The institutions changed from aid to investment.

Going beyond an analysis of the regulations and drawing attention to the actors participating in the CDM, Benecke and her colleagues showed that it matured over time from a public-private partnership into a fully-fledged market. While it was initially dominated by government-initiated public-private partnerships, it transformed into a marketplace in which "public and private actors engage in normal business transactions and have even become competitors" (Benecke et al., 2008, page 13). For private actors, this transformation implied that they had moved from being government objects and implementer of regulations to also being a government subject, able to propose changes and help setting up new regulatory agencies (ibid.). For some analysts, the innovative element of the CDM was particularly this establishment of a global carbon market (Figueres and Streck, 2009, page 228). It defined standards and processes for creating carbon credits and for reducing mitigation costs, which later turned into a benchmark for other carbon markets. The CDM itself has matured into "the leading international carbon market" (He and Morse, 2010, page 1).

From a critical perspective that understands the CDM as an indication of a larger hegemonic structure, Matt and Okereke wonder about the political struggles that occurred in the climate regime and that led to the "emergence and persistence of carbon markets as key instruments for addressing global climate change" (Matt et al., 2015, page 113). Taking the examples of the CDM and EU Emissions Trading System (EU ETS), they argue that the 1990s first saw a challenge of the neoliberal regime by the developing countries' attempt to

frame climate change in terms of justice and equity. However, a powerful coalition of developed countries and their think tanks responded to it by means of an accommodative strategy. They accommodated these concerns into the flexibility mechanism of the CDM and thus were able to pacify criticism. Matt and Okereke argue that carbon markets are compromises among competing societal and political actors and serve for the interest of a powerful alliance of carbon-emitting actors (Matt et al., 2015, page 127).

A similar argument, but with recourse to a hegemonic neoliberal discourse, is provided by Bailey et al. (2011). Analyzing the development of different carbon markets, they show that while in the early 1990s climate change was a threat to the economy, within a short time frame carbon governance was reframed into an "opportunity to construct a new carbon economy" (Bailey et al., 2011, page 683). They argue that this development took place in a political space populated by a variety of governmental and non-governmental actors. Market-based forms of carbon governance won support of these actors, as they offered an opportunity to accommodate their different interests: meeting emission reduction commitments without sacrificing other policy goals, particularly development; providing least-worst options for managing risks of regulation, and creating new commercial opportunities (Bailey et al., 2011, page 697).

Focusing more on the development of the discourse that guides the UNFCCC, Paterson claims that the market approach to climate governance has its origins in the two central issues, which were put on the table of negotiations in the early 1990s, and which henceforth constituted the central discursive frame in which climate governance was discussed and shaped. These issues were flexibility and efficiency. They led to the adoption of Joint Implementation (JI) in the Rio Convention and the flexible mechanisms in Kyoto (Paterson, 2011, page 615). Also being interested in the discursive dimension of climate change governance, Bäckstrand and Lövbrand characterize the UNFCCC governance arrangement in the 1990s by a green governmentality, a science-driven, centralized, multilateral, state-centric administrative approach, "associated with top-down climate monitoring and mitigation techniques implemented on global scales" (Bäckstrand and Lövbrand, 2007, page 124). With the adoption of the Kyoto Protocol and of the operational rules for the flexible mechanisms in Marrakesh in 2001, this governmentality shifted to ecological modernization; this was characterized by the rationale of a possible decoupling of economic growth and environmental degradation, based on liberal attitudes, with its key aspects being green regulation, investment and trade.

In a radical critique of market-based approaches to the climate, Lohmann (2005) analyzes the instrument and technologies of carbon markets. Coming from a perspective of science and technology studies (STS), he argues that the carbon markets of the Kyoto Protocol failed to frame the climate into a calculative space. These failures are problems that cannot be taken into account in what market analysts call learning-by-doing. They are the result of overflowings of the market (Callon, 1998) and the resistance of the climate to become quantified. The success of markets as a response to the climate is thus not due to its environmental performance, but due to a free market ideology that captured political activists, scientists and technocrats alike. The consequences of these markets go beyond their imme-

diate climate mitigation performance and are even contrary to the carbon markets' goal. They create accounting methods and technical institutions that shape and maintain a future based on fossil-fuel, not renewable energy, and which gives authority to experts and corporate actors (Lohmann, 2005, page 230).

Going beyond an ideological and discursive explanation of the emergence of carbon markets, Voß (2007) shows how emissions trading developed from a scientific idea via laboratory and real life experiments into a workable solution to address policy problems. What he calls the innovation journey of the policy instrument unfolds along the phases of gestation, proof-of-principle, development of a prototype, and finally the formation of a regime. In following the instrument, Voß highlights the role of an instrument constituency that had material interest in emissions trading and thus pushed for its implementation in new domains and jurisdictions (Voß, 2007, page 340; see also Voß and Simons, 2014). With a focus on the policy instrument, Voß shows that emissions trading was not just an idea that waited passively to be picked up by a powerful actor coalition to maintain their interests, but was also the result of a push of an instrument constituency. Voß and Simons (2014) further develop this argument, highlighting that the constituency did not have an interest in a carbon market, thereby pushing for it, but developed this interest while building on the idea of tradable carbon. For consultancies and international organizations, carbon markets became a product they tried to sell. With this analysis they turned a common assumption upside down, namely that climate change is the problem and carbon markets are a possible solution to govern it (CDM Policy Dialogue, 2012; Michaelowa, 2000). Instead, they argue that the idea of tradeable permissions was developed independently from the climate change domain and was then subsequently brought into it by the effort of this constituency.

This short review illustrates the interest in change and development of climate governance and shows that climate policy instruments are "a reflection more of the power and authority of actors than 'scientific' or 'efficient' measures to mitigate the effects of climate change" (Wittneben et al., 2012, page 1437). The reviewed literature identifies the political struggles among powerful actors and the discourse resulting in carbon markets. Depending on the author, the actor constellations they are interested in are organized along the differences of public and private actors (Benecke et al., 2008), of business and politics (Newell and Paterson, 2010a; Paterson, 2011; Paterson et al., 2014) or of developed and developing countries (Matt et al., 2015). These struggles occur on the backbone of different structures, be it an international anarchical system (Wittneben, 2007), a neoliberal discourse (Bailey et al., 2011; Lohmann, 2005) or a political economy (Newell and Paterson, 2010a).

The review also shows the diversity of theories employed to understand change in climate change governance. However, first, it falls short in understanding the process leading to this change; with the exception of Voß (2007), this literature is rather silent about the development process itself. The focus is on actors, discourses or institutional structures. While this allows scholars to explain the emergence of market-based, neoliberal, business friendly governance arrangements, it does not enable them to explain the particularities of new governance arrangements like the CDM, nor how they were constructed. The CDM

and carbon markets in general are understood as a policy instrument, a tool that is available and that actors in the area of climate governance can use. With their focus on the political struggle, on actors, and discourses to explain the emergence of carbon markets, this literature departs from the assumption that carbon markets are a rational instrument to address climate, an assumption that is quite common in policy analysis (for a critical discussion of such literature see: Stephan and Paterson, 2012). However, it still does not depart from its instrumental understanding. How carbon markets and the CDM are constructed, the contingency in this process and the practices and struggles involved in it, are not part of the existing literature's analysis.

Second, these studies fall short of taking into account the role of science and technology in the process[1]. They are interested in the role of political and economic actors, in the system of international relations, or the discourse that structure such an international response to the climate – this is where they locate politics. Inherent is a conception of politics that is limited to the policy process of agenda setting, decision-making and implementation (Stephan and Paterson, 2012). It understands the making of collective order as the making of rules and regulations in the institutionalized sphere of politics. In the words of Hilgartner and his colleagues, it "imagines a cartography that maps questions of fact as the domain of experts and questions of value as the domain of democratic choice" (Hilgartner et al., 2015, page 2); facts are the domain of experts and science and values the domain of politics. From the co-production perspective sketched above, however, such separation does not hold. Instead, as scholars from science and technology studies (STS) have repeatedly shown, the construction of facts is the result of social processes (Knorr Cetina, 1995; Latour, 2005), and the separation between facts and values – i.e. between nature and society – the result of modernity (Latour, 1993).

More recent approaches on climate governance address this lack, focusing on how climate was made governable (Lövbrand and Stripple, 2011; Stripple and Bulkeley, 2014b) and addressing the role of technologies in governing the climate (Bumpus and Liverman, 2008; Lohmann, 2009; MacKenzie, 2009). They conceptualize politics not as a matter of the clashes of ideas and interests, but as an immanent process of every social relation (Stripple and Bulkeley, 2014b, page 14); they are interested in providing "powerful ways to think about the rationalities, politics and practice through which the governing of the climate is taking place" (Stripple and Bulkeley, 2014b, page 14). While I welcome, and would like to contribute to, these approaches, I would still like to emphasize how science and knowledge contributes to the rationalities, politics and practices of governing. As I will argue in chapter 2, such an emphasis implies a slightly different conception of rationalities and politics. Rationalities are situational, constructed in the interaction of actors; politics concerns the drawing, proposing and deciding of a collective order that ascribes the roles, functions and agencies of humans and non-humans.

I propose to study the contribution of science and knowledge to this process with the concept of governance experiments. Recently, scholars in the realm of governance have be-

[1] With the notable exception of Lohmann (2005) and Voß (2007)

come interested in experiments (Hoffmann, 2011; Overdevest and Zeitlin, 2014; Sabel and Zeitlin, 2008), as they provide a new modus to identify problems and construct solutions in times of uncertainty. Governance experiments are seen as a chance to make use of rational science to move towards a new and better state of affairs (see chapter 3). This increasing scholarly interest corresponds with repeating instances of experiments in my case study. Interview partners mentioned them and documents described them frequently. However, as we have seen, science is not as rational as it is supposed to be. Assuming that governance experiments would be a rational approach to uncover the objective truth of nature would mean to apply the 'cartography of conventional wisdom' of the separation of science and politics, and thus reject the insights of STS.

I will take a different approach. I will take the insights about experiments which STS literature has compiled for experiments in science to the study of governance experiments. Callon, Barthe and Lascoumes (2009) argue that research works through a process of translation. First, the enigmatic world is translated into a laboratory. Here, researchers can intervene into a purified world and control their intervention. Thereby they construct a new reality which is translated back into the macrocosm. In this process of translation, new realities are constructed. The authors call this process "secluded research", as it takes place outside the public realm. Their central concern is that this research does not detect an objective reality, but constructs a new world that appears to be real from the outset. In secluded research, politics happen.

In chapter 2 and 3, I will argue that taking this analysis and argument to the realm of governance allows the researcher to analyze how the macrocosm climate change is translated to secluded experiments, where specific governance arrangements are constructed, and how these new arrangements are expanded back to the macrocosm – in short how a new political order is constructed in secluded governance experiments.

Having indicated my theoretical approach, I can now specify my research: how was the CDM governance arrangement constructed in a process of secluded experimentation in the period 1988 to 2001?

Outline: the politics of governance experiments in the CDM

To develop my argument, the book is organized in the following way. In chapter 2, I will first provide a more in-depth literature review of studies about climate change governance, carbon markets and the CDM. I will identify the theoretical backgrounds of these studies and argue that a performativity perspective is fruitful for an analysis of the development of the CDM, which also takes into account science and scientific models. Such a perspective is interested in how new sociotechnical and governance arrangements are constructed in practice as the realization of scientific models. This literature argues that scientific models do not observe reality, but are engaged in the construction of the reality they describe (Callon, 2007). Scholars have taken up this perspective to analyze carbon markets, and in this chapter I will make a claim to re-combine this perspective with a governmentality perspective which is interested in how governing works in practice. My argument is that we can

analyze governance arrangements, rationalities, agents and technologies of governance, with a performativity perspective. Such a perspective comes with a specific understanding of politics. Politics, I will argue, refers to the construction of a specific spatiotemporal order or reality. At a specific time and space, this order of how the world is, appears as a fact. The construction of this order or reality of the world we want to live in is the politics of performativity.

In the third chapter, I turn to a specific practice of performing governance, to governance experiments. I develop a model that allows me to analyze how new governance arrangements are constructed in in-vivo and in-vitro experiments. Therefore, I combine work from different scholars in science and technology studies (STS), showing the processes and dimensions of governance experiments. I propose that, in governance experiments, the "enigmatic world" (Callon et al., 2009, page 50) is reduced to an actor, material and discursive dimension. Rationalities, agents and technologies are adjusted in a way that works. An economic rationality, accounting and carbon offsetting technologies, private investors, governmental agencies and technical and scientific experts are combined into an arrangement that mitigates emission reductions efficiently and thus contributes to climate change. Thus, the experiment constructs a new reality of climate governance, a reality within which climate change has been problematized into treatable economic, scientific and political issues. Within this reality, the governance arrangement works and is naturalized. It expands from the experiments towards the world again on the material, discursive and actor dimensions. At different sites, actors use this technology employed in the experiments; the experimental constituency pushes and lobbies for the governance arrangement to be used at other sites; and in the discursive dimension, the rationality of the experiments expands as a reference for a further evaluation of climate governance. Through the process of reduction, construction and expansion, a model inscribed in the experiments performs a new reality.

After having described the interpretative case study approach I took to analyze my data, in the second part of this study I will investigate the construction of the Clean Development Mechanism (CDM). In chapter five, I analyze the development of international climate governance in the late 1980s and early 1990s, focusing on how climate change was reduced into experiments of an economic climate governance arrangement called "Joint Implementation (JI)". I draw attention to the negotiations of the international climate agreement, as well as to some experimental activities that influenced these negotiations. I argue that in this period, climate change was increasingly problematized as a concern of efficiency. This problematization was a result of economic simulations, as well as in-vivo experiments, which tested whether and how a climate governance arrangement based on efficiency would work. These small-scale experiments resulted in the proposal of JI, a concept that would allow countries to address climate change jointly and make use of different marginal abatement costs of emission reductions. This proposal initiated intensive negotiations resulting in a pilot phase to test and further develop such an economically inspired governance arrangement. At the end of this phase, an experiment was installed that could test and demonstrate a climate governance arrangement that was undisturbed by the enigmatic world. This experiment reduced climate change to a set of methodologies, controllable greenhouse gases and an economic rationality.

Chapter six covers the process of how economic climate governance arrangements were constructed in experiments. First, in an emerging transnational constituency that constructed governance experiments, an economic model of marginal abatement costs was accepted as a guiding model of climate governance. This constituency developed the idea of a private investment market and influenced the international negotiations thanks to personal contacts and via powerful international organizations. Second, in experiments in the USA, a climate governance arrangement that rested on private investments was constructed in-vivo. The USA used the experience made in this experiment to request during the international negotiations a climate governance arrangement that is based on private investments. Third, nation states set up a global experiment with an economic climate governance arrangement. They constructed an experimental boundary of this experiment and rendered the enigmatic world measurable and comparable. The actors thereby successfully reified a framing of climate governance as a private investment arrangement in the experimental setting.

The last empirical chapter, chapter seven, draws attention to the process of expansion. In experiments particularly of the World Bank, the discursive practices of the Organization for Economic Co-operation and Development (OECD) and the United Nations Conference on Trade and Development (UNCTAD), and the use of the technologies, instruments and agencies constructed in existing experiments, a climate governance arrangement expanded from the experiment into the macrocosm. Within this process of expansion, the experimental governance arrangements and the macrocosm of climate governance were adjusted and modified into a global private investor market arrangement. A new governance arrangement finally came into existence; a performation of the economic model of marginal abatement costs with its adjustment of tradable credits.

Based on the insights of my case study, in the concluding chapter I propose a theory of governance experiments. I argue that we can analyze the construction of new forms of governance as an experimental process in which the world is reduced, a new world constructed and expanded. I highlight the benefit of such a perspective which enables an insight into the work invested in making governance experiments work. It enables the research to analyze how in each process new interests, actors and materials are accommodated and the experiment adjusted to new situations. It thus works to avoid a rational assumption of experiments in governance and to highlight the politics involved. The chapter argues that its primary contribution to literature is the detection of the co-production of social order (Jasanoff, 2004a) in governance experiments. As a consequence, I derive some recommendations for a responsible form of governance experiments that rests on the precautionary principle, and the concept of collective experimentation. In such experiments, actors would work in an interdisciplinary manner, and affected groups would participate.

Part I: An analytical model of governance experiments

2
Theoretical perspectives on climate governance – actors, discourses and sociotechnical arrangements

In this chapter, I will review literature on the Clean Development Mechanism (CDM), carbon markets and climate governance. I aim to identify the different theoretical perspectives these studies take to analyze climate governance and to discuss their advantages and disadvantages to study the emergence of new governance arrangements. I searched for literature that looks into the development of new forms of climate governance and political ordering. The reviewed literature is thus not exhaustive on the topic of carbon markets and the CDM. Attempts have been made to provide such overviews (e.g. Paulsson, 2009) and it would be beyond the scope and space of this study to add a further one. I am interested in how this literature understands the order of climate governance and how it explains change and the emergence of new forms of governance. I will categorize the literature into three perspectives. The first perspective understands climate governance as problem solving and is concerned with how it can be made effective and legitimate. These studies are located in the realm of international relations and global governance and consider how climate change can be addressed within the existing political order. They take an institutionalist perspective, reflecting upon either how states could cooperate to address climate change while there is anarchy in international relations, or how new climate change could be addressed effectively through new forms of governance. Effectiveness and legitimacy are hereby the central concern.

The other two perspectives do not take for granted existing political order and institutions but analyze how they came about and are now taken for granted. I identify two strands, governmentality and performativity, which address this question from either a macro perspective (governmentality) or a micro-perspective (performativity). I will discuss their theoretical backgrounds and how these are taken up in empirical studies. Governmentality studies assume that political organizations and institutions become agents in a political order through the legitimizing role of rationalities. These rationalities are the studies' primary concern and can be identified in mundane practices. Their focus is on how governing works in these practices and which governmentality applies. Performativity on the other hand is interested in how forms of order are constructed – performed – in practices. It questions how actors become agents through the assemblage of human and non-human actors into sociotechnical arrangements. Its focus is on the co-production of science and social order (Jasanoff, 2004b). Besides their difference, I will identify commonalities. I argue at the end that we can productively combine these commonalities. A performativity perspective that is enriched with the notion of rationalities is able to analyze the construction of climate governance in practice, as arrangements in a discursive, material and social dimension.

Actors in climate governance: International relations, global governance and political economy

In international relations, scholars explain the emergence of the Kyoto Protocol in general, and the flexible instruments of the Protocol like the CDM in particular, through interest-based, rational choice perspectives. The starting point is the assumption that countries can only cope with global climate change in cooperation. Individual action is not sufficient and the question is how and why states cooperate. The global climate is perceived as a public good, and nations who do not pay for the costs of stabilizing emissions cannot be excluded from it. In such a situation, it is rational for states to take advantage of the benefits produced by others at no further cost (Luterbacher and Sprinz, 2001). Cooperation is not rational, but a scientific necessity. Besides this general game-theoretical problem, in international politics and climate change in particular, governments are influenced by the state of scientific knowledge and their interests. These are, inter alia, dependent on the production and use of fossil fuels, the vulnerability to impacts of climate change and the availability of affordable options to reduce carbon emissions (Oberthür and Ott, 1999, page 13). From this perspective, the Kyoto Protocol reflects the US dominance in the international negotiations and the weakness of foreign policy in the EU, Japan and elsewhere, as most of their demands are reflected in the protocol (Grubb et al., 1999, page xxxvi). Such an approach toward environmental governance understands the system of global politics as structured by states and law (cf. Newell, 2008). States interact and construct international regimes, regulatory arrangements like the CDM or the Kyoto Protocol, around specific issues to achieve their goals (Keohane and Victor, 2010, page 3). The black-box state itself is not opened-up (Newell, 2008, page 513). In this perspective, the evolvement of the CDM is the result of states which negotiate the legal framework, CDM. Science gives advice to governments about the best solutions, itself being outside politics.

This is the theoretical perspective of a wide range of evaluation studies. They take the CDM to be a "rather unproblematic starting point and focus on the fine-tuning of some particular aspects of the mechanism" (Paulsson, 2009, page 76). Paulsson reviewed over 200 studies that assessed the CDM's environmental integrity and its ability to result in sustainable development. Coming from both grey literature and scientific literature, these studies addressed the additionality concept, problems with defining the baseline, with the leakage and permanence of the emission reductions, and how benefits for host countries could be increased. Often, they were carried out by those who have been part of the implementation and design process (Greiner and Michaelowa, 2003; Grubb et al., 1999; Lecocq and Ambrosi, 2007). Implicitly or explicitly, these studies apply a positivist international relations perspective. They claim to evaluate the CDM neutrally and propose refinements based on thorough scientific evaluation, seeing themselves as mere consultants or as doing technical work. The actors having an agency are the states who negotiate and develop the best, i.e. most effective, solution for climate change.

This is still the dominant social scientist approach in climate change (Stripple and Bulkeley, 2014b). However, as Newell argues, such an approach has little value for understanding

"the particular nature of environmental problems and the political and material relations which create them and within which they are managed" (Newell, 2008, page 509). It takes for granted a social and political order, in which climate change is conceived as an international problem to be addressed by nation states and rational individuals, and in which policy-making and science is neatly distinguishable. The development of policies would thus be understood along the lines of international negotiations, rational actors and a division between science and policy, with the former advising the latter.

Global governance concepts have challenged the centrality of the state and the separation between domestic and international realms. These concepts evolved in response to a perceived fragmentation of authority and a multiplication of actors involved in policy-making processes (Stripple and Bulkeley, 2014b, page 5). Within this perspective, the concept of transnational governance evolved as an alternative to state-bound notions of political space. Transnational governance describes new forms of networks of actors that cut across national boundaries and the public-private divide. An example is Braun (2009) who demonstrates the role knowledge and policy networks played in developing the EU emissions trading system (EU ETS). Using a policy network perspective, he shows how the emissions trading directive evolved in an informal policy network built on the sharing of knowledge on emissions trading (Braun, 2009, page 483). The Directorate-General (DG) Environment was responsible for writing the directive. However, it lacked relevant knowledge to design an emission trading scheme, and thus approached NGOs and consultancies which had practical and theoretical experience in emission trading. In a learning process, DG Environment, NGOs, consultancies, and companies built a European network on emission trading. Based on this network, members from DG Environment became key players for the development of the directive beyond their formal role of just proposing one (Braun, 2009, page 484).

To analyze whether such new forms of governance are legitimate and effective and how effectiveness and legitimacy can be enhanced is a further prominent problem in the literature on global governance (Bäckstrand, 2006). In different publications, Bäckstrand addresses this problem in the realm of environmental and climate governance. Bäckstrand (2008) maps different transnational partnerships in the realm of climate governance, and asks how legitimacy and accountability can be applied to such fragmented, networked climate governance. Legitimacy refers to the "perception by the actors of the overall quality of the social order, which includes institutions, norms and rules" (Bäckstrand, 2008, page 79); accountability rests on transparency, monitoring mechanism and stakeholder representation. With this concept, she builds different types of transnational partnerships, with different accountability mechanisms. Bäckstrand and colleagues ask to what extent these transnational partnerships result in more legitimate and effective policy outcomes (Bäckstrand et al., 2010). They argue that these governance arrangements "rest upon a normative agenda to open up politics and make environmental decision-making more inclusive, transparent, accountable, reflexive and effective" (Bäckstrand et al., 2010, page 217). In practice, however, these governance arrangements fail to deliver this promise.

A further daunting question in governance literature regards the role of the state and the differentiation between state and non-state governance. Lederer (2012a) and Engels (2006) show, for example, that for carbon markets to work, governmental intervention and institutional settings are crucial. Markets are not the opposite of regulation but are also political institutions, as only states and intergovernmental agreements can provide the necessary underpinnings. Thus, Lederer argues, "it is too early to claim that non-state actors take over state functions as global governors or that the differentiation between state/non-state governance arrangements has become secondary" (Lederer, 2012a, page 256).

Studies in the realm of political economy assume a close relation between politics and economy. From this starting point, specific actors, mainly industry and business are a driving force for carbon markets. According to Bailey and colleagues (2011), and Newell and Paterson (2010), carbon markets fit with the interests of international bodies, governments, industry, intermediaries and speculators (Bailey et al., 2011, page 697; Newell and Paterson, 2010a). Carbon markets offer a way to cut greenhouse gases without sacrificing other policy goals such as economic development; they present a "least-worst" regulatory option for emitting industries and create new commercial opportunities (Bailey et al., 2011, page 697). For Paterson and Newell (2010b) particularly, the finance sector played an important role in introducing carbon markets. It resisted command-and-control approaches and carbon taxes, and in the US, the Clinton administration was able to overcome this resistance when proposing market based approaches in the international negotiations. After the Kyoto Protocol was adopted, new financial firms specializing on carbon markets were created, which then started to organize themselves in associations. A carbon economy emerged accompanied with the rise of a political constituency that has "an interest in safeguarding the credibility of offset markets and seeing them succeed over other ways of responding to climate change which are perceived to be less business friendly" (Bailey et al., 2011, page 692). This constituency was crucial in pushing for carbon markets, and was especially important when international negotiations in the Kyoto Process became difficult and the US withdrew from the process (Newell and Paterson, 2010b, page 85). It lent carbon markets authority and legitimacy and worked to show its effectiveness; this was especially necessary, since its normalization was contested by opposing constituencies like the US Tea Party (Goodman and Boyd, 2011, page 102). The development of a specific constituency and a carbon economy was part of a broader development the beginning of what Newell and Paterson (2010a) call "climate capitalism", a form of capitalism in which de-carbonization is an economic opportunity, not a threat (Newell and Paterson, 2010a, page 1).

This literature importantly advances from an a priori definition of political authority based in nation states, and reveals how it can "be exercised nonterritorially or in scattered pockets connected by flows across space-spanning networks"(Agnew in: Stripple and Bulkeley, 2014b, page 5) . This network can be based on knowledge as in Braun's example or on a partisan interest (e.g. Buhr, 2012; Newell and Paterson, 2010a). Besides this difference, however, this perspective also regards the evolution of new governance along the lines of rational actors, interests and functionality, if at all. New forms of governance emerge either in an evolutionary process as the result of the ineffectiveness and illegitimacy of state governing; or as the result of powerful actors who are able to shape governance options. The

questions this literature is interested in are not so much how new governance comes about, but rather whether it is more effective and legitimate, whether it reduces the power of the state, and how a politico-economic elite is able to shape the political response to climate change.

In unease with these three approaches, in the last decade we have seen an increase in approaches emerging in the field of climate governance, which started with a different ontological and epistemological understanding of politics and the political order. Instead of starting with a predefined international sphere of the political, a neat distinction between politics and other spheres of society, and a clear ascription of agency to political organizations, this literature started to question the social and political ordering which the above sketched approaches take for granted. These critical approaches wondered how governing the climate is possible and how certain political agencies become authoritative agents to deal with it. They originate mainly from two theoretical perspectives; first, a governmentality perspective inspired by Foucault, and, second, a performativity perspective inspired by constructionist work in the realm of science and technology studies (STS). In the next sections, I will introduce these two perspectives shortly and present studies from both, showing how, and for what interest, these perspectives are applied.

Climate governance embedded in orders of discourse: governmentality

Governmentality inspired studies draw attention to the daily activities of governing, thus going beyond an institutionalist understanding of politics that is dominant in international relations and governance. They focus on text and discourse and question how "particular mentalities – ways of thinking and acting – are invested in the process of governing" (Stripple and Bulkeley, 2014b, page 9). Having their roots in discourse theory, they understand governance as the realization of specific discourses and are interested in how practices are embedded in them. Their focus is on hegemony and totalizing discourses. It is thus an interesting starting point to analyze how the open situation of climate governance in the early 1990s turned into a narrow situation of carbon market governance in the early 2000s.

In a series of lectures in the late 1970s, Foucault introduced the term governmentality as a concept of considering how particular mentalities are invested in the process of governing. Governmentality is concerned with "techniques and procedures for directing human behavior"(Foucault, 1997, page 82). It is an ensemble formed by institutions, procedures, analyses and reflections, calculations and tactics (Foucault, 2005, page 171) and is inscribed in the mundane practices of daily life. The process of governing is not restricted to political institutions but concerns the behavior of children, souls and consciences, household, state and individuals (Foucault, 1997, page 82). Inspired by this idea, in the 1990s scholars started to focus on the role of discourse as a deep knowledge order of governing. The form of government and the political institutions that we take for granted today, Foucault argues, are only one form of governmentality, contingent and only temporally valid (Foucault, 2005, pages 171–172). Forms of governments are invented and assembled in "particular apparatuses and devices for exercising power and intervening upon particular problems" (Rose, 1999, page 19).

Governmentality studies do not take for granted the political power of social entities. The current political order is the result of a historically contingent process that has led to concentrated power relations (Lemke, 1997, page 104). How these institutions gained power through a discursive ordering of reality is in the interest of governmentality studies. They want to empirically investigate who governs what, with what logic, with which kind of technologies, and towards what end (Rose et al., 2006, page 85). Governing is thereby not restricted to the government and its institutions, but understood in a broader sense as the "conduct of conduct". It can be identified in governments, but also in the guidance of families, the management of households and the directing of the soul (Lemke, 2002, page 50). At these minor sites of practical governing, languages, and techniques that "reshape understandings of the subjects and objects of government" (Rose 1999, 31) are invented. These languages and techniques, which are understood as adding to and being embedded in broader discourses, are thus the object of governmentality studies (Dean, 2010, page 37).

Central to governmentality is the notion of a political rationality, of political programs, and of governmental technologies. Political rationality is a "discursive field within which the exercise of power is conceptualized, the moral justifications for particular ways of exercising power by diverse authorities, notions of the appropriate forms, objects and limits of politics" (Rose and Miller, 1992, page 273). It is the translation of the concept of discourse for the analysis of regimes of government and, in a similar vein to discourses which order the social world, political rationalities order the political sphere. Consisting of a moral dimension that legitimates authority, an epistemological dimension that defines spaces, persons, problems and objects of government and an idiom, "a certain element of thought" (Rose, 1999, page 27), it describes who governs, what and how. In political programs, these rationalities are adopted to the government of specific problems. In governmental technologies, these programs are made workable. They are the "mundane programmes, calculations, techniques, apparatuses, documents and procedures through which authorities seek to embody and give effect to governmental ambitions" (Rose and Miller, 1992, page 273).

Let us turn to studies which have applied this perspective to the analysis of climate change and governance. Oels analyzes the political rationality that guides political responses to climate change. She suggests that the understanding of climate change has shifted from being "an environmental issue framed in moral terms" towards one which "is now mostly discussed in economic terms of cost-benefit analysis" (Oels, 2005, page 197). This new rationality, which she calls advanced liberal government, underlies how states, as well as the United Nations Framework Convention on Climate Change (UNFCCC) rendered climate governable. It is a shift away from what Foucault (2009, page 1) called "biopower", a disciplinary technology that manages birth, death and reproduction of a population. This shift has political consequences as it restricts the realm of possible policy options. In biopower, far-ranging policy interventions were justifiable as well as the "extension of the state in the name of 'survival' of planet earth" (Oels, 2005, page 201). In an advanced liberal government, however, climate change reveals state failure and calls for the need of market-based solutions and the creation of markets. Technological measures of energy efficiency are the only possible policy options, and the location for these measures is purely considered on the basis of costs, not moral responsibilities (Oels, 2005, page 203).

Bäckstrand and Lövbrand (2007) argue that different rationalities exist at once in the field of environmental governance, competing and sometimes merging: first, green governmentality, characterized as a science-driven, centralized, multilateral, state-centric administrative approach; second, ecological modernization, a "decentralized liberal market order that aims to provide flexible and cost-optimal solutions to climate problem" (Bäckstrand and Lövbrand, 2007, page 124); and, third, civic environmentalism that – in its radical form – advocates fundamental transformation of consumption patterns and abandons capitalism, and – in its reform-oriented form – highlights transnational society and the need for accountability and legitimacy of the climate regime. Since the 1990s, the authors suggest, the managerial approach of green governmentality has lost ground against the rationality of environmental modernization, which has since become the dominant discursive space in global environmental governance. Since the mid-2000s, these rationalities have become mutually constitutive for a climate governance in which a science-driven, state-centered governance provides the institutional background for the artificial carbon market (Bäckstrand and Lövbrand, 2007, page 131; cf. Lederer, 2012a). Both rationalities are challenged by the civic environmentalism discourse; yet the latter was silenced by the win-win rhetoric accompanying the emergence of global carbon markets (Bäckstrand and Lövbrand, 2007, page 137).

Methmann analyses the CDM from the perspective of governmentality. Using it as an example, he shows on the one hand how advanced liberal governmentality was established in climate change, and, on the other, how the CDM helped to establish a form of climate governance based on what he calls carbon governmentality. He states that the CDM is a clear example of the conduct of conduct, as it does not directly intervene in investment decisions of market participants, but creates incentives for climate-friendly behavior (Methmann, 2011, page 78). With the establishment of the CDM, the state fades into the background and governs at a distance through the installation of liberal norms at international level. He further argues that with the installation of the CDM, a form of global governance is exercised which depoliticizes climate change. Instead of leading to structural change – as one would assume with a problem as new and big as climate change – he argues that the CDM comprises the installation of a set of political technologies which protected business as usual from any major change (Methmann, 2011, page 79). Through the technologies of carbonification and marketization, only those activities are rewarded which do not have a major impact to wider social structures, simply because such impacts are not measurable (Methmann, 2011, page 81). Stripple (2010) specifies the rationalities that guide the CDM. He argues that the CDM is guided by an administrative rationality, as it works only in the shadow of hierarchy and is governed by administrative standards, rules and procedures.

Wondering how climate change was rendered governable as a market problem, Lövbrand and Stripple (2011) turn to calculative practices and carbon accounting. They argue that carbon accounting turns carbon into objects of governance. Recent climate governance "hinges on the ability to account for stocks and flows of carbon" (Lövbrand and Stripple, 2011, pages 187–88). However, stocks and flows of carbon are part of the realm of nature, and to be governed, they need to be translated into the realm of the social and political.

Carbon cycles globally between the atmosphere, the biosphere and the oceans, but world politics is territorially bound. Nation states are the central epistemological principle that orders world politics. This contradiction between the global carbon cycle and nation states challenged practitioners of climate diplomacy, and they put a lot of effort into breaking the global cycle down into the geopolitical grammar of the nation-state (Lövbrand and Stripple, 2011, page 192). Parties developed national inventories of sources and sinks of greenhouse gases, and the Intergovernmental Panel on Climate Change (IPCC) defined common reporting guidelines, standardized definitions, units and time intervals, to make them compatible. Thus, much of the techno-scientific infrastructure of the UN climate regime was devoted to making carbon governable within what they call the epistemology of world politics, the division of the international sphere in nationally bounded territories.

The theoretical discussion and the short sketch of governmentality studies in the realm of climate change and governance reveal their potential for the analysis of governance and change. Starting from the interest in how behavior is governed, these scholars leave the realm of institutions and established order and turn towards political rationalities and the techniques which make these rationalities work. They assume that institutions and organizations do not possess power, but that they established it in a contingent historical process. Drawing from Foucault, the current political order is assumed as a system of thoughts, rationalities, programs and technologies; it is historically constituted, but appears for political actors as natural. Thus the central question is how the current political rationalities and systems of thought assert themselves and become concrete in climate practices. Scholars in this tradition try to denaturalize this system.

However, the focus on political rationalities and systems of thoughts also comes with limitations. Particularly the question of agency had been raised for years, wondering which power human beings and actors have in such a system (for an early notion of this critique see Honneth, 1989). This critique was caused by early governmentality studies which often fell into the methodological difficulty of applying a deterministic understanding of rationalities (Bröckling et al., 2011, page 17). The will to detect the logics behind the actors has led authors to search for neo-liberal rationalities, biopower, or other broad patterns of governmentality within different technologies of government, implicitly assuming a totalizing neoliberal rationality which directs all activities (Blok, 2014, page 45).

In response to this critique, scholars in this realm started focusing more on "practices, techniques and rationalities employed to shape conduct in particular places", (Bulkeley and Stripple, 2014, page 244) allowing them to identify multiple governmentalities. Instead of starting from a totalizing narrative, they begin focusing on how rationalities are constituted in practices.[2]

Lovell and Liverman, for example, focus on the technologies that create carbon credits in voluntary and compliance offset markets, taking the CDM as an example for the latter. They highlight the diversity of technologies involved in carbon offsets, suggesting that –

[2] The possibility for such an endeavor can be found already in Foucault's later work, where he turned to the concept of power (Lemke, 1997, page 53) and highlighted the importance of human resistance.

depending on the technologies – tensions occur when making standardized carbon credits. Certain offset technologies, such as large-scale energy efficiency technologies, allow for standardized credits and can thus be regulated under the CDM, while others are uncooperative and can be addressed only in voluntary offset markets which are less standardized. In their analysis, they show that the CDM frames the problem of climate mitigation "in ways that can be addressed by and managed by international systems of CDM audit and calculation" (Lovell and Liverman, 2010, page 263). A neoliberal rationality guides the CDM activities which are "about trying to make markets work, about creating the framework for a carbon market to function efficiently" (Lovell and Liverman, 2010, page 269). On the contrary, the voluntary carbon offset market is less concerned with a regulatory system, but with individual offset projects. The specific sites are not translated into a standardized commodity, and remain visible in the global discourse. Therefore, the authors identify in the voluntary market a rationality of sustainable development and appeals to moral bargains (Lovell and Liverman, 2010, page 269). By turning to the techniques and technologies that constitute carbon markets, the authors could avoid identifying an all-encompassing discourse and become sensitive for the diversity and specifics of particular arrangements. Certain technologies are just not cooperative with a neoliberal rationality and governing those calls for a different governmentality.

Lovell and MacKenzie (2011) are interested in technologies of government and combine this interest with an analysis of actors involved in reframing climate change. They are specifically interested in how climate change was made calculable for corporations, i.e. how it was "characterized in technical terms" (Lovell and MacKenzie, 2011, page 710). With this interest, they turn to the accounting profession and show how it actively engaged in turning climate change into a corporate problem. It used its expertise to provide technologies that take emission reductions into account. Thus, they argue, the accounting profession had a central role in the governing of climate change.

Governmentality studies are interested in the orders of discourse that governs, that conducts action and behavior. It therefore leaves the institutionalized spheres of government and policy making and turns to the deeper rationalities inscribed in mundane practices, and the technologies that operationalize these rationalities. Its primary interest is in understanding the political order and asks how governing works in practice and which governmentalities guide our daily life. With this perspective, it is able to turn to actors, discourses and technologies that have been out of scope for global governance scholars. Convincingly, it can show for example that accounting bodies play a central role in governing, and how neoliberal rationalities are inscribed in calculation and standardization techniques, which in turn affect which offset technologies can be used. On a macro level, this perspective can address the existing political order searching for the underlying discourse that makes it powerful. While it risks applying a totalizing narrative subsuming the world under the notion of broad discourses like neoliberal governmentality, recent approaches have moved on to scrutinize in more depth mundane practices and how they are governed. Instead of a totalizing narrative, scholars in this perspective now proclaim multiple governmentalities. Although interest in practices increases, the research interest remains in understanding the order behind these practices. It assumes that overall discourses constitute social and politi-

cal order, thus practices are conceived as instances where the researcher can identify and test discursive order. They do not become the interest of this research per se.

The perspective is able to identify change in governmentalities over time, but only marginally does it address how they come about. If I was to apply this perspective, I could ask whether the activities and structures of climate governance I identified in the introduction are a new governmentality specific to climate change (cf. Bulkeley and Stripple, 2014), or whether climate change has been squeezed into an existing governmentality (cf. Lövbrand and Stripple, 2011). I would have to show how they relate to broader organizing discourses; I could critically ask what makes the existing climate governmentality powerful and detect the naturalized rationalities. What I cannot ask, however, is how the existing governmentality came into being. The theoretical roots of governmentality rest in Foucault's analysis of discourses and its research interest in unearthing naturalized rationalities. Using this perspective to analyze the construction of new governance arrangements, as I want to, would overstretch the theory. It would make the weakest part of this perspective, namely the role of practice and agencies in forming and changing new political order, a central focus. It would understand the emergence of climate governance as a competition between orders of discourse.

In the next subsection, I turn to performativity studies and propose them as a perspective that is able to analyze the construction of new governance arrangements, or governmentalities in Foucault's language.

Climate governance as a sociotechnical arrangement: Performativity of economics and governance

A performativity perspective has its main advantage in its focus on the role science plays in performing a new social order and in how scientific models are inscribed in the material dimension (Callon, 2007). It is not interested in how mentalities are invested, but how actors assemble and construct new political fora and problems (Blok, 2014, page 42). Its focus is thus on plurality and conflict rather than hegemony and totalizing discourses (Bueger and Gadinger, 2015).

Performing carbon markets

Recently, performativity of economics has become interested in carbon markets. I will present its theoretical origins and research interest and discuss studies which took this perspective to the analysis of carbon markets. I will show that this perspective is particularly suited to turn to the practices of constructing new socio-technical arrangements like markets.[3] It draws particular attention to the material dimension of these arrangements and understands economic order not as the result of underlying discourses, but as the situated and always contested achievement of practical doing.

[3] This theory does not have an elaborate sociological concept of practice. It is used synonymously with other terms like action, activities and work.

Market as a sociotechnical arrangement

In his book "the laws of the market", Callon developed the perspective of the performativity of economics (Callon, 1998). His starting point is that markets do not just exist, but have to be constructed. He argues that economics is central in this task, as it formats calculative agents and thus performs an economy. He understands a market as a calculative space which frames transactions and considers how agents can calculate an uncertain world. Using an example of Bourdieu, he asks how agents know whether a transaction is a gift or a market transaction (Callon, 1998, page 15). His solution is based on an understanding of agents as actor-worlds (Callon, 1998, page 8), an argument he had developed together with Latour within the notion of actor-network theory (ANT) (Callon and Latour, 1981; Latour, 2005). Actors are embedded in a network, which configures the actor. Simultaneously, the network is constituted by its actors. They are two sides of the same coin. What is relevant here is the argument that every action in such an economic actor-network is calculative. An agent calculates the relations of the network surrounding him and acts based on this calculation (Callon, 1998, page 11). To calculate whether a gift is a gift or a transaction, the agent needs a framing, "the tracing of a boundary between relationships and events which are internalized and included in a decision or, by contrast, externalized and excluded from it" (Callon, 1998, page 15). It "demarcates, in regards to the network of relationships, those which are taken into account and those which are ignored" (ibid.). These frames make visible and calculable specific relations, and leave others out. Those not be taken into account are what economics call externalities. Callon argues that intense investments have to be made to construct such frames. It defines market agents – seller, producer, buyer – as objects and goods and thus enable markets to exist (Callon, 1998, page 17). Importantly, framing is never complete. There will always be externalities, and even if they are internalized, new externalities appear. Frames overflow, as Callon calls it (Callon, 1998, page 18).

To be internalized, overflowing has to be measured. Environmental pollution of a chemical plant needs to be put into the frame of economic calculation to become internalized. With the help of techno-scientific instruments, pollution is measured, in laboratory experiments a correlation between pollution and health risks is established and quantified. To connect the emission of the plant with the associated health risk, a standardized equivalence has to be constructed that enables the translation between a chemical substance and human lives. Here, money comes into play: "it facilitates a calculation which makes commensurable that which was not so before: grams of dioxin and a human life" (Callon, 1998, pages 21–22).

Drawing from these considerations, Callon devotes particular interest to calculating tools. For a market to function according to economic models, agents needs to be calculative and be able to put other actors, goods and objects into the frame of a calculative space. This ability to calculate, he claims, could not exist without calculating tools (Callon, 1998, page 23). Agents use such tools, like accounting tools, to measure and take into account nature – and what the tools cannot measure does not count. Importantly, these tools "do not merely record a reality independent of themselves; they contribute powerfully to shaping, simply by measuring it, the reality that they measure" (Callon, 1998, page 23). Calculative tools

perform reality, here the market. Managers might adapt to new accounting tools which incentivize specific earnings by changing the goal of their company. Callon cites a study that shows how managers deferred expenditures for maintenance and research and development to increase earnings. Their bonus depended on the reported earnings and so the accounting tool provoked this new strategy, Callon claims (Callon, 1998, page 24). This shows that, for a market to work, it needs calculative agents, who in turn need calculative tools. These tools shape reality, as they put some relations into the calculative space, while leaving others outside.

Theory of performativity of economics

Callon draws central attention to the role economics play in performing the economy. Economists and economic models are key for the economy to work. They are not outside, but influence and structure it (MacKenzie et al., 2007, page 2). However, this is not unilateral. They are developed by a collective of professional economists of academia – the "confined economists" – and of practitioners – "economists in the wild" (Callon, 2007) – to measure and calculate the economy. Once used in practice, they have an effect on economic practices. Practitioners measure, collect data, compare and generalize it. This feeds back to economics, influencing the academic discipline as a new body of knowledge (Callon, 1998, page 28).

Callon's theory of performative economics should not be confused with constructivism. Market laws are not mere constructions of social sciences to have a simple framework of the enigmatic and complex reality at hand. Instead, it is a structurational understanding of the world, in which the social science laws "account for regularities progressively enforced by the joint movement of the economy and economics… These regularities perform behaviours and therefore have the obduracy of the real; yet in turn they are performed by these behaviours and therefore have the contingency of an artefact" (Callon, 1998, pages 46–47). Market laws, which format relations among calculative agents, are the structures that stabilize the market. These laws are the joint effort of practitioners and scientists, of economic rationales, tools and theories, and their enactment in practices.

About a decade later, Callon further elaborates on the theory of the performativity of economics. He argues that science is performative through the application of scientific theories, models and statements. Statements include formulas, methods, tools, instruments as well as verbal formulations (MacKenzie et al., 2007, page 15). They "are not constative; they are performative, that is, actively engaged in the constitution of the reality that they describe" (Callon, 2007, page 318). Callon roots his theory of the performativity of economics in Austin's performativity thesis that there is no language, but only language acts (Austin, 1975). This also counts for science. Scientific models, statements and theories are the utterance of academia. They refer to a phenomenon which they describe. But like the performative language act, the theory performs the world it describes. In demarcation to it, however, Callon's performativity is not only a language act, but also has a material dimension. To stress this dimension, he introduces the notion of a "sociotechnical agencement" that describes the entangled world and statement. It is a carefully adjusted arrangement of heterogeneous elements, including human agents and things. To avoid being accused a

constructivist, he argues that this arrangement is endowed with the capacity of acting (Callon, 2007, page 320). As we have seen in the illustration he gave in "the laws of the market", formulas produce overflowings, trigger reactions and "produces effects that might strike back" (Callon, 2007, page 323). In contrast to what he calls a constructivist perspective, "performativity is not about creating but about making happen" (Callon, 2007, page 327).

Contrasting conventional economic arguments which ascribe markets one fundamental, underlying law, Callon argues that there are several temporary and spatially limited laws. For him, markets are the result of situated practices. Thus, a central element of performative practice is experimentation. Market laws and statements only work in a specific arrangement. When adjusting to another arrangement a

> statement reveals problems, causes the appearance of misfits, maladjustments, untimely overflowings. During these successive displacements and the consequent trials, the statement's world becomes more complex. Just as one discovers only progressively, through replications and movements, why an experiment succeeds (or fails), an equally long process is required to explore the sociotechnical agencements that a statement or model needs to function in such-and-such a spatiotemporal frame (Callon, 2007, page 331).

A statement is the utterance with which we formulate how we know the world. It encompasses not only verbal formulation but also formula, methods, tools and instruments (MacKenzie et al., 2007, page 15). These utterances and the world which it performs coevolve. As a consequence, market laws always need to be renegotiated and constructed at local sites; a mere transposition of tools and laws from one site to another would cause collapse (Callon, 1998, page 47). This means that experimentation is central to the construction of sociotechnical arrangements. We will come back to this in chapter three.

Performativity differs from governmentality in two regards. First, it stresses situated practices as the primary point of interest; and second, it highlights the material dimension of constructing order. One cannot reduce the making of order to the realization of a specific discourse, but also needs to take into account the material world and how they produce effects. For carbon markets, this becomes particularly visible in the role of trees as carbon sources. Despite all attempts to make them standardized, trees do not grow like calculations simulate; they do not always absorb CO_2 as suspected; once they die, this CO_2 is again released into the atmosphere. Bugs can also unexpectedly destroy whole plantations, thus having a massive effect on the correctness of calculations of emission reductions. In addition, the calculative tools that calculate the emissions a tree sequesters are also only able to capture a defined part of the world. Accounting needs a clearly distinguishable entity – carbon emission – which is defined in space and time. Emissions that occur outside this frame are not taken into account. Thus, "they contribute powerfully to shaping, simply by measuring it, the reality that they measure" (Callon, 1998, page 23). This cannot be reduced to a discourse, Callon argues, but needs to be taken into account as the material dimension of performativity.

Performativity devotes a particular perspective on the role of science. It avoids the distinction between science and society, claiming that the former is an elementary part of the latter. Scientific models perform the reality they describe and this reality then feeds back into the models. For performativity, the central dynamic is thus not between discourse and practice, but between scientific models and reality (see for a comprehensive discussion of the co-production of science and social order: Jasanoff, 2004b).

Studies on carbon markets: situated construction of an economic frame

Taking this perspective up to the study of carbon markets, Ehrenstein and Muniesa (2013) are concerned with the situated construction of this market, which involves negotiations among local and international actors, transformations of local sites into calculative spaces, and the setting up of new calculative agencies. They analyze the translation of formal requirements of UNFCCC documents and handbooks to a local site in Africa. The project developer and local actors, as well as the World Bank and national administrations, had to turn the project developer into the owner of the future emission reductions. Therefore, traditional land rights had to be formalized and clear spatial and temporal boundaries of the project set (Ehrenstein and Muniesa, 2013, page 169). Furthermore, to make the site fit a CDM project, national institutions had to be set up according to the UNFCCC's requirement and the project needed to be translated into an economic viable calculation of specific futures (Ehrenstein and Muniesa, 2013, page 181). This preparation work is necessary to transform the field into a site of calculation. But it is concealed and based on the calculations that a conditional future becomes a reality. Their analysis shows that carbon markets had to be constructed at local sites and how a specific sociotechnical arrangement was set up to construct a calculative space, calculative agent and thus a locally economic frame.

Bumpus (2011) focuses on carbon offset technologies analyzing the role materiality of offset technologies plays for commodifying carbon. He argues that the project development document (PDD) that is submitted to the UNFCCC when proposing a project, and the methodologies for calculating baselines "are all present to constrain, define and individuate carbon reductions" (Bumpus, 2011, page 620) of offset projects. Not all carbon offset technologies are equally suitable to these governing techniques. The calculative tools restrict suitable technologies to those in which emission reductions could be measured by a standardized means. While the emission reduction of energy efficiency technologies and industrial gas abatement technologies can be calculated with these tools, other carbon is uncooperative. Cook stoves of already profitable renewable energy projects, for example, contain more "uncooperative carbon" (see also Lovell and Liverman, 2010, page 264). Carbon offsets are thus materially and discursively constructed.

Going beyond an analysis of the situated construction of carbon markets, MacKenzie takes up the perspective to analyze the construction of the calculative tools that enable calculating carbon. Analyzing how greenhouse gases are made the same in the CDM, he shows the intricate technologies and practices that need to be invented. A baseline must be developed, measurement equipment standardized, and a regulation found to translate one GHG into another (MacKenzie, 2009, page 445). This regulation, the global warming potential of greenhouse gases (GWP), was developed in the IPCC. Here, different concepts to define

and measure the exchange rate for greenhouse gases were negotiated and over the course of time, the IPCC even changed the GWP after new interpretations became dominant. However, for the market to function, it was important that negotiations about the uncertainties with this measurement and whether the GWP indeed gives the best estimate to measure the climatic effects of greenhouse gases remained with an expert circle and considered a technical issue. Otherwise, "liquidity in such markets would be greatly reduced if the relevant 'exchange rate' between gases had to be negotiated ad hoc for each transaction"(MacKenzie, 2009, page 446). If the GWP was challenged in practice, transactions could not be conducted. For the moment, this has not happened. MacKenzie suggests that it is the IPCC's expert authority to deal with such detailed matters which prohibited the controversy to spill over into the carbon market (MacKenzie, 2009, page 447). He concludes: "gases are thus made the same by a combination of measurement devices, complex natural science, and the capacity (at least so far) of the Intergovernmental Panel on Climate Change to keep the estimation of global warming potentials bracketed off from carbon-market politics" (MacKenzie, 2009, page 447).

While such a combination is important for the market to work, he gives a first notion of the subpolitics involved in such work, of politics "outside and beyond the representative institutions of the political system of nation-states" (Beck, 1996, page 18). Coming from a perspective of the performativity of economics, he understands carbon markets as "an attempt to change the construction of capitalism's central economic metric: profit and loss" (MacKenzie, 2009, page 441). Greenhouse gases should get a price, being brought into the frame of economic calculation. If this is successful, carbon markets are civilized and become economically and environmentally effective. The tools that calculate greenhouse gases and commodify them are then more than just technical. They set the frame for the new capitalism. It is here that the character of capitalism is shaped and the market made effective. A wrongly set calculative tool would make the market economically and environmentally ineffective, MacKenzie fears. Thus, it is particularly important to turn to the technical issues and the practices of how they are constructed. This construction needs lay, professional and academic witnesses to allow for a social learning process in which the effectiveness of carbon markets to reduce emissions could be constantly improved.

Focusing not only on the calculative mechanisms of market construction, but on the design of carbon markets as a whole, Callon (2009) approaches the EU ETS. He understands it as a sociotechnical arrangement that was designed and continuously experimented with by a collective of experts. Similar to MacKenzie, he argues that the efficiency of the market depends on this sociotechnical arrangement; designing it is thus crucial. However, establishing markets never comes without problems, as no one can be entirely sure which organizational forms and material agencements are needed to make the market work (Callon, 2009, page 536). It would therefore not be sufficient to design it in a laboratory and then set it up in the real world. Instead, it needs to be constructed as an in-vivo experiment to "identify the effects produced, the bugs encountered, and the reactions triggered, so that they can be taken into account and the architecture of the markets under experimentation altered" (Callon, 2009, page 537). His claim is to identify mechanisms that make carbon markets work better. The sociotechnical arrangements of which a market is made is relevant for its effec-

tiveness and thus its design needs particular attention (cf. MacKenzie 2009). But designing it is not sufficient. One needs to experiment with the markets in reality to identify the problems that occur and take them into account (Callon, 2009, page 536). The problem is too complex to be reduced to the laboratory setting. Taking the problems which occurred in EU ETS and CDM as illustrations, he argues that no market comes without problems. Thus, we should develop governance structures that are reflexive and take these problems into account (Callon, 2009, page 536). Going back and forth between laboratory and real experiment would be a proper way to advance with carbon markets and make them effective. While MacKenzie claims that the construction of the sociotechnical devices needs public witnessing, Callon argues that for a market to become effective, this is not enough. The public needs to become part of the experiment.

These studies approach carbon markets as particularly useful cases to further develop the theory of the performativity of economics. Carbon markets have to be constructed from scratch. The debates and negotiations in and about carbon markets have not, as yet, cooled down; thus, one can still observe the practices incorporated in producing, maintaining and stabilizing them. The different elements of markets Callon identified – calculative tools, calculative agents, framings, as well as the practices of commodification and commensurabilization and the knowledge inscribed in them – are still identifiable. The studies on carbon markets enrich this perspective with new empirical evidence and make it applicable for carbon markets.

What these studies have in common is their concern with the materiality and practices that construct a market, as well as the relation between science, politics and economy in the process of constructing a market. They claim that the activities of setting standards, constructing calculative mechanisms, designing market organizations and developing local projects are not outside the market, as economics conventionally assumes, but are in fact the market itself. They construct and constantly shape and reshape it. Therefore, the studies' research interest focuses on the sites where elements of sociotechnical arrangement are constructed and negotiated. These studies specifically show the role of material technologies for constraining and enabling carbon markets. Meters to measure carbon are necessary; but to work, they need to be standardized. This standardization restricts certain technologies –such as stoves and urban mass transit – from becoming CDM projects, as their emissions cannot be as easily measured as those of industrial gas projects. They also identify the practices involved in commodification and commensurabilization of nature into carbon. This perspective sensitizes the researcher for the work that has to be invested into markets to make them work. Scientific, material, technical and institutional investments are necessary to transform nature into a commodity, to make agents calculative, and to install a framing that allows for calculation. To understand these activities, scholars in this tradition not only depart from an institutionalist point of view, but also regard the discursive perspective of governmentality studies as insufficient. Instead of discourses, one needs to look at the practices in which agents construct sociotechnical arrangements and thus perform a new world. It is here that an economic order is constructed and that an issue is turned into a scientific, economic or political problem.

The advantages of this perspective for my research interest are obvious: particularly its interest in the construction of markets is what makes this perspective attractive. Its interest in practices and technology, its pragmatist understanding of knowledge production as a practice, and its concept of agents as those actors who are able to calculate within the framing, and who are enabled by the frame as agents, allows for an analytical openness. In turn, this openness engenders me to see the activities performed in the 1990s in various places and by various actors as part of the construction of a global climate governance arrangement.

However, some limitations stand out. First of all, the studies are limited to the construction of an economic order. The authors are interested in how models of economics are made to work in the real world; how actors become calculative agents, the role of calculative tools and the construction of an economic frame. The performativity argument is limited to the performativity of economics and the question of how economics perform the reality they describe. How such an analysis would work for the construction of governance is not quite clear yet. What is the frame, what are the agents, what are the tools in governance? Second, the studies lack a sense of contestation and struggle. While they highlight the nitty-gritty details of negotiation and the power inflected ways of how specific calculative tools, emission permits and property rights come into existence, they lose sight of contestation of the general market approach. They do not consider that carbon markets are only one alternative of dealing with climate change. They are interested in subpolitics, as it is in these subpolitics that carbon markets can be improved; they are not interested in the possibility that new forms of governance can emerge here; they analyze subpolitics as a source of improvement, not change. This leads to the third limitation, a limited understanding how markets became a dominant frame to deal with climate change politically. If sociotechnical arrangements are constructed in situated practices and need renegotiation and readjustment, it remains unclear as to how a specific approach has spread among different spatiotemporalities and become the reality for climate governance. It is the question governmentality studies try to answer with recourse to an ordering discourse.

Recent studies have identified some of these limitations, trying to make the performativity of economics literature applicable to the analysis of political processes, of processes about a collective order. They analyze governance arrangements as situated, issue problematizing arrangements. They are the flipside of the governmentality perspective, prone for the practices of making governance. They are able to understand and analyze the emergence of new governance arrangements as the result of the performative practices of human and nonhuman actors.

Performing governance arrangements

Governance as multiple sociotechnical arrangements

A first good starting point to an understanding of governance from a performativity perspective is Blok (2014). He further elaborates on the notion of problematization suggested by Callon (2009). Callon argues that an issue has to be put into an existing framework. This not only applies to economics, but also to science and politics. As yet, no political rationality exists to address climate change in its totality. Thus, in an experimental process, actors

creatively invent new forms to deal with it, and turn the issue 'climate change' into multiple economic, scientific and political problems (Blok, 2014, page 43). Instead of talking about climate change, people are concerned with market efficiency, North-South responsibility, technological innovations and other issues. Around these issues, "specific constellations of actors, material devices and political arenas emerge (or disappear) as authoritative promoters of specific governance objects" (Blok, 2014, page 47). Thus, around these issues, a specific governance arrangement emerges. Carbon markets are just one such arrangement, like the IPCC and urban climate governance networks. Central here is that many such arrangements exist in which climate change is shaped, debated and governed (Blok, 2014, page 42). They are "proposed, tested and recalibrated in power-inflected but open-ended ways" (Blok, 2014, page 47). There is no hegemonic order, but sociotechnical arrangements that order an issue. Instead, how the climate is governed is a practical achievement of human and nun-human agents. In such a conception, it becomes necessary and possible to analyze the emergence and maintenance of specific governance arrangements.

Blok offers an analysis of this process in a paper that draws attention to the role of environmental NGOs in the construction of carbon markets. Reading different studies of the performativity of economics, he argues, that politics "is understood less along the lines of capitalist political economy, and more along the lines of a techno-economic 'sub-politics' of expert-dominated social engineering" (Blok, 2011, page 459). While he welcomes such a perspective, he argues that it risks to not take into account political processes in which market frames as such are contested. Using the example of carbon markets, Blok shows how NGOs elaborate and promote alternative, non-market based forms of socio-natural framings to govern the climate (Blok, 2011, page 456). The practices of contestation he identifies rely "on dynamic assemblages of collective actors, sites of engagement and political technologies… Politics, in this approach, is a dynamic of situated contestation, in which some state of affairs is turned into a 'matter of concern' for some affected public(s)" (Blok, 2011, page 457).

In his analysis, Blok shows how environmental NGOs are engaged in the performation of carbon markets via consuming, engaging or confronting carbon marketization. Pro-market environmental NGOs, like the Environmental Defense Fund, consume the promise of economic expertise, advocate emissions trading, and even try to extend markets to other domains such as biodiversity. Blok identifies a more critical engagement with the politics of market design in the work of, for example, the WWF, the organization promoting a gold standard for CDM projects which promise to deliver high-quality emission reduction. With their critical engagement, these NGOs "attempt to reshape unwanted processes of carbon marketization, while accepting the market frame as the locus of compromises between economy and ecology" (Blok, 2011, page 463). Such engagement opens up spaces of political contestation inside carbon markets (Blok, 2011, page 464). They participate in the experimental process and co-perform the market construction. A third mode of engagement he identifies aims at contesting market frames as such (Blok, 2011, page 456). Radical critics of carbon markets – like the World Rainforest Movement, Carbon Trade Watch or the India-based Centre for Science and Environment (CSE) – confront the process of market

construction. They try to "to turn the market frame as such into a site of political contestation" (Blok, 2011, page 464).

Blok's analysis highlights that the formatting of carbon markets is not as smooth as it seems when reading for example MacKenzie (2009) and Callon (2009). Different actors perform different formats or even in fact counter-perform the market format. He thereby understand politics as "itself a performative practice, in which concerned actors like environmental NGOs endeavour to articulate alternative socio-natural futures" (Blok, 2011, page 456).

Similarly interested in performative economics in the realm of governance, Lane investigates how efficiency was made a social law of environmental regulations. Such laws "shape, frame and determine the viability of environmental regulation" (Lane, 2012, page 584). Efficiency, he argues, is this central law in the social world of carbon market advocates, participants and commentators. Taking a perspective of translation and performativity, he argues that this law has been constructed as a natural fact. Consequently, it silently prescribes certain regulatory forms and proscribes others. Going back to the 1970s, he shows how in the US the fact of efficiency of emissions trading was constructed alongside the fact of inefficiency of command-and-control regulations. He argues that through three translations, a nascent environmental economics discipline constructed this fact: first it was able to distinguish between the means and ends of regulation; second, it converted a specific local regulation, the US Clean Air Act, into an archetype form of command-and-control; and third, it developed empirical evidence of the efficiency claim and re-constructed early activities as such experiments (Lane, 2012, page 585).

The notion of promiscuity is important to Lane's argumentation. In contrast to Callon's argument that carbon trading was experimented with at different places and for decades already, Lane argues that this narration is a construction which needs to be investigated. He argues that instead of such a linear story, we can witness a "heterogeneous array of actors involved in the construction of emissions trading regulations" and a process in which "specific, local regulatory compositions are brought together with other" (Lane, 2012, pages 588–589). Instead of a linear story of emissions trading which goes back to the 1960s, Lane thus argues that emissions trading and economic accounts of efficiency have been constructed and reconstructed "to render the technological and regulatory innovations more durable" (Lane, 2012, page 589). Through the attempt of economists and their active engagement with politics, they have contributed towards constructing a new norm about appropriate forms of social organizing: efficiency.

Lane's paper illuminates a central point in which the performativity literature can be extended to a political analysis. He approaches social laws of carbon markets not only as a frame for calculation which performs behavior of market participants as Callon understood it (Callon, 1998, pages 46–47), but as a law for regulation that "shape, frame and determine the viability of environmental regulation" (Lane, 2012, page 584). What he does though is to translate a concept developed for economics to the field of policy and governance. The

law permits specific market-based approaches on the expense of other command-and-control approaches.

Blok and Lane show how the idea of formatting can also be made fruitful for the realm of governance. Blok showed how different governance arrangements co-exist and compete. Governance arrangements are specific constellations of actors, material devices, political arenas and specific governance objects. They emerge around issues. Lane identified efficiency as a social law for regulation and showed how this economic concept performed the realm of regulation. Via economists and economic models, the efficiency criterion was inscribed into political programs. However, efficiency is only one social law for regulation. As there are multiple arrangements, multiple laws might exist. While Lane focuses on the discursive dimension of performativity, Blok highlights the material and actor dimension of governance arrangements.

The central process is what Callon calls performation struggle (Callon, 2007). Different sociotechnical arrangements compete on how the world really is. Through real world experimentation, new governance arrangements come about. Centrally, these arrangements are forms of organizing governance of a reality the arrangements perform. In contrast to what is discussed in governance literature, there is no problem out there for which the best solution needs to be found; in contrast to governmentality literature, the problem and its solution is not constructed through a discursive process, but in the pragmatic process of experimentation, in an adjustment process of actors, material and discourses with a real world. In the end, there is not one single governance arrangement that organizes an issue, but multiple arrangements with multiple realities.

Such an understanding of governance as the organization of reality needs a specific understanding of politics, to which I will turn now. I conceive politics as the mode of shaping this reality collectively; of constructing a reality in a way that its constructedness is cancelled and perceived as real (Beck, 1996, page 7).

Politics of performative governance: shaping reality

A very good and indicative starting point is Mol's suggestion of ontological politics (Mol, 1999). In this essay, she proposes an understanding of politics as an active mode of shaping reality (Mol, 1999, page 75). The starting point is a pragmatist understanding of reality, an understanding that "the conditions of possibility are not given. That reality does not precede the mundane practices in which we interact with it, but is rather shaped within these practices"(Mol, 1999, page 75). Politics for her is ontological as it concerns the reality, the conditions of possibility we live in. The world is not an objective fact but performed in discourse, materiality and – particularly important for her – practice. Let us look closer at this notion.

Mol distinguishes the performativity perspective from two closely related perspectives she calls perspectivalism and constructivism. Both perspectives are concerned with truth, and thus with epistemology. Perspectivalism argues against a singular objective truth. Instead, it advocates different standpoints being valid. Instead of one truth, this perspective multiplies truths. The different perspectives might be exclusive and discrete (Mol, 1999, page 76). A

constructivist perspective looks into how a specific version of the truth was crafted. Truth is socially or materially constructed, and not objective. Social groups, as well as materialities, support the crafting of a specific claim into an objective fact. Such a perspective is interested in the process of how one truth has become a fact. At the beginning, alternatives are possible, but over the course of time they get lost. Possibilities in the past vanished. "There have been might-have-beens but now they have gone. The losers have lost" (Mol, 1999, page 77). In contrast to these perspectives, performativity highlights that multiple realities exist. It is not about truth and knowledge claim, i.e. about epistemology, but about ontology. "Reality is done and enacted rather than observed … by means of various tools in the course of a diversity of practices"(Mol, 1999, page 77). We came across this understanding in the discussion of the performativity of experiments. Here, the epistemic object is manipulated and modified, and in the process of translation, this new object is performed as reality. Mol goes one step further with her claim that in practice, multiple realities are constructed. She illustrates it with an example from the field of health. Anemia is a disease that is performed differently in laboratories, clinics, and in pathophysiology. In each performance, different technologies, practices and discourses are used, performing the disease differently. These versions are neither exclusive, nor is any particular one wrong. They also exist at the same time, none of them has disappeared. As a consequence, various realities of this disease co-exist, Mol argues, not only various perspectives (Mol, 1999, page 78).

We came across an analogy in climate governance when I discussed Blok (2014). He showed that global climate governance is not guided by one hegemon discourse but by multiple governance arrangements. Like Anemia, global warming or climate change is not one phenomenon or issue that bears an objective reality. Instead it is problematized into different versions, which performed different "relatively enduring configurations of governance" (Blok, 2014, page 48), the IPCC as a world parliament of experts, transnational carbon markets and urban climatic sustainability, to name but a few. These different versions co-exist, each carrying different practices, texts, material forms, techniques of power and way of problematizing (Blok, 2014, page 48). Just like the clinic, the laboratory and the pathophysiology, Mol identified anemia. Any totalizing account of climate governance is not able to see these differences.

Mol's account of multiple realities highlights the consequences of ontological politics. Depending on the practices applied, i.e. depending on the version of reality, the outcome differs. If, for example, the detection of anemia is organized along the laboratory model of statistical analysis, the entire population would be screened and those individuals, whose hemoglobin levels are too low, would be detected and signified as ill. In a clinical setting, however, individuals with a low hemoglobin level might be undetected, as they do not feel ill (Mol, 1999, page 79). The consequences are obvious. In the first case, the people are treated, either as an outpatient or in a hospital; in the second case, they can live their life as before, they did not feel ill and they are not ill. But beyond the individual case, this perspective has also consequences for the organization of governance system. Mol suggests that the relation between experts having information and lay persons choosing between them is incompatible with a performativity perspective. Experts do not have information of a reality anymore. Centrally, however, not only words and images representing a reality are now

contested, "but also the very material shaping of reality in diagnosis, interventions and research practices" (Mol, 1999, page 86) as it is here that realities are crafted, that theories are enacted into these products which then start transforming the world (Mol, 1999, page 75). If one accepts the performativity perspective, as I do, these diagnoses, interventions and research practices should bother. Effectiveness of an intervention cannot be taken anymore as face value. We need to investigate which effect is evaluated, how it was defined, measured and observed. For as a consequence of such claims, actors are constructed as some kind of agent, be it a patient (Mol, 1999), a governing authority or an object of governance (Blok, 2014). This is what happens in experiments, and this is the politics of experiments.

The inability to observe once and for all the ontological reality and the consequences this causes for politics are issues Latour repeatedly discussed (Latour, 1993, 2004, 2005). If there are multiple realities, or natures, as Latour calls them, then we should not further embark on the process of searching for the one Nature, an objective unified reality that only needs to be uncovered. In the modernist world, the assumption of this one Nature has been the basis for politics, which resided on defining and negotiating human values. In this modernist world, experts mediated between this nature and the human values. These experts, mostly scientists, attempted to unify the natures into one Nature, one reality. It was a modernist endeavor. It was the attempt to "shortcut political due process by defining once and for all which world we all have to live in" (Latour, 2004, page 9). In the ordinary world we now live in, this endeavor failed. In this ordinary world, politics resides in "drawing, deciding, proposing a cosmogram, a certain distribution of roles, functions, agencies to humans and non-humans" (Latour, 2004, page 9). As realities are multiple, experts cannot legitimately try to define for others the world they live in. The boundaries they draw between the different roles, functions and agencies of humans and non-humans is, thus, politics. This is the role statements and models perform when they are made real in experiments (Callon, 2007, page 318). A good example of this drawing, deciding and proposing is provided by MacKenzie (2009). In his paper, "Making things the same – gases, emission rights and the politics of carbon markets", which I already discussed above, he temptingly shows how actors tried to define greenhouse gases and how they can be accounted for. They constructed sophisticated methodologies to equalize gases like sulphur and carbon dioxide and translated them into an existing set of accounting procedures. What is interesting for our discussion of politics is that in this process a new cosmogram was drawn, in which parts of nature were turned into an object of governance. While this was – in Latour's understanding –a modernist attempt of unifying nature, it was nevertheless – from a performativity perspective – genuine politics. It constructed gases and accountants as agents of climate change.

Latour's understanding of politics adds a certain specification to Mol's concept of ontological politics. For Mol, practices in the hospital and the laboratory are politics, as they shape reality. The problem with this concept is that it blurs the term politics. Every practice is politics, as it shapes reality. However, with Latour's specification of politics being a practice of drawing, deciding and proposing a cosmogram, Mol's very open concept is specified a bit. It is a more interactive concept. Politics does not just happen in every practice, but a cosmogram has to be actively drawn, decided and proposed. A proposal and its decision

include the affirmation of several actors and the word cosmogram implies that it affects others. Politics, thus, is the drawing, proposing and deciding of a collective order.

The drawing of new boundaries has consequences for public engagement in an issue, as Marres (2007) argues. She translates the above considerations into an analysis of democracy. In contrast to political science and democratic theory, this conception allows us to understand issue formation not as a discursive process, but as a process of intervening in collectives (Marres, 2007, page 762), as the "building of the cosmos in which everyone lives, the progressive composition of the common world" (Latour 2007, 3). For studies in the realm of policy and public controversies this means "that we treat the definition of public affairs and the organization of affected publics as practical achievements of issue articulation"(Marres, 2007, page 771). While in political science, most prominently in the model of the policy cycle (cf. Jann and Wegrich, 2003), issue formation is understood as the setting of a new political agenda that is subsequently addressed by the established political institutions and procedures, in Marres' conception, the formation of issues affects the definition of a new public affair and of new organizations. The issue comes first and politics, the shaping of reality and building of a new cosmos, revolves around these issues translating them into a problem. This process of defining a public affair and assigning it to some organizations instead of others is a contested process (Marres, 2007, page 771), in which only some state of affairs turn into a problem – and only for some affected publics (Blok, 2011, page 457). This is what Callon calls "performation struggle" (Callon, 2007, page 330).

What follows from this perspective is to consider the characteristics that turn an issue into a public affair. Marres suggests the term 'issue articulation' which can publicize or de-publicize an issue. A publicizing articulation renders explicit "the mutual exclusivities between associations that different constituencies bring to a controversy, and which are caught up in the matter at stake, and de-publicizing articulations can render such exclusivities obscure" (Marres, 2007, page 773). Articulating an issue is always – at least partly – exclusive, she argues. It shapes realities and their organization. Actors become object or subject of a governance arrangement. If this exclusivity is hidden as a matter of fact, the issue is de-publicized; if it is made explicit, as a matter of concern, public engagement in the issue is possible.

Marres applies a perspective of democratic theory to the perspective of performativity. The translation of issues into problems always affects reality; it furthermore always occurs in an exclusive setting, which is problematic from Marres' democratic perspective. The shaping of reality should be made open to a public so that it can be legitimized democratically. This is also the argument we can identify in political science literature which analyzes human agency in the politics of creating reality and governance arrangements.

Performing reality in governance: actors and technical issues

The literature I discuss in this section is concerned with the de-politicization effects of performative practices. By making use of normative political theories, this literature argues that the subpolitics the performativity literature reveals have consequences, and thus should be politicized. It is in this subpolitics that collective order is made. What follows from this is a

concern for the role humans and social entities play in this process and its social consequences. This literature analyzes how human beings engage in these subpolitics, lobby for their interests and try to change collective order. It shows that these subpolitics are fragile, and argues that it should be the task of analysis to open up these politics by drawing attention to the human actors involved in it. In the end, these scholars hope, one could genuinely question again whether carbon markets are the governance arrangement we want to have to regulate climate change.

In the introduction to a special issue about the politics of carbon market, Stephan and Paterson address the lack of the political dimension in the performativity literature and suggest a perspective rooted in post-structuralist political theory to understand it. Using a distinction by Edkins (1999) based on Mouffe and Laclau between the political and politics, they argue that what happens in carbon markets is genuinely political. With their perspective, they draw attention to the political aspect the supposedly technical issues of carbon markets have. It is in these technical issues that social structures are established, and it is in these issues that they can be challenged. Carbon markets are "political in that they involve relations of power and authority and the contestation of these relations, which shape and reshape the structures of the markets and other social structures beyond them" (Stephan and Paterson, 2012, page 550), they claim. They are political because, first, the distinction between political and technical issues itself is rooted in norms and past power inflected conflicts; second, this distinction has political consequences, as it gives authority to experts who decide on what is good and right; and third, the subpolitics are embedded in complex networks, institutions and discourses (Stephan and Paterson, 2012, page 555).

As long as carbon markets are perceived as purely technocratic, they are taken-for-granted and removed from the need for political decisions. However, this framing is fragile as Lane and Stephan argue. They claim that "carbon markets, once they are implemented, might seem to be purely technocratic in nature but they do not lose their contingent character. There is always the possibility of dislocative events that might challenge the taken-for-grantedness of carbon markets" (Lane and Stephan, 2015, page 9). This political moment can be caused by disasters like the financial crisis but also – and this is especially important here – by internal processes. Over the course of constructing carbon markets, new objects might open up and new sites of disagreement might develop; dislocation might also be caused by the fragility of calculations, technologies and narratives as they might fail and be contested (Lane and Stephan, 2015, page 10). If, for example, specific project types in the CDM fail to result in emission reductions due to faulty calculations, as was the case with Hydroflourocarbon-23 (HFC-23) projects, this may open up spaces of contestation in which the possibility of governing is questioned and disrupted (cf. Barry, 2002, page 270). Failure of technologies and fragility of calculations is thus not a mere technocratic issue, but might have a political effect if it opens up a new political space in which the relation between markets, companies, actors and technologies is questioned (Barry, 2002, page 279). This opening up, however, happens not by coincidence, but by the activities of human and institutional actors, Lane and Stephan argue. They claim: "the role and importance of the actors – whether institutional or human – that actually bring about, lobby for, bear these

policies to fruition and then contest them is radically undercut" (Lane and Stephan, 2015, page 6).

Drawing on the notion of human agency and explicitly adjusting it to the performativity literature, Simons and Voß (2015) are concerned with the politics surrounding the enactment of models for the construction of carbon markets. The economic theory of carbon trading is not just enacted in carbon markets, they argue. Instead, this theory became forceful by the activities of a constituency. This constituency articulates the theory, provides it with validity and develops it into a program of collective action (Simons and Voß, 2015, page 52). It legitimizes carbon markets through the development of technical models and helps to mobilize resources and political power to implement them. Through implementation, the models gain empirical evidence and attract public funding for further research (Voß and Simons, 2014, page 4). To legitimize the model and to mobilize resources and political power to implement it, the instrument constituency applies practices like "political issue framing, agenda setting, coalition building, business development, marketing and lobbying, management of innovation networks, professional organisation" (Voß and Simons, 2014, page 3).The instrument constituency, as they call it, evolves into a transnational actor in the politics of carbon markets; it is interested in carbon markets as such and also starts to promote markets for application in other domains and scales. Thus, the instrument constituency is not a reaction to the emergence of carbon markets, but an actor who acts on the development and extension of such markets.

Lederer shows how the routinized practices that make carbon markets work give experts authority and power and reify a specific, technocractic, approach towards the climate (Lederer, 2012b, page 649). He identifies commodification (turning carbon into a commodity), commensuration (making different forms of carbon alike and converting them into carbon dioxide equivalents) and standardization tools and methodologies of monitoring, reporting and verification (MRV) as such practices in which background knowledge is institutionalized. They all involve decisions of human agents, make carbon markets work and have political and economic consequences. Commodification turns nature into a commodity and thus creates a new social order; the possibility of commensuration makes specific projects like industrial gas projects economically viable or not; and MRVs make new actors like the German Umweltbundesamt and verifiers and validators powerful agents. Changes in these practices, which he claims reflexive human agents are capable of, result thus in changes of social and political relations. In unanimity with performativity literature, Lederer shows how academics are able to reinforce, change and hinder change of markets and governance. In the IPCC, and through government-initiated reports like the Stern report on the economics of climate change written for the British government in 2006, a community of practices consisting of confined scientists and scientists in the wild (Callon, 2007) influenced important changes: the Stern report increased the legitimacy of market-based instruments, and the IPCC's finally found consensus on carbon sinks resulted in a growing consensus to include forests into future carbon markets (Lederer, 2012b, page 650).

This strand of literature adapts the concept of the politics of shaping reality to the classical realm of policy and governance making. These authors identify particularly the supposedly

technical elements of policy and governance making as the occasions where reality is constructed. They stress how in this technical world making new actor constellations become important actors; scientists, consultants and auditing companies develop the knowledge and skills to change and hinder change of governance. It also shows that technological failure can open up again a naturalized policy. Thus, turning the analysis to the construction, contestation and enforcement of technologies and technical issues of policy- and governance-making is important for analyzing how reality is shaped and how governance arrangement emerges.

In the next part, I will suggest an analysis of performative governance on three dimensions. Based on the discussion in this chapter, I suggest that we can analyze the practice of performing new governance arrangements on an actor, discourse and material dimension. I suggest a performativity perspective that is enriched with Foucault's understanding of governing and the methodological considerations of political rationality. This, I argue, works well in order to analyze the construction of new climate governance arrangements like the CDM.

Conclusion: a performativity perspective of climate governance along three dimensions

The aim of this chapter was to develop a theoretical perspective that is able to analyze how the political order of the CDM I identified in the introduction emerged. Therefore, I reviewed studies that were concerned with climate change and governance in general and carbon markets in particular. I categorized them into three theoretical perspectives: international relations and governance; governmentality; and performativity. I argued that the international relations, governance and political economy perspective is not equipped to address the question of how the market liberal climate governance I described in the introduction came about. The perspective is restricted to institutions and mainly concerned with who governs and how governing could be made effective and legitimate. How a certain form of governance emerged is either perceived as a functional necessity, or ascribed to the influence of particular powerful actors, namely business and economy. As the world becomes more complex and hierarchical steering loses effectiveness and legitimacy, new forms of governance beyond the nation-state are deemed necessary.

Next, I approached two perspectives which are concerned with how the existing social and political order emerged, and how political institutions gained power and authority. I discussed, first, the governmentality perspective. Starting with Foucault's concept of governmentality, which understands governing as disciplining and empowering that can be found in mundane practices, different scholars approached climate change and instances of climate governance. They wondered how climate change was made governable, arguing that it was translated into existing political governmentalities, orders consisting of rationalities and technologies. They also wondered which rationalities guided political action, drawing attention to advanced liberal government. Last, they showed how existing forms of governing manifested these rationalities. They thus turned the analysis of politics and governing from

institutions to discourses, wondering how the existing political order emerged, manifested and changed. Explanans is the discourse, explanandum the ordered practices. I showed how studies in this realm recently turn to the practices they want to explain as a starting point of analysis, rather than the discourse. Rather than showing how neoliberal discourse is everywhere, as studies did for some time, they now try to detect the multiple governmentalities that guide and order the political.

Second, I turned to the performativity of economics literature, which took the opposite way of understanding order. Starting with a discussion of its founding father Callon, I identified this literature's interest in the practices and materialities that make order. Taking the economy and markets as an example, scholars from this perspective showed how scientific models and theories were inscribed into the world to order it, and how this order was stabilized and made workable in technologies. Models and technologies turned actors into agents as they allowed them to frame and calculate the world. In contradiction to governmentality studies, order here is the explanandum and practices and sociotechnical arrangements the explanans. My thesis is that science is not (anymore) outside society, but that we can witness a firm entanglement of both. This entanglement results in the social order we have, in sociotechnical arrangements that work.

I am interested in how a new global climate governance arrangement has been constructed. As we saw in the introduction, the climate governance arrangement of the early 2000s can be characterized by a multiplicity of public and private actors at various levels; by an efficiency frame and a market-based global approach; by carbon offset units and a centrality of science and technology. Governmentality and performativity seem to be well equipped to understand the emergence of this new arrangement. Both share an interest in how the social and political order we live in comes about, becomes manifest and taken-for-granted. However, as argued above, using governmentality to understand how new forms of governance come into being means overstretching the theory. Its particular benefit is to show how supposedly new forms of governance – in this case climate governance – are a realization of existing rationalities (cf. Boyd et al., 2011). In order to stay open for the case that the CDM is not only a realization of an existing rationality, to analyze the practices that bring into existence the CDM and the process of how it became the dominant approach to govern the climate, governmentality seems to have the wrong focus.

With its focus on local practices, performativity, on the contrary, has its benefits exactly in addressing these questions. It understands climate governance as a sociotechnical arrangement (Blok, 2014) that has been performed in practices at local sites. There are different arrangements and formats that compete. In a process of experimentation, certain arrangements become powerful configurations of reality that work.[4] The performativity study thus enables us to look at the practices in which theories are performed and technologies constructed to realize a market. However, so far, most studies have remained in the interest of

[4] At this point, performativity literature's roots in ANT are the most obvious. Power is not considered as something an actor can possess, or as the result of context. Instead, it is understood as the network an actor is able to knit. The larger and stronger the network is which an actor or arrangement has constructed, the more power this actor/arrangement has (Callon and Latour, 1981).

studying markets. The studies concerned with carbon markets do not approach them as a form of governing, but as a new economy, wondering how this market works, how practices of commodification, commensuration and calculation work. Carbon markets are so far unaddressed as a mode of governance, a way it has been conceived of in governance literature (e.g. Bäckstrand et al., 2010).

At this point, the performativity studies can benefit particularly from the notion of rationality. Both perspectives – governmentality and performativity – overlap in their understanding of framings (performativity) and rationalities (governmentality). For performativity scholars, frames describe what agents observe and calculate when they make market transactions; what is outside cannot be accounted for. It resembles what Miller and Rose wanted to address with their notion of "rationalities and technologies of government" – that problems have "to be rendered thinkable in such a way that it is amenable to political deliberation" (Rose and Miller, 1992, page 179). What is outside the political rationality cannot be perceived or addressed by the existing political order. I thus suggest making use of the term rationality in the performativity perspective, as it would allow an understanding of how issues are made governable. In such a perspective, however, this works without referring to a broader discursive order. Rationalities are performed in the practice of the governance arrangement; it is the discursive dimension of governance arrangements. For the analysis of climate governance, this means to understand the laws of the market; not only as laws of the market, but, in a manner of speaking, as laws of governance.

A second element in which both strands can merge concerns what governmentality studies call the technologies of governing and performativity calculative tools. Technologies of governing comprise "mundane programmes, calculations, techniques, apparatuses, documents and procedures through which authorities seek to embody and give effect to governmental ambitions" (Rose and Miller, 1992, page 273). Calculative tools in the performativity literature refer to instruments that measure nature and turn it into goods and objects within a calculative space (Callon, 1998, page 23). Without these tools, economic models would not function. Agents were not able to calculate. Similarly, technologies of governing are the tools that make reality calculable and governable. Without these technologies, government does not know the world and it is not able to turn its governing ambitions into effect. For the analysis of climate governance, calculative tools are thus not only tools to measure and take nature into account, but also to govern, to bring a governmental program into effect.

Blok (2011, 2014) and Lane (2012) provide first indications of how an analysis of governance and regulation could look from a performativity perspective. They show how economics can also be performative for regulation and how different governance arrangements compete and co-exist. Mol (1999), Marres (2007) and Latour (2004) argue how this competition can be understood as politics, as the construction of a collective order around an initially open issue. While this literature draws particular attention to the material dimension of performative politics, Stephan and Paterson (2012), Lane and Stephan (2015), Simons and Voß (2015) and Lederer (2012b) made more explicit how this politics can be

analyzed and identified on an actor dimension and how actors make a certain configuration work and hinder others to be realized.

Based on this discussion, I would assume that a climate governance arrangement has been performed in practice through the assemblage of rationalities and human and non-human actors. In practice, agents – be they human or non-human – perform governance arrangements through the enactment and adjustment of theories and the world; thus they translate an issue into a treatable problem in situation specific activities. This process of problematization and performing a governance arrangement can be divided analytically into three dimensions. First, on a discursive dimension, theories and statements become rationalities when they are adjusted successfully; they permit certain forms of governing, while prohibiting others and defining governance objects. Thereby, these rationalities ascribe authority to certain actors and perform new actors and agents. Second, on a material dimension, theories and statements materialize in technologies, in the common sense of technologies to be found in e.g. power plants and forests plantations, as well as in the sense of technologies of governance to be found in monitoring, reporting and verification tools and methodologies and theories. These technologies are part of the arrangement; they organize the order just as the discourse does. I comprise both types of technologies under the term material, as they bear the feature of resistance. Models and statements are inscribed into these technologies, and it is here that the adjustment of model and real world causes misfits.

Third, on an actor dimension, the construction of such an arrangement involves academics, policy makers and business people alike – confined scientists and scientists in the wild (cf. Callon, 2007) – who develop interest in an arrangement, contest it and lobby for other arrangements. From a performativity perspective, *governance is thus an arrangement of rationalities, agents and technologies that govern an issue – in my case the climate. Politics is the practice of constructing and contesting such arrangement.* To understand how new governance arrangements emerge, we need to analyze how in the three dimensions, material, discourse and actor, a new reality is constructed.

In the next chapter, I argue that this performation happens in experiments and suggest a model to analyze such governance experiments.

3
Analyzing governance experiments

In the last chapter, I argued that climate governance arrangements are performed in practice through the assemblage of rationalities and human and non-human actors. In this chapter, I will now turn to a practice in which this assembling takes place, the experiment. I will argue that in experiments, governance arrangements are constructed. I will propose a conceptual framework that enables the study of this process of construction. I will distinguish between three dimensions and develop three processes along which experiments construct governance arrangements. I will develop a notion of experiments that goes beyond an understanding of experiments in laboratories and situates them in society.

I will start with a discussion of the literature that is concerned with experiments in governance. Here, experiments are perceived either as quasi-experimental constructions or as new forms of governance outside the institutionalized spheres of politics to identify the best forms of governance. In this literature, experiments are perceived as rational approaches to identify good solutions to existing problems accompanied with the hope that they result in innovations in governance (see, for example, Jordan and Huitema, 2014). The literatures diagnoses such experimental approaches as a proliferation in the realm of climate governance, thereby resulting in a polycentric regime (Jordan et al., 2015; Paterson et al., 2014). They are perceived implicitly or explicitly as favorable practices of doing governance, because they can overcome institutional deadlocks and allow learning based on knowledge and de-centralized trial and error. I welcome the argument to turn to experiments in governance making, and take the diagnosis as a starting point for my interest in governance experiments. However, I contest the rational assumption that underlies literature in this field. This assumption seems to rest on an idealist notion of science and experiments. My contest is based on the performativity perspective I elaborated on in the last chapter. This allows us to draw attention to the actors, discourses and materials that participate in the experiments. To better understand these elements, in a second step, I will discuss studies and approaches to experiments from the field of science and technology studies (STS). They argue that experiments perform a reality, instead of describing it. The aim is to identify central elements for an analytical framework for the study of performative governance experiments. Based on this discussion, I will argue that in experiments, knowledge is produced as the result of social and material interaction, not as a rational observation of reality; that in experiments a heterogeneous constituency emerges which performs these experiments; that in experiments issues become politically addressable problems; and that these experiments are secluded materially, discursively and on an actor dimension from a macrocosm. In the last section I will draw these elements together into a framework to analyze governance experiments.

Experiments in governance

The term 'experiment' has its origins in science and research, and is commonly understood as a scientific activity or as a way of trying out new ideas or methods (Oxford Dictionaries). It carries an intellectual baggage (Ansell, 2012) which goes back to the 17th century, when the experiment was invented as a scientific method to explore and demonstrate new and surprising events (Shapin and Schaffer, 1986). Since then, the experiment has developed into a standardized method in science to test hypotheses and to generate new knowledge (Ansell, 2012; Callon et al., 2009; Groß et al., 2005). The common understanding of experiments derives from experiments in natural science which are characterized by an "artificial set-up of an experimental system, the inducement of changes by external control of certain parameters and the measurements of observable effects" (Gross and Krohn, 2005, page 64). Experimenters try to manipulate the mechanisms and functions of the experimental system and the results of this manipulation are understood as representing reality.

Experiments are increasingly discussed in the realm of governance and climate governance in particular (Hoffmann, 2011; Jordan et al., 2015; Jordan and Huitema, 2014; Sabel and Zeitlin, 2008). Aim of this section is to discuss these approaches and to distill the underlying assumptions.

In the early 1960s, Campbell advocated a natural scientific understanding of experiments as a method of discovering the best possible results from policy interventions. He regarded the public domain as a place to test the efficacy of political programs and argued that through experiments with and in the public, one could learn and design policies better in the future (Campbell, 1969). His understanding of experiments stems from the scientific concept of experiment; a controlled intervention of an interdependent variable on a dependent variable conducted in the confined walls of a laboratory would be the gold standard of an experiment. Campbell aimed at applying it to the innovation of social reforms, and although he noticed it would be nearly impossible to design social reform experiments in this way, he demanded "we must do the best we can with what is available to us" (Campbell, 1969, page 4) and turn society into a quasi-experimental design (cf. Ansell, 2012, pages 160–161). In this concept, learning from experiments would rest with the scientists, who would be assigned the task to discover necessities and functionalities of social organizations, just as they were supposed to discover necessities and functionalities of their experimental objects in the laboratory. Soon, this approach was criticized as technocratic, as a "colonization of the everyday world of potentially everybody" (Gross and Krohn, 2005, page 76).

Discussion proliferated as to whether it would be possible to construct a laboratory-like experiment on society and what its possible limitations would be (Ansell, 2012, page 161). The idea to use experiments for social sciences survived and found for example, in Elinor Ostrom a prominent successor. She applies experimental research to the governance of common-pool resources but does not try to experiment with society. This she confesses would be impossible as one could not control all variables. Instead, she proclaims to set up an artificial version of a real world situation in an experimental laboratory. In this artificial

setting, researchers can study and control isolated variables and deduct which one causes a specific outcome (Ostrom, 2006, page 150). As the title of her paper claims, these insights can be used as representative for the study of institutions. Thus, Ostrom and her colleagues try to seclude research on society from the enigmatic reality and translate it to the controlled confines of the laboratory, hoping to better identify causes for behavior as when researching in the field.

We can find another prominent example in Sabel and Zeitlin (2008), who apply such an experimental perspective to the study of European governance. They understand the European Union (EU) as a form of experimentalist governance architecture in which trial-and-error and diversity is crucial for making EU law. The EU has adopted a framework within which the nation states can experiment. Through a process of reporting and reviewing, the best approach is identified and can diffuse. Key features of this experimentalist governance are framework goals and measures, lower level units with the autonomy to address them, regular reporting and a periodic revision of framework goals and measures (Sabel and Zeitlin, 2008, pages 273–74). For them, this new form of governance is "a machine for learning from diversity" (Sabel and Zeitlin, 2008, page 276). As such a machine, this form of governance allows for new forms of accountability: national administrations are required to justify their way of implementing rules in the light of alternatives implemented in other EU member states. The different national experiments with rule implementation can be evaluated by experts. For Sabel and Zeitlin, this has a democratizing effect as "the widespread institution of peer review, experts criticising and responding to criticism by experts in public, undercuts the very notion of incontrovertible technocratic authority" (Sabel and Zeitlin, 2008, page 277). It is a recursive, deliberative learning process that helps to overcome entrenched settled practices and to generate novel reactions to problems, they argue (Sabel and Zeitlin, 2008, page 276). Its value is that it links decision-makers with real world experiences. Brussels is no longer detached from daily life, its decisions secluded from the real world, but is linked to what happens in the member states (ibid.).

However, Sabel and Zeitlin are not so bold as to allow for open experimentation. Instead, they pose particular importance on the framework that is deliberated between member states and the EU. The local experiments are only ways to learn about the best way to achieve a goal; the goal itself is not part of the experiment. The importance of the framework and the focus on experts qualifies their understanding as a quasi-experimental form of governance – an attempt to put the scientific experiments into the realm of society and governance. Their hope that such experimentation would yield better and even more democratic results stems from a positivist understanding of science and experiments. Sabel and Zeitlin assume that experts with their sophisticated apparatuses are able to detect the objective world. They are able to observe experiences and identify the best solutions among those tested.

According to Ansell, central for these approaches to experiments on society are verification, as well as falsification. He distinguishes them from other approaches on experiments in policy and governance, which he designates as originating from a pragmatist understand-

ing of experimentation (Ansell, 2012). Such an understanding emphasizes the "provisional, probative, creative, and jointly constructed character of social experimentation" (Ansell, 2011, page 12). Here, experiments are understood as social practices to deal with the messiness and complexity of modern life (Ansell, 2012, page 163; Groß et al., 2005, page 13ff.). They become a proceduralization of contingency (Gross, 2010, page 72) with the generation of variation as key.

For ecological restoration and adaptive management to a changing environment, Groß et al. develop a concept of real world experiments as an intervention outside the laboratory that aims to generate new knowledge and experiences (Groß et al., 2005). The world is too complex to be put into a laboratory, the authors argue, and thus a new form of producing and generating knowledge is required. Science needs to take place outside the confined walls of the laboratory and needs to become embedded in social, ecological and technical processes, they claim. Such real life experiments need to be organized differently to those in the laboratory. Due to contingency and uncertainty that characterizes them, no one has an experimental protocol and a theory to test. Instead, real-life experiments are controlled trial-and-error processes that enable taking into account the unexpected and unwanted elements of nature (Gross, 2010, page 69)Groß et al., 2005, pages 11–12).

In such real world experiments, local units are empowered to experiment and thus produce differences. Through comparison, "best practice" is identified. Ansell describes the underlying logic of comparing and selecting the best practice as a natural selection model. Through experiments, variation increases and success and failure of an experiment are then "relatively self-evident" (Ansell, 2012, page 163). The experiment is no longer understood as a controlled, purified microcosm but as a "social laboratory … where many ideas are tried out" (ibid.). Groß and his colleagues justify such pragmatist experimentation with the centrality of non-knowledge and unintended consequences in a modern knowledge society (Groß et al., 2005; Overdevest et al., 2010). They argue that in a knowledge society uncertainty is unavoidable and suggest real-world experiments as a modus to act in view of such uncertainty (Groß et al., 2005, page 11). In such experiments, they argue, it is possible to learn recursively. New knowledge is generated in the process of applying it to a local context. This is necessary as one does not know '"before the trial' whether or not the social and ecological risks are acceptable, and whether the knowledge for an intervention has been sufficient"(Overdevest et al., 2010, page 283). For them, the generation of variation and the comparison of best practice is fundamental (Ansell, 2012, page 163).

Scholars in the realm of climate governance observe a shift in the model of global climate governance from a state-oriented multilateral process towards an experimental form of governance consisting of a multitude of voluntary activities (Bulkeley et al., 2012, page 159). Most prominently, Hoffman identifies experiments as a means for new governance to emerge beyond the multilateral treaty-making of the conference of the parties to the climate convention. These experiments appear on different scales and in different contexts, ranging from corporate social responsibility, carbon rationing action groups, cities for climate protection networks to carbon emission trading systems, and regional networks (Hoffmann, 2011, pages 7–8). These diverse 'bottom-up' activities in climate governance

have been outside the scope of conventional studies of international relations. However, they deserve attention as climate governance is shifting away from 'megamultilateralism' towards experimental climate governance. While in the 1990s there was a stable system within which every actor concerned with climate change oriented its activities toward multilateral treaty-making, by the end of the decade, uncertainty about this approach increased and experimentation with activities which were only loosely connected to it emerged, resulting in a new polycentric climate governance (Jordan et al., 2015). In these experiments, actors practiced with new forms of governance (Hoffmann, 2011, page 70). Due to two processes, friction generation and smoothing, these experiments have the potential "to influence the shape and evolution of the global response to climate change" (Hoffmann, 2011, page 9) by creating significant momentum (Hoffmann, 2011, page 29). First, they provide a source of friction in politics and markets. They may push for new sets of rules actors must follow, change who is responsible for making rules and form new coalitions committed to climate action. Thus, they can catalyze a broad transformation of society and economy. Second, experiments can smooth "the path of the response to climate change by building institutional, technological and political capacity" (Hoffmann, 2011, page 28).

To delineate climate experimental governance from non-experimental activities, Hoffman defines three criteria: first, experimental governance activities are "primarily engaged in explicitly making rules that shape how communities respond to climate change" (Hoffmann, 2011, page 17, emphasis in original), that is an initiative which intends to shape behavior by setting up rules for a community of implementers. Second, "climate governance experiments are independent from the Kyoto process or national regulatory measures" (Hoffmann, 2011, page 18); and third, "climate governance experiments cross jurisdictional boundaries of some sort" (Hoffmann, 2011, page 18) – both vertically and horizontally. With this delineation, Hoffman identifies 58 experiments worldwide, which illustrate that we witness the emergence of a new form of addressing climate change politically; through an experimental system of governance, and not megamultilateralism (Hoffmann, 2011, page 25).

For Hoffman, experiments are far away from the notion of a controlled, randomized and purified microcosm that is so present in natural science. What he understands as experiments are those approaches to climate governance which are "less familiar, messier, more diffuse and dynamic" (Hoffmann, 2011, page 5). In an article Hoffman wrote with Bulkeley and other colleagues, the authors further elaborate on this understanding of governance experiments. They argue governance experiments are a type of transnational governance arrangement which "implicitly or explicitly give a sense of a process of trial and error" and which "are constructed in an institutional vacuum" (Bulkeley et al., 2012, page 150). They "are taking place in and actively creating new political spaces that do not have an established infrastructure for governing" (Bulkeley et al., 2012, page 151). These authors describe experiments as a practice in which actors work to propose, implement and establish new governing institutions (Bulkeley et al., 2012, page 152). Bulkeley and Castán Broto give an example for such experiments in cities. They define climate change experiments as "purposive interventions in urban sociotechnical systems designed to respond to the imperatives of mitigating and adapting to climate change in the city" (Bulkeley and Castán

Broto, 2013, page 361). They are conducted by a collective of policymakers, researchers, business and communities, which confronts a new problem and searches for a solution. What is experimented with is the sociotechnical system of the city, trying to shape it in a way that it better mitigates and adapts to climate change. It is a practice of governing that is more decentralized and reflexive than a centralized planning approach. While such centrally planned approaches to climate governance on the urban level has "encountered significant challenges related to institutional capacity and political economy" (Bulkeley and Castán Broto, 2013, page 361), experimental approaches are an alternative that can improve urban planning as it addresses its limited capacity.

This pragmatist (Ansell, 2012) strand of governance literature on experiments differs from the above discussed scientific strand on the conception of the experiment. Real life experiments are no longer a deficit form of laboratory experiments, but a social learning process. They enable learning about new forms of ecological restoration and thus new forms to live with nature, as well as about new forms and institutions of governance. These authors promote real life and governance experiments as pragmatic ways to overcome institutional deadlocks or as ways to deal with uncertainty and contingency. Learning from these diverse experiments occurs in an evolutionary process (Ansell, 2012) which will eventually lead to a transformation of society toward a better state of affairs, namely a more sustainable society.

In contrast to Campbell's rational approach – criticized as technocratic and top-down, as it leaves politics to the hands of experts and shifts decision making to the scientific mode of experimentation – proponents of pragmatic governance experiments claim that their experiments are open for local participation and local contexts, are decentralized forms of adapting, and can be used functionally to improve planning processes. However, a critique pertaining to both approaches remains. They are understood as favorable practices of doing governance, as they perform better than the institutionalized forms of politics, in the climate negotiations or in Brussels' bureaucracy. One can identify pragmatic solutions in local settings and once a working solutions is identified, it can have a significant impact on overall governance (cf. Bulkeley et al., 2012, page 152).

Underlying the conception of real world and governance experiments is the assumption that these experiments somehow naturally result in knowing the world better. These scholars acknowledge that the world becomes too complex to be understood in a central institution, be it in the laboratory or via the European bureaucracy. Instead, knowledge generation for science and policy has to be done on the ground. These experiments reveal the local reality, which is uncontroversial. Problems only appear in how the experiment should be organized so that it indeed reveals the truth.

From a performativity perspective, I contest this assumption about real world experiments as forms of natural learning. Science does not reveal the truth, but performs new reality, as we heard in the last chapter. And science is a field of social activity, just as every other social sphere (Knorr Cetina, 1995, page 146). Taking this perspective to the study of real world experiments, attention turns to the actors that do the experiment and the ways in which they do it. When Sabel and Zeitlin claim that, in experimentalist governance, best

practice is identified and diffused, the question is: who identifies what, and how does it diffuse? When Groß and his colleagues claim that the experiment is a social laboratory, where many ideas are tried out, questions remain: whose ideas are tried out and which idea finally asserts itself and how? They claim that real world experiments are a controlled process of trial-and-error, and we should wonder who controls what in the experiment by which means. When Bulkeley and colleagues argue, however, that climate governance experiments are a process of trial and error constructed in an institutional vacuum, we should ask who constructs the experiments and what is tried in it. And when Bulkeley and Castán Broto claim that experiments are interventions to identify solutions for existing problems, it is not clear whose problems are addressed, whose solution asserts itself, and how the intervention is designed. Experimenting and learning from experiments is not natural or evolutionary, but a socio-material process. To take this into account, we need to analyze governance experiments by analyzing who experiments with what, who evaluates how and how learning from it works in practice.

To better understand these issues, I suggest taking a closer look at literature on experiments from science and technology studies (STS). STS offers a large amount of studies that have been interested in the role of experiments for constructing new knowledge and new realities. This literature draws attention to the social and material interaction in which experiments generate new knowledge and provide the concepts of experimental object, technological system, experimental collective, problematization, in-vivo and in-vitro experiments, reduction, construction and expansion. With these concepts, I can advance toward an analytical framework for the study of performative governance experiments.

Towards an analysis of performative governance experiments

The experiment in natural sciences: producing knowledge, constructing reality

In this section, I will discuss some studies from the realm of STS that devote special interest to experiments in the process of generating new knowledge. The proposition of scholars in this realm is that scientific knowledge –like every other knowledge – is not an objective, natural truth. Knowledge, instead, is "whatever people take to be knowledge" as Bloor, one of STS' founding fathers, states (Bloor, 1991, page 5). And the resulting question must be: how do people take something to be knowledge? For my purpose, two aspects are important: the social construction of knowledge in an experimental process (Collins, Shapin) and the material element of producing knowledge (Rheinberger). I will analyze some authors who have been concerned with this and come up with three dimensions in which experiments perform reality, namely in an actor, discourse and material dimension.

When Rheinberger analyzed experiments in the natural sciences, he was concerned with the "practical process of producing knowledge" (Rheinberger, 1992, page 307). To understand how this process actually works, he argued that one needs to investigate the experimental system as the smallest functional unit of science, rather than as theory, or the relation between theory and experiment (Rheinberger, 1992, page 306). The experiment itself, he observed, is designed to produce knowledge that we do not yet have. It is a device that not

only generates answers but also – and as a requisite – shapes the questions that are going to be answered. One does not know exactly where the experiment will lead to. If one did, it would not be necessary to perform the experiment at all (Rheinberger, 1992, page 309). This is what makes the experiment so important in research. It is the reason why the experiment deserves particular attention when we aim at understanding the process of producing knowledge.

The experiment serves two functions simultaneously: "It cogenerates, so to speak, the phenomena or material entities and the concepts they embody" (Rheinberger, 1992, page 309). The experiment is performative, as the epistemic object is constituted during the process of setting up an experimental system. It does not preexist from the outset (Rheinberger, 1992, page 310). To better understand this process, Rheinberger introduces the distinction between the epistemic object, which is the thing under investigation, and the technological object, which is the condition in which the investigation takes place (Rheinberger, 1992, page 310). In the experiment, the technological objects are the arrangement that is known and pre-determined. This arrangement works according to known regularities. In contrast, the epistemic object "is yet in the process of becoming materially defined" (Rheinberger, 1992, page 310). The technological systems contain the epistemic object "in the double sense of the word: they embed it and they restrict it" (Rheinberger, 1992, page 310). Within the stable technological system it is possible to detect new and surprising results, namely the epistemic object. Little by little, these objects may become part of the technological system of another experiment. They turn from an epistemic object into the technological system (Rheinberger, 1992, page 323).

The distinction between technological object and scientific object is helpful to better understand the process of producing new knowledge:

> The character of fluctuation and oscillation of the scientific object within the experimental system, as a future-generating machine, is thus itself, in a way, the result of technological construction. Without a system of technically-granted identity conditions, the differential character of the scientific object remains meaningless; in other words, the particular piece of nature under inquiry does not exhibit the characteristics of a scientific object (Rheinberger, 1992, page 312).

To turn nature into a scientific object, the technological system of the experiments is crucial. It grants the object under inquiry its identity. The technological objects, thus, allow for an experiment to work: it is the controlled boundary of the experiment, in which the scientific object can be observed. It also determines the characteristics of the scientific objects: only the identity granting of the technical arrangement allows the scientific object to be distinguished from nature. Without this arrangement, nature does not become a scientific object; it cannot be studied. The technological system thus conditions the characteristics of the object under study. This modification of nature into a scientific object results from the knowledge put into the technological system in earlier experiments. This knowledge thus determines the scope of investigation for the next round of experiments (Rheinberger, 1992, page 312). Knowledge that has been produced in experiments is thus made technical

in the course of experimenting. What has been unknown at one point in time gradually becomes accepted and is the container in which new knowledge occurs.

For our understanding of experiments, we can deduce that while an experiment is a method to produce knowledge about the world, this knowledge is not independent from the experiment. Quite the contrary, it is produced within the experiment. The technological system modifies nature and turns it into an epistemic object. What is more: in experiments, not only knowledge but a material reality is performed. The instruments, the laboratory and the objects of inquiry are not only a social construction; they are a socio-material reality that has been performed in the experiments.

The technological system of the experiment is an important part of this process. It is constructed and regulates the experimental outcome. The technological system allows for an experiment to work, as it is the controlled boundary of the experiment, in which the epistemic object can be observed. However, it also determines which characteristics of the epistemic objects one can observe, as only the technical arrangement allows an understanding of the epistemic object. The technical arrangement bears the knowledge put into it in earlier experiments and determines the scope of investigation for the next round of experiments (Rheinberger, 1992, page 312). Producing new knowledge through experiments is thus a process in which knowledge is made technical, i.e. material and taken for granted. What has been unknown at one point in time gradually becomes accepted and the container for new knowledge to occur in.

A problem that arises with Rheinberger's observation is the question of how a scientific object becomes stable, i.e. accepted for further research. Collins approaches this problem with the concept of the experimenters' regress (Collins, 1992). The paradox he observed in science is that scientists do not know the correct outcome of an experiment, unless they know that the instrument, the technological system applied in the experiment, is correct. However, they only know that the instrument is correct, if it results in the correct outcome (Collins, 1992, page 84). This circular problem cannot be avoided by the experiment itself. Instead, a scientific community which participates in the controversy over the experiment negotiates on the correct outcome and the correct instrument. They apply non-scientific tactics to break the experimenters' regress (Collins, 1992, page 143). Once this controversy is concluded, a technological system is accepted, and the experiment can be replicated.

Drawing attention to the site of experiments, in his paper "House of Experiments in seventeenth-century England", the historian of science, Shapin, was concerned with the question "Why ought one to give one's assent to experimental knowledge claims?" (Shapin, 1988, page 374) This question is especially pertinent if one has not personally witnessed the experiment. Experimental sites are specific times and places at which an experimental phenomenon could be arranged and produced (Shapin, 1988, page 376). In 17th century England, no accepted experimental sites existed. The laboratory as a place for doing experiments was not yet established, and it was mainly in private residences that experiments were performed. These residences were modified for the experimental purpose (Shapin, 1988, page 377). What was important for the objectivity and reliability of experiments per-

formed in such private places, was the attendance of a credible experimental public, consisting of gentlemen. Attendance of this public was "germane to the making of knowledge" (Shapin, 1988, page 394). Before an experimenter showed his experiment to this public, he tried in private to make it work.[5] Once convinced it would work, he demonstrated it to the experimental public, which then started to interpret it either directly at the experimental show, or at some other place and time (Shapin, 1988, pages 399–400).

While Rheinberger was more concerned with the material dimension of an experiment, both Collins and Shapin were concerned with the social construction of knowledge. Both aspects are largely outside the scope of the governance and real-world literature discussed above. Collins and Shapin claim that experimental outcomes are the results of negotiation of an experimental collective; they are the result of a social process not of rational science. This is because of the interpretative flexibility of the empirical observation, as well as of the scientific object and the technological system of the experiment (Meyer and Schulz-Schaeffer, 2006, page 26). Without such negotiations, experimental results cannot be accepted. An experimental public discuss the experiment. They interpret what they or others have observed.

In contrast to the governance and policy literature on experiments, the literature discussed here argues that experiments are not just rational methods to observe reality and derive understandings of the real world. Instead, they produce this very reality. This happens first, by constructing socio-technical artefacts, as is well illustrated by an example we find in Rheinberger's study. Here, he discusses how a protein is constructed in the experiment to produce specific signals that the experiment could receive. By the use of radioactivity, alkali and acid, the researcher "destroyed what was 'not wanted' and purified what was 'wanted'… the production of one type of clear signal implied the destruction of others" (Rheinberger, 1992, page 317). The experiment thus is not a method to understand and adapt to nature, but the other way around; it is a method to perform epistemic objects that are supposed to represent nature. Second, it happens through a social process of demonstration and negotiation. Without a credible public that gives authority to the experiment, the experiment does not reveal valid insights. This experimental collective interprets the experiment and negotiates on its meaning. In a controversial process of arguing and with the help of negotiating tactics, the experiment creates new knowledge.

This literature demystifies experiments and highlights how it constructs reality. An experimental collective, the negotiation among them, its methods and theories and the technological system, are relevant not only for a new knowledge to occur, but also for a new reality. The experiment only enables specific things to happen and restrict us from experiencing others.

The discussion of Collins, Shapin and Rheinberger reveals three dimensions in which experiments construct reality: actor, material and discourse. On the discursive dimension,

[5] Shapin's example of experimenters were all men (e.g. Robert Boyle, Robert Hooke). While it would have been possible that also women performed experiments, when reading Shapin's story it seemed as if usually it were men who performed and witnessed them. Thus, I only use the male form here.

new knowledge is produced in experiments through their ability to generate questions and to be open to knowledge we do not yet have; on the material dimension, knowledge is made technical, and new material devices are constructed that conditions further research. On the actor dimension, results are demonstrated to a research collective, negotiated by this collective and finally accepted through forms of interaction. This distinction enables us to draw attention to the knowledge production process and sensitizes us to ask which knowledge an experiment translates into reality and how this reality is accepted.

But what does this mean for the analysis of governance experiments? The discussed literature has been concerned with experiments in laboratories of natural scientists. They showed how in physics and in biogenetics new knowledge is produced, as new realities are constructed. To make these insights useful for an analysis of governance experiments, we need another step; this step is a translation of these insights from the natural sciences and the confined walls of the laboratory to social science and real world experiments. I will do this in the next section.

Experiments in economy: in-vivo construction of reality

In the late 1990s, a branch of STS emerged that was concerned with the question of how the performativity argument made for laboratories could also be made more widely applicable (see chapter 2). In contrast to the scholars discussed above, authors concerned with the performativity of economics broaden the view and focus on the social sciences and especially economics and the role they play in enacting the world (Callon, 2007, page 315). Performativity of economics starts with the observation of "the move of economics from the journals, textbooks, and lecture theaters into 'the real economy'" (MacKenzie et al., 2007, page 2). Economics is not (anymore) a scientific discipline which observes and studies the real world; it is at work within economies. It swings between representing and acting, between science and policy, between inquiry and intervention. Economics is at work within economies either in the form of personal contact between economists and policy-makers, or in the form of economically informed tools that are used in and influence and restructure economies (MacKenzie et al., 2007, page 2). Neither is economics pure science, nor can we understand the economy without the economic models developed in economics:

> It would thus be meaningless to distinguish between an existing reality (economy) and the analytical discourse explaining it. Social science is no more outside the reality it studies than are the natural and life sciences. Like natural science, it actively participates in shaping the thing it describes (Callon, 1998, page 28).

With the expansion of the performativity argument to the realm of social sciences, especially economics, we need a clear indication of the experiment in social sciences. Muniesa and Callon propose an understanding of experiments and a distinction of different types that cover all kinds of economics experiments, from laboratory to marketing experiments. They identify three features of experiments, namely location, manipulation and demonstration. These features allow them to

> highlight (1) the fact that an economic experiment takes place in a located site that might be described as a specific sociotechnical device and characterized by the actors that can access it, (2) the way in which objects of experiments are constructed and tested in order to put forward some specific traits, and (3) the operations of demonstration, verification, testing, and proof that render both problems and solutions explicit (Muniesa and Callon, 2007, page 168).

These features resemble the three dimensions of experiments developed above. An experiment is a located sociotechnical device (material dimension) to construct and test a claim (discourse), which is then verified and demonstrated (actor). Within this general understanding of experiments, the authors distinguish three ideal-types of experimental configurations, which they differentiate primarily by its degree of openness between the experimental site and the outside world. The first type is a laboratory. It is a demarcated setting into which objects from the exterior are transported. It purifies objects "in order to make them fit for manipulation and production of controlled information" (Muniesa and Callon, 2007, page 170). To make the experiment valid outside its specific location, the experimental collective demonstrates information to specific audiences, colleagues, and sometimes a larger public of decision makers – this is like the laboratory experiment we discussed in the last section. In such economic experiments, the willingness of consumers to pay, for example, is tested. Participants are trained to behave in an economically rational manner; they are put into an artificial experimental setting in which they should act as if they were in a supermarket. Within this setting, all other parameters are controlled in order to reveal how much consumers are willing to pay for genetically modified organism (GMO)-free food (Muniesa and Callon, 2007, page 171).

The second type is a platform experiment, which tries to overcome the distance of outside and inside. To do so, it constructs the outside world using simulations. The experimental object is perceived as too complex to be reduced and purified. It is open to a plurality of actors – researchers, consumers, economic and also juridical or political actors – with different interests, skills and projects. What the experiment demonstrates is a compromise of the different interests involved in performing it (Muniesa and Callon, 2007, page 174). Examples are computer simulations and models. They are developed by a variety of actors, engineers, economists, civil-servants and other potential stakeholders. They involve a set of variables and simulate different scenarios. Models demonstrate evidence by forecasting without performing on the real-scale object. It remains a computer model. However, testing – as done by consumerist associations – is also a form of platform experiment. In these experiments, a hyper equipped consumer reveals the quality of a product and journalists, lawyers and individual end-consumers participate (Muniesa and Callon, 2007, pages 175–177).

The third type is an in-vivo experiment. In-vivo experiments are located in the real world and performed by an open collective. The inside and outside of the experimental site are blurred as experimenters, witnesses and experimental subjects are the same actors. Its main objective is to extend the list of actors involved in the experiment and to make those appear who are engendered by this experiment. The objects are not delineated a priori. In-

stead of purifying, reducing, simulating or testing, the research method in these experiments is to inject, i.e. to precipitate a "controlled intervention as a way of observing how the object reacts and deducing its properties and the manners in which it can be transformed" (Muniesa and Callon, 2007, page 178). The example they give is from a stock exchange. In the Paris Bourse, a new trading protocol was to be invented. The experimenters did not know how this new protocol would affect the trading, as they lacked the relevant data. Because of the many uncertainties that thus existed, they decided to introduce it on a small scale, monitor it and use the data to decide whether, and how, to scale it up to all transmissions (this relates directly to what I discussed earlier as a real world experiment). This experimental process of gaining knowledge was characterized by tinkering and composition – in other words a completely different approach from the controlled setting of the laboratory as well as from the "the degree of analysis and simulation that characterizes an experimental platform" (Muniesa and Callon, 2007, page 182).

This typology makes the experiment applicable to experiments outside the laboratory. However, although in-vivo experiments are characterized by a high degree of openness between inside and outside, and by an equalization of experimenters and objects, it does not mean that the boundary between macrocosm and laboratory disappears. It remains a controlled setting at a specific spatiotemporality, generating reactions which can then be translated to the macrocosm. Like the other experiments, in-vivo experiments work only in a local setting, manipulating their object and demonstrating a theoretical statement or model by turning it into a set of explicit mechanisms (Muniesa and Callon, 2007, pages 167–168). To control and observe, the experimental collective needs models which work as a production schedule, defining what to measure and how to adjust to the world (Holm, 2007, page 235). Within the experimental setting, the reactions of the experimental collective and its objects become visible, analyzable and calculable. Furthermore, the results of in-vivo experiments are not straightforward. The demonstration always leaves things invisible, and thus the collective of experimenters "must be convinced of the validity of the reaction recorded, of the interpretations provided, and of the transformations proposed" (Muniesa and Callon, 2007, page 179). The German "Energiewende" illustrates this argument quite well. It is an in-vivo experiment in which Germany tries to change its energy sector from fossil fuel-based to renewable. Although this experiment is open with regard to potential and actual experimenters, it depends on the data that is generated, the interpretation of this data by authorized experimenters, and their ability to convince others of the validity of their interpretations. Experimenters record data on the experiment and discuss and try to convince others that their records are valid. In this struggle over data and interpretation, the experiment reveals answers to questions like those whether it is possible for Germany to change the energy sector fully in a short time frame, whether the energy infrastructure works or whether a decentralized or centralized system is able to stem it.

The broad understanding of experiments and the translation of experiments from the laboratory to in-vivo experiments makes this perspective useful to analyze governance experiments without losing the theoretical insights of STS: it understands experiments not as rational tools to observe reality, but as devices to construct a reality. The experiment reduces the enigmatic world to measurable and controllable problems, and thereby manipulates

and modifies its object. As part of a network of experiments, it reconfigures the world as we can see it to the models inscribed in the experimental setting. Crucially, in-vivo experiments are also not fully open in their actor, material and discursive dimension. They are reduced with regard to the experimental collective constructing, negotiating and promoting them, with regard to the discursive frames that are constructed and tested, and with regard to the technological system that is installed in the experiment. What happens in experiments is secluded from a wider public and the complex world.

In a paper on carbon trading, Callon (2009) illustratively applied an experimental analysis from a performativity perspective on carbon trading and particular on the EU emission trading system (EU ETS). He describes the EU ETS as a sociotechnical arrangement which must be designed and experimented with to function properly. He claims that problems always occur when markets are established, as no one can be entirely sure which organizational forms and sociomaterial arrangements are needed to make the market work. It requires in-vivo experimentations, in which the produced effects are monitored and evaluated. In design activities, these effects need to be taken into account, and the markets under experimentation altered (Callon, 2009, page 537).

Carbon markets provide empirical illustration of in-vivo experimentation. Theoretical origins of carbon trading date back to the 1960s, and experiments of carbon markets were practiced in different places and forms like the US sulphur trade program, in experiments at BP, in Norway, the UK and Japan (Simons, 2015; Voß, 2007). Importantly, these sites "explicitly referred to one another" (Callon, 2009, page 538), thus making it a collective, distributed experimentation that aims at capitalizing expertise and knowledge. Such networks enable the jointly advancement of theoretical knowledge and practical devices of carbon markets. Thus, experiments with carbon markets are spread in time and space and connected in "networks of experimentation with markets". To make markets work, Callon claims, the construction should swing back and forth between in-vivo experiments and design activities, with both sites taking into account the experiences and insights of the other site. Although he does not make it explicit, these spatiotemporally spread in-vivo experiments apply to my discursive and material dimension. The experiments take the experience, instruments and knowledge produced in earlier experiments as a starting point for further elaboration.

The experiments also have an effect on the actor dimension: along the path of experimentation with carbon markets, an experimental collective emerges which comprises "large numbers of different actors from diverse temporal and spatial horizons," who work "on the conception and explication – mainly theoretical – of new market agencements" (Callon, 2009, page 538). This experimental collective is a new actor formation that operates across political boundaries at multiple levels and across the private and public divide. Policymakers, practitioners, scientists, NGOs, consultancies, international organizations to name but a few participate in these experiments. They construct, demonstrate, negotiate and enforce the experiments. They might develop interests and identities which depend on the experiments, their outcomes and successes (Bulkeley et al., 2012, page 166). This actor formation, which Voß and Simons (2014) call "instrument constituency", seeks to expand

the use of transnational governance experiments to implement new governance schemes: "The emergence of particular forms of experimentation, particularly those based on the development and extension of carbon markets, might be expected to lead to the emergence of constituencies with a stake in their continuation" (Bulkeley et al., 2012, page 166).

While they all have a stake in continuing the experiments and setting up carbon markets, they are not a homogeneous group. Instead they have multiple expectations towards a future carbon market:

> The multiple actors engaged in the functioning of markets all have their own expectations, conceptions, projects and interests, on the basis of which they promote different modes of structuring and organization. Through their disagreements over goods and their qualification, but also over the calculation of costs and prices, the evaluation of results or the taking into account of externalities and, more radically, their differences concerning the role of markets in controlling climate change, they reveal the potential diversity of forms of market organization (Callon, 2009, page 540).

Examples for these different organizations are the WWF Gold Standard, taxes accompanying the market, or the role of the state in the market. Ongoing controversies between these different actors and their expectations accompany the construction of the market. Callon calls this performation struggle (Callon, 2007, page 330), a power-inflected process of constructing a socio-technical arrangement, a carbon market.

On the discursive dimension, Callon's analysis reveals a process "of joint problematizations at the end of which the problems to be treated by either markets or political institutions or scientific institutions will temporarily be distinguished" (Callon, 2009, page 542). The origin is an issue, here climate change, for which no codified understanding exists, whether it is a political, economic or scientific problem; and it still defies all attempts to format it as political, economic or scientific. Gradually, however, it was split into distinct problems "which are qualified as political and others as economic, technological or scientific" (Callon, 2009, page 543). This problematization is only temporal. In the case of carbon markets, the market organization will change due to the experiences made in the EU ETS; research will alter what we know about technologies, greenhouse gas equivalences, and anthropological causes of climate change, and this will presumably change the established spheres, namely the political, the economical and the scientific (Callon, 2009, page 544) ones. Irrespective of how stable this problematization is, it is important that this process acts on existing configurations and contributes towards changing them. Depending on whether climate change is translated into an economic, political or techno-scientific issue, problems are formulated differently, different treatments are chosen, and different solutions implemented. It is a historically situated and contested process "whereby specific constellations of actors, material devices and political arenas emerge (or disappear) as authoritative promoters of specific governance objects" (Blok, 2014, page 47). An issue is not only translated into one problem, but into a meshwork, as is the case with climate change. It has been translated into a meshwork of climate problems and specific governance arrangements have evolved to ad-

dress these problems; the IPCC, transnational carbon markets and climate sustainability are instances for such new governance arrangements. Each is "associated with its own spatio-temporalities, knowledges, techniques and assemblies" (Blok, 2014, page 49). What is considered technical, political or economic rather depends on the configuration in place when the issue becomes public. Addressing climate change through markets stems from economic theory; addressing it through emission abating technologies stems from the fact that science and technology could legitimately claim which technologies work and how they could be evaluated (Callon, 2009, page 543). In an experimental process, a new issue is adjusted to, and framed by, existing sociotechnical configurations.

Performative experiments: translating the world into experiments and back

Thus far, I have developed three dimensions of experiments, actor, discourse and material; showed how scientific experiments constructed new realities in an interrelation of these dimensions; extended the notion of experiments from the laboratory to in-vivo experiments; and revealed how an analysis of experiments work for the introduction of carbon markets. The question remains of how these experiments and their realities relate to the world outside the experiment.

Callon, Lascoumes and Barthe offer a detailed model of translation to explain this process, starting from the observation that research has been increasingly secluded in modern times. Research is produced in laboratories which are secluded from amateur and lay people and from the disturbances of the ordinary world, including the complexities of nature and social life. Research was isolated from the ordinary world and conducted in laboratories, in which professional researchers observe the world only through instruments. These laboratories became the place for the production of research and knowledge. The world is reduced into a manageable and purified set of materials, which are transported to the laboratory. In the laboratory, these materials are subjected to the test of experimentation and then brought back into the world. Through the change of scale from the enigmatic world to the purified laboratory, such secluded research increases the productivity (Callon et al., 2009, page 49). To understand this performation process, they suggest a model of translations from macrocosm 1 to macrocosm 2.

For analytical purposes, Callon, Lascoumes and Barthe distinguish between macrocosm and laboratory (Callon et al., 2009, page 69). The first translation is a movement "that starts out from the big world in order to arrive at the laboratory, and which replaces a complex and enigmatic reality with a simpler, more manipulable reality, but which nevertheless remains representative" (Callon et al., 2009, page 50). In this process, snippets of the world are transported into the laboratory, where they are put into the confines of an experiment. Before they become subject of experimentation, these snippets are purified and manipulated, so that they can reveal features which are interesting for research. A drosophila fly which is subjected to tests in a laboratory, for example, is not a fly the researcher caught in the wild and brought to the laboratory. Instead, it is a cultured fly, already the product of the research infrastructure. The data of the experiment in the laboratory are fabricated (Callon et al., 2009, page 52).

The next translation, translation 2, concerns the work of the research collective. In the laboratory, inscriptions of the data in the forms of diagrams, films, maps, photos and the like are produced, which allow discussion, interpretation and mobilization. "This, and only this, is what the scientist registers, describes, exhibits, analyzes, compares, and measures" (Callon et al., 2009, page 52). The macrocosm has been replaced by the laboratory setting and the inscriptions but, importantly, these inscriptions remain representative for the macrocosm. The researchers deal with the purified drosophila fly as if it were a wild fly; and they deal with the treatments they inject and the reactions they observe in the laboratory setting as if it were a natural injection and a natural reaction occurring in the real world. The inscriptions are on the one hand determined by how the instrument translates the macrocosm to an inscription; on the other hand they are also open to interpretation, as the inscription does not clearly articulate what its message is. Not everybody can produce or interpret the inscriptions – we already came across this aspect when discussing Collins and Shaping above. Callon and his colleagues argue that a research collective organizes and coordinates the production and interpretation activities (Callon et al., 2009, page 54). It includes human beings, researchers and technicians, as well as the instruments and other non-humans. The human beings debate, discuss, set up practical activities and interpret results (Callon et al., 2009, page 56); the instruments (the technological system) transform material substances into inscriptions, diagrams or figures (Latour and Woolgar, 1986, pages 51–52). The research collective organizes experimentations with the data to transform them into theoretical interpretations and statements via a chain of equivalences. They produce and discuss inscriptions, combine them with other inscriptions, articulate them in texts and link them with other statements. This collective thus produces in laboratories a thick and extensive layer of interwoven statements; a process the authors call translation 2.

Translation 2 also contains the transformation of the paper world into the experimental setting. The paper world or statement world (Callon, 2007, page 330) is a world of papers, colleagues and students in which statements are developed and used; in a particular place, and at a particular time in this world, a statement works. But to become universally true, the statements need to work in different settings, and at various places and times. However, if the statement is shifted to other spatiotemporalities, i.e. other experimental sites, problems appear. For the statement to work in a new sociotechnical arrangement, not only does the statement need to move, but the whole sociotechnical agencement, as Callon calls it (Callon, 2007, page 331). The sociotechnical arrangement that goes with the statement and allows it to work needs to be moved to the new site as well. This trial-and-error process is similar to the process undergone in setting up the experiment in the first place. One does not know the conditions under which statements from the paper world work in the real world of experiments. What is only worth a few words in the paper world may be the tricky and crucial part in the real world. Thus, the adjustment of both worlds happens in a pragmatic process of trial-and-error (Callon, 1998, page 28).

After translation 1 and 2, the world is transformed into statements and interpretations which work in the laboratories. The third translation, translation 3, then refers to the process of how experiments are upscaled to the macrocosm. The authors identify two processes of how the experimental arrangement is translated back into the world. First, the

research collective needs to find allies. "In order to mobilize the resources and support without which it would quickly disappear, the research collective must interest other actors in its enterprise. It's not important who they are so long as they have influence or money!" (Callon et al., 2009, page 61). Therefore, the research collective needs to promote its research so that the allies are convinced that the collective's projects are in their interest. It needs to find a relationship between the research and the allies' interests. In mutual realignments, the research is adjusted to incorporate the different interests (Callon et al., 2009, pages 62–63).

The second process to translate the experimental results back into the macrocosm is called "laboratization": "For the world to behave as in the research laboratory, we don't have to beat about the bush, we simply have to transform the world so that at every strategic point a "replica" of the laboratory, the site were [sic.] we can control the phenomena studied, is placed" (Callon et al., 2009, page 65). This is crucial. It is important that the world that has been constructed in the experiment also works outside the experiment. To do so, to make the human and non-human agents act as in the experiment, the whole experimental setting is transferred to other places. The authors illustrate it with the example of Pasteur's vaccination serum. They argue that this serum could only become successful and transform the French world, because doctors transformed their offices into an annex of Pasteur's institute. They had to educate themselves, train the methods and know-how of bacteriology and install small labs in their office, with microscopes, serums and petri dishes. Only then were they able to manage the vaccination serum and treat their patients with it. Vaccination changed the world in the end, as increasingly doctors, who were at the strategic place to identify diseases, constructed laboratories and turned into researchers (Callon et al., 2009, page 66). Here, the experimental setting, the instruments, the skills and the know-how were transferred to other spatiotemporalities. In contrast to the processes in translation 2, at this point in the process, the claim that the experiment worked had been accepted by the doctors. They did not want to do research; they did not want to test whether the serum worked; they accepted that it worked and thus installed the laboratories in their offices. While in translation 2 different experiments were set up to develop theories and to construct sociotechnical arrangements in which a claim would work, in translation 3, the actors generally accepted the claim that a specific sociotechnical arrangement would work. In translation 3, the experiment turned from a questioning machine into an answering machine, from science to technology (Rheinberger, 1992).

The translation process Callon, Lascoumes and Barthe describe results in a transition of the macrocosm from state 1 to state 2 (see Figure 1).

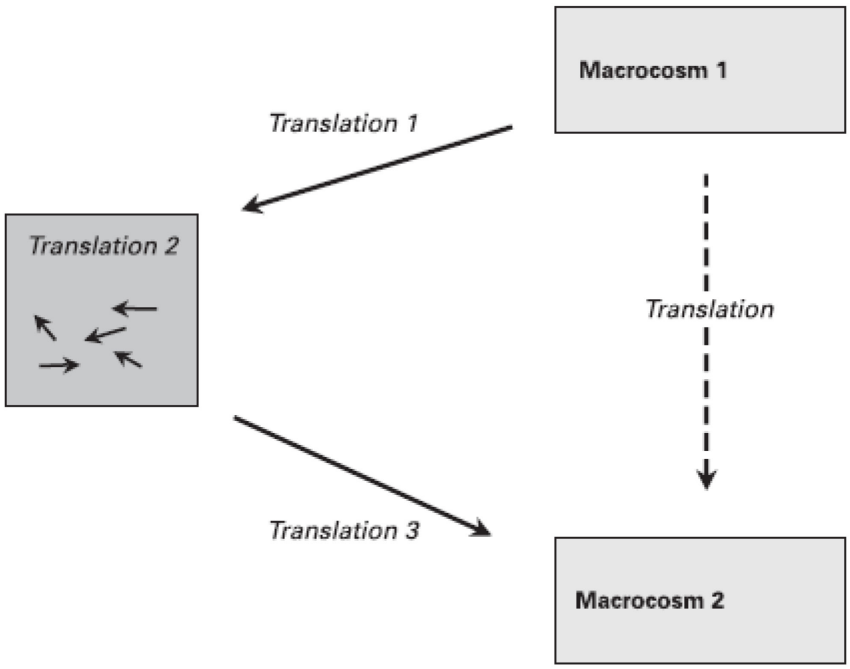

Figure 1: The translation process. Source: (Callon et al., 2009, page 69)

This figure is a good starting point to develop further a secluded experimentation model. In the above section, I suggested three dimensions to analyze the process of how experiments construct reality: an actor dimension, a discourse dimension and a material dimension. Although Callon, Lascoumes and Barthe do not systematically and explicitly distinguish between these three dimensions, they implicitly refer to them; for example coalition building (actor) and the setting up of laboratories (material) as elements of translation 3.

When we apply these dimensions more systematically, we can differentiate each translation: translation 1 is the reduction of the macrocosm on an actor, discourse and material dimension. In experiments with a market-based governance arrangement for climate change, the governance of climate change is reduced to concerns of efficiency (discursive dimension); to the specialized public of experts of market instruments (actor); and to instruments and methodologies that account for reduced greenhouse gases, as well as only some specific greenhouse gases (material). In translation 2, we can distinguish these dimensions in the process of constructing of sociotechnical arrangements that work. Economic models on how efficient emission reductions can be achieved are inscribed in an experimental setting (discursive); an experimental collective is developed that further improves this model (actor); and instruments, methods and skills are constructed that make the experiment work (material). The expansion to the macrocosm, translation 3, can finally be distinguished as the alliance building process between the collective experimenting with governance arrangements locally, and powerful actors in the macrocosm, such as business groups, governments or international organizations (actor); the presentation of the experiment as a best practice and a workable arrangement for doing climate governance (discursive); and the expansion of the technological system of the local experiments to other countries, regions and technological sectors (material).

As a consequence of this process of reduction, construction and expansion, the world has changed in these three dimensions. The experimental collective has become an agency in the new governance arrangement and has attributed agency to others; concerns turned into facts; and an experimental setting turned into a governance technology.

Conclusion: a conceptual framework to analyze secluded governance experiments

I started this chapter with a discussion of experiments in governance and policy literature. I argued that this literature applies a rational understanding of experiments. They are understood as devices to identify a best solution to a problem. They are a form of generating knowledge in the real world instead of the laboratory and of setting up decentralized institutions that are able to address problems more effectively. I confronted this rational understanding with the performativity perspective which I developed in the last chapter and discussed literature in STS on experiments to identify conceptual elements for an analysis of experiments. Combing both the governance and the STS literature, I can now derive an understanding of governance experiments as performative experiments. In such an understanding, governance experiments reduce the macrocosm into a controllable spatiotemporally bounded setting. In this setting, an experimental collective constructs an epistemic object, a new governance arrangement, and a sociotechnical arrangement which controls and tests this arrangement. In a controversial process, it thereby turns an issue into a governable problem. This governance arrangement expands to the macrocosm through the process of laboratization, the setting up of the experimental arrangement at new sites and the building of alliance with actors outside the experiment. Governance experiments are both in-vivo as well as in-vitro experiments. Understood in this way, a governance experiment is no longer a rational device to identify the best solution, but a social process in which a new reality is constructed. The governance experiment carries its own problematization. Various actors start to deal with an issue and try to frame it into a problem that can be handled. They construct a problem and propose a solution; the experiments are attempts to realize them, to reconfigure the world so that problem and solution works in it. Before the experiment, there were only issues, after the experiment there are problems and solutions.

I discussed in this chapter a variety of experiments. What they have in common is an orientation toward knowledge – either as the ultimate goal (as in scientific experiments), as a new form of governance, or as means of creating new governing institutions. Beside this commonality, they differed widely in scope, scale and issue. What does this mean for my concept of governance experiments? Is any governance experimental? Coming from a pragmatist philosophical background (Dewey, 1984; Latour, 2007; Marres, 2007), the answer is yes. "Politics emerges as ongoing collective experimentation" as Blok states it (Blok, 2014, page 43). However, and more relevant here, is what such a concept of governance experiments brings into focus for the analysis of governance processes. Its focus is on the role of knowledge and science in this process. It thus differs from, and complements, perspectives which focus on policy and business actors, as well as on hegemonic discourses

(see chapter 2). It complements the latter, as it shows the social processes involved in what is often considered rational knowledge production. Policy and business actors, as well as discourses, play a role in this process as much as they play a role in what is more conventionally understood as politics and governance: agenda setting, decision-making and governing. And they construct in these experiments a new political order at least as much as they do when drawing, proposing and deciding new policies.

If, in experiments, new governance arrangements are constructed and problems and solutions are developed, they deserve particular attention in the analysis of the development of governance. They reconfigure the world we decided to live in (Callon et al., 2009, page 68) and are thus political – as discussed in chapter 2. As a modification of Callon, Lascoumes, and Barthe's translation model, Figure 2 conceptualizes the process of constructing governance arrangements and secluding politics through experiments. It serves as the question generating model for my further empirical research. The starting point is a macroscosm at stage 1, the endpoint a macrocosm at stage 2. As argued above, macrocosm means an existing collective order. It is one reality that is accepted collectively. The broken arrow marks the development of macrocosm 1 to macrocosm 2. The general question to be asked with this model is how a collective order is established in the process of secluded experimentation. In the model, I distinguish between phases of reduction, of construction and of expansion, as well as three dimensions in which seclusion happens: discourse, material and actor. The bold arrows on the left side of the diagram designate the phases and dimensions, highlighting the secluded experimentation. Starting from an existing macrocosm, a process of reducing the enigmatic world into the confined settings of a governance experiment begins. Being interested in how the climate issue can be governed, experimenters carve a specific, controllable and purified governance arrangement out of the macrocosm. As a governance arrangement, I defined in the last chapter an assemblage of rationalities, agents and technologies that govern the climate in a particular way. Besides human agents, plants and forests are part of these arrangements, just as governmental technologies such as monitoring, reporting and verification tools and methodologies are. The experimental collective carves out this arrangement by adjusting the world to models and theories and vice versa; it constructs technological systems in which it claims to test and develop a governance arrangement; and it reduces the multiple and unspecific concerns that are out there into specific, testable concerns. The questions, thus, are: how is the macrocosm reduced in a discursive, actor and material dimension? Which models do the experimenters apply to reduce the world? Which instruments do they set up to observe the world? Which actors are present in the experiment? Experiments reduce the world differently with regard to rationality, agency and governmental technologies. The reduced world of global climate change that I identified in some (and in the end successful) experiments is a world in which the problem was turned into the controllable reduction of specific greenhouse gases; in which agency to address this problem was attributed to large corporations; and in which a mandatory market was supposed to regulate the process of emission reduction. Other experiments constructed urban and regional governance arrangements, voluntary markets, as well as subjectified climate governance like in individual carbon calculations (e.g. Hargreaves, 2014)

The second phase in this model describes the construction of the experiment, the establishing of an experimental collective and the negotiation of the experimental results. The question is how a new reality is brought into existence in the experiment. A research collective starts interpreting the experiments and negotiating on these interpretations. It develops monitoring equipment, interprets the inscriptions and demonstrates them to other researchers. While there are different experiments and different inscriptions, in this process of inscribing, monitoring and demonstrating, the research collective starts to construct and accept a certain reality. The question is how this process works. We need to analyze the mechanisms of how the experimental collective accepts a reality, the instruments it uses and the model it inscribes into the experiment.

The third phase describes the expansion of the experimental reality into the wider world. The question focuses on how the reduced and experimentally constructed reality is expanded into the macrocosm. How are others made to believe that the realities that have been 'observed' in the experiment also exist on other occasions? Following Callon, Lascoumes and Barthes, I assume that the research collective seeks allies with powerful actors who have power and resources to enforce the governance arrangement. They try to align the interests of the actors with the research collective's interests. This gives the experimental collective power and influence to set up more experiments. The expansion also works on the material dimension. Instruments, technologies and procedures are installed at new sites. On the discursive dimension, I assume that the experimental reality is demonstrated as a fact, thus limiting the discursive arena. In translation 3, the theory about how the world works – which has been tested in the experiment – has turned into a reality. Indications for such translation are generalizations of experimental results; for example if an experiment is promoted as a best practice or as a demonstration for Joint Implementation (JI) and the Clean Development Mechanism (CDM).

Whether the process of secluded experimentation is a fixed sequence going from reduction to construction to expansion is an empirical question. One can assume that the different translations happen simultaneously and could also go back and forth. While the experimental collective constructs local experiments, some could already try to expand the experimental reality, while others still try to clarify the reduction of the experiment.

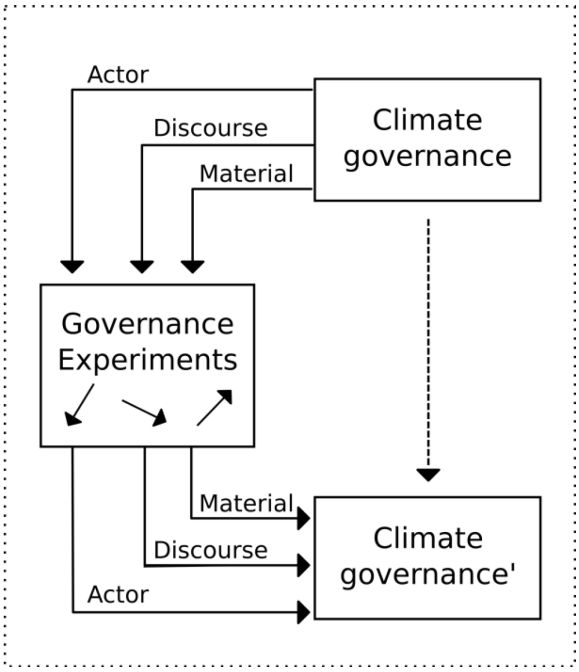

Figure 2: Secluded experimentation in climate governance

The material dimension in my analytical model applies to instruments, procedures, technologies, methodologies and manuals, in short to what Callon identifies as devices and equipment (Callon, 1998, page 21). The discursive dimension refers to the rationalities that permit certain forms of governing, while prohibiting others and defining governance objects. The actor dimension refers to the activities of the experimental collective in constructing the governance arrangement, such as negotiating, alliance building, and lobbying. Following Callon, I understand an experimental collective consisting of all actors who work "on the conception and explication – mainly theoretical – of new market agencements" (Callon, 2009, page 538). An experimental collective thus consists of actors who work on the same issue; in my case on the new climate governance arrangement, JI and CDM. However, to stress the political character of this collective, I prefer calling the collective 'experimental constituency' (cf. Voß and Simons, 2014). The notion of a constituency does not imply that its members share an understanding of, or an interest in, making the experiment work. It is an empirical question.

Being equipped with an analytical framework that is able to focus on experiments in governance processes, we can now turn to the empiricism, the construction of a market-based governance arrangement in climate governance. Before, I will provide more detail on my method, an interpretative case study approach, and the data I analyzed.

4
Research approach: interpretative case study of governance experiments

In my investigation, I apply a case study research design following Yin (2005). A case study is "an empirical enquiry that investigates a contemporary phenomenon within its real life context especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2005, page 13). Its basic promise is that it enables an in-depth understanding of the concerned phenomenon under real-life conditions and that it is particularly useful for answering how and why questions. These two promises justify my use of a case study research design. A case study can be investigated qualitatively as well as quantitatively, in an interpretative or constructivist analysis, as well as in a positivist analysis aspiring causal explanation (Andrade, 2009, page 43; Bennett, 2004, page 21). I will use it qualitatively in a constructivist analysis. This will require some departure from Yin's approach, particularly with regard to the use of theories and its role in the research process.

Case study design

A case study research consists of five components:

1. A study's questions;
2. its propositions, if any;
3. its unit(s) of analysis;
4. the logic linking the data to the propositions; and
5. the criteria for interpreting the findings (Yin, 2005, page 21).

To cover these components of a research design, Yin suggests constructing a preliminary theory related to the topic of study. My research wants to analyse how the Clean Development Mechanism (CDM) was established in secluded experimentation; it studies the emergence of the CDM as a case of secluded governance experimentation. In the previous chapters, I developed such a theory. The development of a theoretical model is central for a case study approach, because it serves as a blueprint for the study. It enables the deduction of theoretical propositions which guide what data to collect and the strategies for analyzing them (Yin, 2005, page 29). The theoretical model I developed in chapter 3 provides me with the following propositions:

- Essentially, I assume that a collective political order is established in the process of secluded experimentation. I call this order 'governance arrangement', an assemblage of rationalities, agents and technologies that govern the climate in a particular way.
- This process can be distinguished analytically into the subprocesses of reduction, construction and expansion, as well as three dimensions in which these subprocesses happen, namely the discursive, material and actor dimension.

- In an experiment, an experimental collective reduces the enigmatic world by adjusting it to an explicit or implicit theoretical model or statement. This model reduces the climate issue to a specific problem, the material world to a set of controllable and governable technologies, and the actor world to a delineated research collective.
- In these secluded experiments – whether they are in-vivo or in-vitro – the experimental collective constructs a specific governance arrangement, i.e. a specific problem framing, a specific object of governance, a specific governing authority and specific governing technologies.
- To expand the governance arrangement that was constructed in secluded experiments, the experimental collective seeks allies with actors who have power and resources to enforce the governance arrangement and set it up in other locations. Thereby, they try to align the interests of the actors with the interests of the experimental collective. The instruments, technologies and procedures which have been tested in the experiment are installed at new sites. On the discursive dimension, I assume that the model that has been tested in the experiment turns into a fact.

The unit of analysis is the establishing of the CDM. It is a case for secluded governance experiments. I selected this case for a variety of reasons. First, I started with a general interest in international governance of climate change and the emergence of new policy responses in this area. Carbon markets are the centerpiece of international climate governance (Paterson et al., 2014, page 420) and the CDM is still one of the central and largest carbon markets. It was also the first global carbon market. Although its future is uncertain, it will potentially serve as a blueprint for new markets in climate governance (CDM Policy Dialogue, 2012). Second, in the field of climate change and climate governance, experimentation has become an increasingly relevant topic, both in practice (The Climate Group, 2014; e.g. The Lab, 2015) as well as in academia (Bulkeley et al., 2012; Hoffmann, 2011; Jordan and Huitema, 2014). Academic literature focuses primarily on the EU Emission Trading System (EU ETS) (Callon, 2009), on urban climate governance (Bulkeley and Castán Broto, 2013) or on specific technologies like geoengineering (Stilgoe, 2015). Being a central instrument in international climate governance and the first among a diversity of carbon markets justifies the selection of this case. Third, empirically, in the process of establishing the CDM, there is explicit use and mentioning of experiments, pilot projects, learning by doing and the like, which has hitherto not been addressed and problematized theoretically. This explicit use of the theoretical term makes it a promising case for the study of secluded governance experiments.

To link my case with my theoretical proposition, I used the analytical technique of pattern matching (Yin, 2005, page 116). I compare the empirically based pattern with the theoretical pattern. If they coincide, it strengthens the internal validity of my analysis (ibid.). A pattern is a theoretically guided attempt to explain a phenomenon. Yin suggests the researcher to develop rival explanations with mutually exclusive patterns of independent variables (Yin, 2005, page 119). The theoretical pattern that explains the phenomenon better than the other is the valid explanation as long as there is no better one.

However, the methodological assumptions of Yin's case study design are positivistic and rely on a rationalistic research understanding. He assumes that the researcher collects data that reflects an objective reality and could just be applied to a predetermined research approach to the collection and analysis of data. Such methodological propositions do not coincide with my theoretical argument which I developed in the last chapters. From my theoretical point of view, neither data are objective nor is the research process a rational and linear process. While Yin makes a convincing argument as to how a case study can contribute to research beyond the specific case, the case study approach needs thus to be refined to work within my theoretical perspective. In the next section, I will argue that the interpretative research paradigm will serve as a good complement and show how I used it for collection and analysis of my data.

Interpretative analysis

Instead of developing a fully-fledged theory and a rival theory in the beginning of the research process, as Yin suggested, I deployed an iterative research style which has its methodological foundations in grounded theory (Strauss and Corbin, 1990; Strübing, 2005) and in an interpretative research paradigm. Grounded theory is an attempt to be as sensitive as possible for the empirical phenomenon and to develop context-specific theories in abduction. While researchers developed a profound guidance for doing grounded theory, there is still no such thing as grounded theory methodology (cf. Strübing, 2005, 2010). Instead, it is rather a research style which suggests some broad principles. For Strübing, the central elements are an iterative-cyclic process of theory and data generation, the constant comparison of the concepts, and the accompanied writing of theoretical memos (Strübing, 2010, page 33). These elements were central in my research.

The analysis of my empirical case follows an interpretative paradigm. Such an interpretative approach to the analysis of policy and governance has its roots in the work of Blumer (1986) and was taken up to the study of policy and governance processes by inter alia the work of Fischer and Forester (1993), Yanow (1996) and Rhodes and Bevir (2003). Nowadays, a considerably broad community of scholars uses analytical approaches that are labelled interpretative. Besides all differences, these approaches share the assumption "that policy formation and implementation, or broader, the activities and interactions of government agencies, public officials and their publics in civil society, cannot be properly understood unless we grasp their relevant meanings" (Wagenaar, 2007, page 429). Task of the analyst is to understand how actors interpret these activities and institutions. Basic categories within the field of politics like institutions, governance, programs or regulations are "not pre-given, but should be explained as the contingent products of actors' ongoing actions, struggles, and negotiations" (Wagenaar, 2007, pages 436–437). This interest in and openness for the actor's meaning and interpretation of situations and institutions makes it a suitable methodology for my theoretical argument. It enables the researcher to go beyond an institutionalist reading and become sensitive to the activities and discourses in the field. As one does not take institutions and regulations as an objective fact, but as the product of

action, struggle and negotiation, it enables the researcher to analyze the emergence of a new political order – my research interest.

The methodological consequence of such a paradigm is that data does not have an objective meaning. The data a researcher collects is always a specific interpretation of, and within, a situation. The task of the analyst is to interpret this interpretation. In the remainder of this section, I will show how I collected and analyzed my data.

Data collection and analysis

Data collection is an especially challenging task for interpretative analysis. It is impossible to collect all data on a process or thing under study (Clarke, 2005, page 186). Before collecting data for proper analysis, it is thus necessary to become knowledgeable of the case under study. Knowing the case allows for the identification of relevant activities, actors, and discourses. My case has been intensively studied from multiple disciplines and theoretical backgrounds from practitioners and academics alike. I took this variety as an asset to develop an in-depth knowledge of the case, of its activities, actors and discourses from a variety of perspectives. Having thus developed a broad understanding of the case of the construction of the CDM, I could start collecting data. I focused therefore on the process of international negotiations as well as on different experiments that had been discussed prominently in the field.

The central data for my study are documents. The documents I used for my analysis are process-generated data – data that was not produced for scientific research but as a by-product of social processes –, as well as secondary data, originally collected for social science research, which I re-analyzed (Baur, 2011, page 1234). The documents I collected consisted of reports mandated by international organizations or national governmental agencies, scientific papers published by experts in the field, conference papers presented at conferences in the field, books published by experts in the fields, and official documents published by UN agencies or national governmental agencies. I collected these documents, first, from the UN website and the website of the Earth Negotiation Bulletin, a reporting service on UN environment and development negotiations. Second, to collect documents on the experimental activities I used a key word search on google and google scholar. I finally coded 115 documents (see Annex 1) and interviews in a top-down strategy using my conceptual framework.

Throughout the research process I conducted 13 semi-structured interviews with senior experts from the field, which have participated in the construction of the CDM. They came from NGOs, research institutes and consulting companies in Germany, Belgium and the USA, the UNFCCC secretariat, and policy makers from the USA. In a first round of expert interviews, in September 2013 I interviewed seven experts from academia, business actors, consultants, NGOs and activists. I asked them about their understanding and concerns of the CDM, about their work with regard to the CDM, about their narration of its development and about their assessment of the community involved in developing and working on the CDM. Thus, I focused on the expert's technical knowledge, process-related knowledge

and interpretative-evaluative knowledge (Bogner et al., 2014, page 18). The interview partners are experts in the sense that they have specific knowledge of the field, about processes and events to which I could not get other access. They are seniors in leading positions (Littig, 2008, paragraph 8). I selected them via document analysis and through a snowball system. Access was surprisingly good. Only two approached experts either did not respond at all, or we did not manage to arrange an interview. These interviews took between 0.5 and 1.5 hours. At the time of interviewing, all interview partners had been active for several years in the field and had thus acquired a tremendous amount of knowledge and experience. Some were retired, some were still active. One of the interviews was via Skype, the other ones in a face-to-face situation. I transcribed all interviews. Simultaneously, I gathered more and more documents about the CDM. While the exact interest was still not clear, the selection focused particularly on scientific papers and reports, on analyses by relevant actors in the field and on policy documents. In December 2013 and January 2014, I conducted another five interviews, one via phone, the others face-to-face, with field experts, this time also from UN agencies, using similar questions in an open interview format. These interviews took between 1 hour and 1.5 hours. I transcribed them afterwards. The last interview was conducted in September 2014 via phone. It took approximately 1.5 hours.

As mentioned above, I conducted my research in an iterative-cyclic process (cf. Strübing, 2010). I collected the documents and interviewed experts whilst simultaneously developing the theory. This implies that throughout the process, my perspective and my research interest shifted. As a consequence some empirical material I collected could not be used directly. This concerns both documents and interviews. Some of my interview partners were not active in the earlier years I finally studied and some documents also were not written in this period or did not refer to it. I limited the time frame of my analysis from 1988 to 2001 as a result of a triangulation of secondary data (academic and non-academic analysis) and primary data (interviews and process-generated data). It is bracketed by the time when there were first ideas of understanding climate governance as an economic issue in 1988 and the adoption of the Marrakesh Accord in 2001 in which Parties to the UN Framework Convention on Climate Change (UNFCCC) decided on modalities and procedures of the CDM that could be understood as a reification of this economic ideal.

To analyze the documents, I prioritized them. Highest priority had documents that were circulated and discussed within the official negotiations about the international climate regime. Existing secondary data helped me to identify the relevant negotiations. I justified this prioritization with my interest in how the CDM is reduced, constructed and expanded in experiments. The world from which it is reduced and to which it is expanded is the world of international politics. If there is no trace of an experiment in this world, it is unlikely that it was central to this process, particularly as I propose to find practical lobbying and advocating of experiments. With this prioritization, I identified several experiments – the High-Efficiency Lighting Pilot Project in Mexico (ILUMEX), the carbon offset project in Latin America funded by Applied Energy Services (AES), the US pilot program "United States Initiative on Joint Implementation" (USIJI), the global pilot program "Activities Implemented Jointly" (AIJ) and the "Prototype Carbon Fund" (PCF). I triangulated this

result with interview material and academic literature, thus strengthening the claim that these experiments were indeed important. However, other experiments existed, and I thus do not want to state that these experiments were the only relevant ones. On some occasions in my empirical chapters, I mention other experimental activities, like programs from Sweden, Germany and Canada. However, as the purpose of this study is not a causal one, i.e. identifying which experiment caused the CDM, but a constructionist one, i.e. analyzing how via experiments new governance arrangements were constructed, this is less problematic. While I am not able to guarantee the exclusivity of the experiments I covered, prioritization and triangulation of my material should give validity to the claim that the experiments I studied were indeed highly relevant.

To analyze each of these experiments, I worked with a similar prioritization strategy. For USIJI and AIJ, I started with the analysis of official public documents of the respective administrations, for AES, ILUMEX and PCF I started with official public documents of the actor(s) mandating and conducting the experiments. I triangulated these documents with scientific and gray literature which had described and evaluated the experiments from different perspectives.

The collected documents and conducted interviews do not speak an objective truth. They are interpretations of situations resulting from meaningful social interaction between actors (cf. Blumer 1973). Thus, we cannot take them at face-value, but as interpretations. In a document or interview, actors present a specific interpretation that is always relative to the situation the individual faces (Clarke, 2005, pages 21–23). This draws attention to the context of the document: who writes it/who speaks, to whom? When and in which situation has the document been presented/published/voiced? How is the world interpreted in the document/interview?

Analyzing documents following such an interpretative paradigm implies that it is impossible to uncover an objective truth. It implies that different interpretations co-exist, that some are dominant, and that this dominance may change over time. As a methodological consequence, events to which documents refer can change in meaning. History is promiscuous and events contingent (Lane, 2012). A prominent example from my case study is the narration of the history of the CDM. Nowadays, actors narrate the history of the CDM as an evolutionary story which has its origins in a proposal from Norway and the USA, turned into a pilot program and finally became the CDM (e.g. CDM Policy Dialogue, 2012). However, this story conceals the contingencies that had accompanied the process. As we will see, this 'evolution' did not just occur. It was contested and required a lot of investment in work and resources. The case here is that this narration has become taken for granted. It is a re-narration of events with the consequences that actors have been rendered silent, stable and factual (Lane 2012, 586). To be able to unseal this interpretation, and to identify the contingencies at the time of constructing the CDM, it is thus important to analyze documents from the time at which events happened, not documents that already constructed a history.

A second methodological challenge that results from such paradigm refers to the interpretative capacity of the researcher. A researcher does not approach a new empirical case tabula rasa (Clarke, 2005, page 184). Before one starts to analyze a case, one will already have consulted different sources of information which all interpret the case partially. The methodological challenge is to get rid of the meaning an event later received, as this reduces the imaginable directions a process can take. Again an example from my case: the CDM is nowadays understood as a global carbon market, in which emissions from developed countries are offset by projects in developing countries. However, this was not the way it has been understood throughout its construction. It is already the result of construction processes. At the beginning of the 1990s, the CDM was also interpreted as a mechanism for technology transfer, as an investment mechanism instead of an offset mechanism, and even as a mechanism that only allows action between developed countries. That is, every element of its current meaning has been contingent. To be open for these different possibilities, it is important for the researcher to be reflexive about his/her interpretation. A methodological approach that reduces wrong interpretations is "to place oneself at the time that events occurred even if one were looking at data gathered in the past" (Garud et al., 2010, page 770).

Thus, for the analysis of data, it is necessary to interpret it in relation to its context and to position oneself at the time the document has been published or the event occurred.

I analyzed the documents via coding and used the processes and dimensions of my model of secluded experimentation to guide my analysis. I coded the document along a semantic field of experiments, which include "learning-by-doing", "experiment", "demonstration project", "pilot project", "prototype", "best practice", and "test". To analyze the codes, I applied a coding paradigm (Strübing, 2005, page 238). I approached the codes asking who did the experiment, what did the actors experiment with, what did they want to learn, where and when was the experiment conducted. To understand how the world has been reduced in these experiments, I compared the rational, objective and actors involved in the experiment with the rationales and objectives discussed and the actors involved in the macrocosm, i.e. international climate politics. To understand the construction of a new governance arrangement in the experiments, I asked what actors did to make the experiment work, which agencies have been constructed, which calculation instruments invented, which technologies applied and which models tested. To understand the expansion, I approached my data asking how the experiments were demonstrated in the macrocosm. Demonstrations were studies, submissions and reports. What was presented as a result? What has been presented as a technical issue, what as a political issue, what as a fact? I further analyzed which instruments, procedures and rationales of the experiment were used in other experiments.

Limitations

What are the limitations of this study? The central methodological problem I faced was to make sense of the messiness in the world. Studying the emergence of an international governance arrangement is impossible, if the scope is not massively limited. Just as with the

experiments I studied, I also reduced the enigmatic world, constructed a new arrangement and expanded it to world – albeit only on paper, not materially. Nevertheless – and again just like the experiments I studied – my study is performative. I constructed a world by adjusting theoretical considerations and empirical observations and by presenting it in the enabling and restricting space of these pages.

While this explains that my study is unavoidably a limited perspective of the phenomenon I studied, it does not release me from clarifying where these limitations are. The first limitation concerns my data set. I analyzed documents and interviewed actors who actively participated in this process. I hardly analyzed radical critiques, nor did I analyze the media or social movements, nor particular local groups affected by implementations of the experiment. All of them probably contributed to the reduction and expansion of climate governance. Second, my study lacks ethnographic data. Observing how actors negotiated the meaning of the experiments and how they set up local experiments would probably have added further and more in-depth insights about how experiments are constructed in practice. Third, my analysis was constricted by language skills. I was only able to collect and analyze English and German documents; I could not analyze Norwegian, Dutch or Mexican documents that I had discovered now and then. This particularly restricted the analysis of the local experiments. This limitation was less central for the analysis of the international negotiations. Particularly official documents are translated into English.

Part II:
The construction of the Clean Development Mechanism between 1988 and 2001

5
Reducing climate change to governance experiments: developing Joint Implementation

> Our challenge now is to move aggressively into … a period when practical and economically sensible policies will provide more effective and efficient management of natural resources and protection of the environment (Stavins, 1988, page 9).

In this chapter, I analyze the development of international climate governance in the late 1980s and early 1990s, focusing on how climate change was reduced into an economic climate governance arrangement called "Joint Implementation (JI)". I draw attention to the negotiations of the international climate agreement as well as to some experimental activities that influenced these negotiations. I argue that in this period, climate change was increasingly problematized as a concern of efficiency. This problematization was a result of economic simulations, as well as in-vivo experiments, which tested whether and how a climate governance arrangement based on efficiency would work. These small scale experiments resulted in the proposal of JI, a concept that would allow countries to jointly address climate change and to make use of different marginal costs for emission abatement. This proposal initiated intensive negotiations resulting in a pilot phase to test and further develop such an economically inspired governance arrangement. At the end of this phase an experiment installed that could test and demonstrate a climate governance arrangement undisturbed by the enigmatic world. This experiment reduced climate change into a set of methodologies, controllable greenhouse gases and an economic rationality.

Context: developing a global climate change convention

At the end of the 1980s, climate change was high on the international political agenda. Certainty grew among scientists that climate change would have dangerous consequences, and at a conference in Villach 1985, they started to emphasize the need for research into policy options for responding to any potential climate change. The World Commission on Environment and Development report, "Our common future", repeated this claim, highlighting the urgency of increasing energy efficiency and shifting the fuel mix towards renewable energies (Paterson, 1996, pages 31–32). With disastrous weather conditions worldwide, especially a US drought, a general importance of environmental issues in the late 1980s and a testimony made to the US congress on climate change, global warming peaked on the international agenda in 1988. First, ministerial level conferences were organized (Toronto 1988, Noordwijk 1989), discussions turned toward quantifiable global emission reduction targets, as well as national emission reduction commitments, and a process was started to develop a global response to climate change; this included discussion on a convention, as well as a "World Atmosphere Fund" (Paterson, 1996, page 33). The need to act was by and large accepted and with discussions turning to concrete goals and institutions, two issues

which shaped the subsequent discourse and institutions on climate change massively entered the arena: first, the issue of responsibility - i.e. who is responsible and what consequences this implies - and second the issue of costs - i.e. who pays for climate change policy and how.

Between 1988 and 1990, scientific and political conferences on climate change were convened worldwide, with the first in developing countries being held in New Delhi in 1989. Here, the primary responsibility of industrialized countries to reduce emissions was emphasized (Paterson, 1996, page 36). Discussions on the responsibility and its consequences continued at the World Conference on Preparing for Climate Change in Cairo, Egypt. The conference declaration recommended industrialized countries to develop in their own interest "'bilaterally and multilaterally, funding mechanisms for the transfer of additional financial and technological resources to poorer nations'" (Paterson, 1996, page 38). The issue of costs was first highlighted at a conference hosted by US President Bush in April 1990 at the White House. The media commented that "the purpose of the conference was to emphasise both the scientific uncertainties of global warming, and the costs of reducing emissions" (Paterson, 1996, page 38). Because of the costs of reducing emissions and the scientific uncertainty, the USA did not commit itself to a quantified emission reduction target, a move several other OECD countries had already made. While not being as reluctant to provide clear targets, the UK also emphasized the costs of action. The need to consider them was taken up by experts at the Second World Climate Conference in November 1990, when they claimed that "'technically feasible and cost-effective opportunities exist to reduce C02 emissions in all countries... to reduce these emissions by at least 20 per cent by 2005'" (Paterson, 1996, page 48). Before concrete negotiations on a global climate convention started in early 1991, European governments had committed themselves to national emission targets and declared that they "assume a major responsibility to limit or reduce greenhouse gases" (IUCC, 1993). They further agreed to establish national strategies to limit and reduce CO_2.

In December 1990, the UN General Assembly established the Intergovernmental Negotiation Committee (INC) to negotiate a framework convention. In the five meetings leading up to the UNCED conference in Rio 1992, the main controversies were over industrialized countries' commitments to limit greenhouse gas emissions and the question about the transfer of finance and technology to developing countries (Paterson, 1996, page 50). The US repeated that they would reject any emission reduction targets and the Group of 77 led by India surprised European and Japanese negotiators with the demand for "'new and additional funding to help developing countries implement measures to help combat global warming'" (ECO, 14 February 1991 in: Paterson, 1996, page 54). The final convention did not specify emission reduction targets for the developed countries, simply declaring that they would "adopt national policies and take corresponding measures on the mitigation of climate change" (UNFCCC, 1992 Art. 4.2 (a)) "with the aim of returning individually or jointly to their 1990 levels these anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol" (UNFCCC, 1992 Art. 4.2 (b)). It did not mention a date by when this target should be achieved. And Article 4.3 committed developed countries to "provid[ing] new and additional financial resources to meet the

agreed full costs incurred by developing country Parties in complying with the obligations" to report on their greenhouse gas inventories and to develop measures to limit their emissions.

Within this context of developing an international policy response to climate change, "economics at large" (Callon, 2007) developed economically-informed models for climate governance and a small community of economists started to promote them in the international negotiations.

Reducing climate change in-vitro: economic simulations of global climate governance

At the time climate change was high on the agenda of international policy, we can identify first instances where economics at large started influencing international negotiations. The OECD, economists in the USA, McKinsey, WRI, the IPCC and the Dutch government initiated economic and economically inspired policy simulations that analysed how a cost-efficient climate governance arrangement should look like.

Economic simulations

In the US, 55 individuals from academia, private industry, environmental organizations and government convened under project 88 to develop practical proposals for the use of "economic forces to achieve heightened protection of the environment at lower cost to society" (Stavins, 1988, page ix). Their goal was to make environmental policy cost-efficient and thus, to "move aggressively into a third era [of environmental concern, F.S.] – a period when practical and economically sensible policies will provide more effective and efficient management of natural resources and protection of the environment" (Stavins, 1988, page 9). This project was not concerned with emission targets or with the responsibility to act, but with a cost-efficient design of domestic environmental and climate policy. The rationale was to enhance the US economy's international competitiveness and to avoid any "dictated technological solution" (Stavins, 1988, page 5). To achieve it, regulation should be incentive-based and use the "innovative capacity of American entrepreneurs" (Stavins, 1988, page 2).

One chapter was devoted to climate change. Here, the authors recommended besides others a policy to "offset new source of greenhouse gases through trading", "the prevention of tropical deforestation through debt-forest swaps" as well as "international trading in greenhouse gases" (Stavins, 1988, page 10). The authors took the concept of offsets from experiences US EPA had made with the protection of local air quality, and translated it to the greenhouse gases. They suggested that new CO_2 emissions should be offset by "investing in energy conservation; retiring older more CO_2-intensive facilities; investing mass transit; or carrying out collaborative investments in tree plantations with forest product firms" (Stavins, 1988, page 17). Requiring offsets for new CO_2 sources would increase the costs of constructing new plants, the authors argued, and incentivize carbon emitters to invest in energy efficiency or in offsets, depending on what is less expensive. Thus, such an incen-

tive-based policy would use market forces to make climate mitigation activities cost-efficient. While offsets were proposed as a national strategy, the authors argued that in the long run, climate change would require international efforts. They suggested an international emission trading system which would allow countries to meet their requirements flexibly, chiefly reasoned due to "the fact that market-oriented flexibility in meeting standards will mean achieving those standards at the least possible overall cost" (Stavins, 1988, page 19).

This report stood out in its attempt to make the use of resources for climate policy efficient. It was a completely new interpretation of climate change. Climate change was problematized as an economic issue, dissolved from any ethics and policy. One important factor was the report's proximity to policy. It was mandated by two US senators and was explicitly written to influence national politics. The economic model of cost-efficiency had left the paper world of confined economics, and an economics at large started to infiltrate the US policy arena of climate change.

It was not the only occasion where economics started to enter the climate change arena. At the ministerial conference on Atmospheric Pollution and Climate Change in Noordwijk, the Netherlands in 1989, McKinsey presented the study entitled "Protecting the Global Environment: Funding Mechanisms", in which they calculated the costs for different policy scenarios and considered possible ways to fund these costs. Prepared for the Dutch government, this report concluded that in a global regime for climate change, 35 percent more emission reductions could be achieved at the same cost as if a regional approach were to be applied (Trexler and Kosloff, 1998, page 9). To achieve these cost-savings, the authors suggested a two-phased approach: first, countries would undertake actions domestically which would be the most effective. Having exploited these actions, McKinsey assumed that costs for further actions would rise and societal resistance increase. The second phase would then start, where joint international action under the heading of efficiency would play a key role. Such joint action would then cover all greenhouse gases worldwide. An international clearinghouse would enable action in one country to be substituted by action in another country (Kuik et al., 1994, page 5). The study was an estimation of global marginal cost curves based on consultation with political leaders and senior officials of 17 countries and did not use quantifiable data. It was later said that this study laid down the basic concept of joint international efforts to reduce climate change, in particular Joint Implementation (Kuik et al., 1994, page 5; Trexler and Kosloff, 1998, page 9).

Both the project 88 and the McKinsey studies were first tentative attempts to make economics promote and evaluate an international climate policy design[6]. While project 88 focused primarily on a national approach, it had already made some suggestions for a future international climate policy design, namely an international trading in greenhouse gases. The McKinsey report calculated the costs for a regional and a global design, promoting the latter as being more efficient. They marked the start of a phase in which economically inspired studies were produced in the policy arena, which drew the focus to the question of

[6] For another prominent study on green economy and the use of economics for climate policy, see Pearce (Pearce, 1989)

cost-efficiency and in particular to the cost-savings a global climate regime would result in. As we will see, economic simulations increasingly favored a global response which would capitalize on the differences among countries in their respective costs of reducing greenhouse gas emissions.

Economic simulations of climate change policy intensified. In 1991 and 1992, the OECD economics department published various studies to evaluate the costs of reducing CO_2 emissions through different policy instruments. One of them, a study by Burneaux and his colleagues, quantified the economic costs of possible international agreements. It compared the possible emission reductions of three scenarios: a business-as-usual scenario without any emission reductions; one under which commitments to reduce emissions applied only to OECD countries; and one under which they applied to all countries. It then analyzed the cost-effectiveness of different agreements, namely of carbon taxes and tradable permits, and how gains and losses of such agreements were distributed across regions (Burniaux et al., 1992, page 7). Their calculation revealed that only commitments for OECD countries would not be sufficient. If OECD countries were to stabilize their emissions in 2000 at 1990 levels - a target several countries had just announced - their emissions would be reduced by 43 percent. However, in such a scenario worldwide emissions were effectively only reduced by 11 percent. "This highlights the key message that action to tackle the climate change issue must include the major non-OECD countries if it is to have any hope of success", the authors concluded (Burniaux et al., 1992, page 7). While they calculated that an agreement which would pose emission commitments to all countries would reduce world-emissions in 2050 by two-thirds, the authors advised against such an agreement, as it would not be cost-effective. They stated that differences in costs to reduce emissions between regions were too wide and that any agreement should take this into account. Thus, the authors suggested a global carbon tax that should be applied to all countries or a system of tradable emission rights.

These suggestions reappeared in the IPCC's Response Strategies Working Group (RSWG) report. The US delegation suggested considering two approaches in response to climate change, namely a comprehensive approach and emissions trading. The US advocated them because it perceived them to result in environmental, economic and equity benefits. A comprehensive approach would cover all greenhouse gases worldwide, their sources and sinks, and together with emission trading, these approaches would afford "countries the flexibility to meet their aggregate global climate change objectives through joint arrangements of policies affecting sources and sinks of greenhouse gases" (US EPA and US Dept. of State, 1991, page 80). This suggestion differed from what has been discussed so far. So far, discussions targeted at national responses under the umbrella of a global convention which would prescribe general principles. That nations could jointly respond to climate change had not yet been proposed. Flexibility and comprehensiveness found their way into the document. The executive summary of the IPCC RSWG suggested flexible, market-based instruments as being the most effective response strategies (IPCC, 1991, page xxxiv).

These economic simulations of a global climate governance regime reduced the issue of climate governance to an issue of energy, greenhouse gas, plantations, and emission levels.

As such, it could be addressed economically by means of investments and market-oriented flexibility; costs and efficiency were the central discursive framing. These simulations and their underlying governance arrangement were developed and promoted by actors within project 88, McKinsey, OECD and IPCC. The central consequence of this framing was the identification of different marginal costs to reduce emissions in developed and developing countries. It was considered as a large source for cost-savings and thus promoted as a central element of a new climate governance arrangement by its proponents.

Contesting simulations: the conflict over eco-colonialism

These economic simulations encountered another framing which became increasingly prominent in the international negotiations. At the New Delhi conference, delegates had just emphasized the primary responsibility of industrialized countries to reduce emissions and at a conference in Bergen in May 1990, European countries had assumed their responsibility. The extent to which both framings differ in their consequences can be best illustrated by the economically inspired report "World Resources 1990-91" by the World Resource Institute (WRI). This report was written by the Washington, D.C.-based institution in collaboration with UNEP and UNDP. In this report, which was circulated widely in different languages, the authors tried to quantify the responsibility of nations for climate change. Therefore, they identified not only the use of fossil fuels as major emitters of greenhouse gases, but also "the clearing of forested land for agriculture, industrial and consumer use of chlorofluorocarbons, the growing of rice in flooded paddies, and the raising of domestic livestock" (WRI, 1990, page 4). They argued that besides CO_2, the greenhouse gases methane and chlorofluorocarbons (CFC) were also major causes of global warming. They developed a greenhouse gas index which counted nationwide emissions of these three greenhouse gases. The surprising result of this calculation was that Brazil, China and India were among the largest emitters of greenhouse gases. Asia as a whole was identified as the largest emitter of greenhouse gases with China and India ranking 4 and 5 after the US and the USSR.

Thus, they concluded, "what is evident is that responsibility for greenhouse emissions is spread widely around the world" (WRI, 1990, page 15). Not just the Western world was responsible. This was just the opposite argument to what has been discussed so far, namely that the OECD countries have been the major emitter of greenhouse gases and thus would be responsible for it. Its consequences were obvious:

> Such widespread responsibility for significant greenhouse gas emissions means that any effective agreement to stabilize or reduce these emissions will have to be equally widely based. Global warming is truly a global phenomenon, in both cause and potential effect. (WRI, 1990, page 17)

The authors argued that the national emission targets several OECD countries had set were not only ineffective if developing countries were not also to reduce their emissions; they were even imbalanced. If developed countries were to become subject to emission targets, they argued, developing countries would equally have to set such national targets. They backed this argument by a calculation of greenhouse gas emissions per produced dollar,

showing that emissions in relation to Gross National Product (GNP) are far less in developed countries than in developing countries. While they also acknowledged higher per capita emissions in developed countries than in developing countries, they argued "both per capita and per GNP emissions will need to be taken into consideration in establishing a fair international basis for limiting greenhouse gas emissions" (WRI, 1990, page 18). Fairness had to be based not only on past emissions, but also on productivity.

The authors tried to translate the enigmatic world of climate policy into the confined models of quantified scientific calculation. Political issues, such as the North-South conflict, were neglected and subsumed under what later became the global warming index, the potential of a greenhouse gas to warm the atmosphere. This in-vitro experiment not only simulated the costs of climate policy, but also the responsibility for climate change in an economic framing. Materially, it reduced the climate issue into a problem of greenhouse gas reduction. As a consequence, in such a governance arrangement responsible governance subjects were OECD countries as well as developing countries.

Based on these simulations, the WRI argued that developing countries were responsible for climate change and should bear the burden of responding to it. This claim was an attempt to translate the results of the model back into the real world. However, both the reduction and expansion of this model was disputed. An India-based NGO, the Center for Science and Environment, uncovered the ethics behind this report, claiming that the WRI report was a blatant example of eco-colonialism. Blaming China and India for climate change, the authors argued that "[it] is based less on science and more on politically motivated and mathematical jugglery" (Agarwal and Narain, 1991, page 1). Agarwal and Narain feared that this report would be a justification for developed countries, mainly the USA, not to pay for the costs climate change mitigation and adaptation posed on developing countries. Furthermore, it confirmed the developing countries' fear that "the proposed climate convention will put serious brakes on their development by limiting their ability to produce energy, particularly from coal … and undertake rice agriculture and animal care programmes" (Agarwal and Narain, 1991, page 1). If the emissions of rice patties were equivalent to the emissions of fossil fuel burning in cars and become subject of the convention, developing countries feared they could not develop, but have to pay for the consumption patterns of the developed countries. This point of view was taken up in the WRI report, claiming that "nearly one quarter of the potential warming arises from the forestry and agricultural sectors" (WRI, 1990, page 24) mainly from deforestation in tropical forests, and that countries should develop strategies to reduce these emissions, i.e. to avoid deforestation. For critics, this was like saying that developing countries' development concerns should be subsumed under developed countries' concern for the climate – in short eco-colonialism (Agarwal and Narain, 1991, page 1).

Within this context, the economically inspired idea of an international emission trading was quite unlikely. For such a system it was necessary that the participating countries would have committed to an emission target. But developing countries were far away from such commitments.

Reducing climate change in-vivo: carbon offset projects in Latin America

Privately induced carbon offset experiment in Guatemala

At the same time that climate change peaked in international politics and economics started to simulate international climate policy, first practical transnational experiments towards reducing carbon in a global system took place. In 1988, the American electricity company Applied Energy Services (AES) mandated the WRI to identify ways to offset the lifetime carbon emissions of a new coal-fired power plant in Connecticut. Preceding this decision, AES had considered ways to reduce carbon dioxide at the power plant but none of the proposed solutions seemed to be technically feasible. AES asked WRI to develop criteria and identify and evaluate forestry projects that could mitigate these emissions. For WRI, projects in developing countries were most promising; they appeared to be cheaper and had a higher potential to mitigate carbon emissions, as plants grew faster in tropical regions than in the USA. WRI called for project proposals and evaluated them according to four criteria: whether they were able to offset the estimated carbon emissions, whether these projects had local support, whether there was an ability to leverage additional funds, and whether the implementing organization was experienced in implementing such projects. A project in Guatemala run by the international development organization, CARE, won the tender. The project had existed since the mid-1970s and aimed at forest conservation and reforestation. Its funding ended in 1989 and from then on AES sponsored the project, initially with a sum of US$2 million. CARE was able to raise further funds of US$10 million from the government of Guatemala, the US Peace Corps and others (Faeth et al., 1994, pages 2–3).

The potential of forestry projects to serve as a carbon storehouse has been discussed since the late 1970s. Within academic and expert discussions on climate change, deforestation has been identified as one major source of greenhouse gas emissions and conserving forests were seen as one of three ways to mitigate climate change, besides energy efficiency and renewable energies (Dudek and LeBlanc, 1992, page 2). To date, however, no project with the explicit purpose of offsetting carbon emissions has existed. Thus, for WRI, the project was an "exceptional opportunity to put some hard numbers into what was then a very soft debate" (Faeth et al., 1994, page 2).

But the question was: how could this forestry project in Guatemala offset the emissions of the Connecticut power plant? Originally, the proposed project planned to plant 51 million trees, around 3,000 kilometers of living fences, implement agroforestry practices on 60,000 hectares of agricultural land, and provide training for the local community. To turn into a carbon offsetting project, the carbon sequestration of these activities had to be measured. Therefore, WRI invented a methodology that would estimate the net addition of biomass the project would produce. Based on this methodology, they simulated the carbon sequestration of the project for the next 40 years, concluding that it would store 16.3 million tons of carbon. This was enough to offset the calculated 14.1 million tons of carbon the power plant in Connecticut was expected to emit over its life time (Faeth et al.,

1994, page 2). For AES, this meant that they would offset 14 million tons of carbon for just US$2 million, a mere 14 cents per ton of carbon. It was implemented in 1989.

With US$5 million, AES funded a second project to offset the expected 45 million tons of carbon emissions of a newly constructed power plant in 1990. Again, it mandated WRI to develop criteria, search for projects and evaluate proposals. WRI asked 110 NGOs around the world to submit a project (Faeth et al., 1994, page 4). Throughout the selection process, WRI developed a scenario analysis that allowed for a comparison of alternative management practices at a given site and a comparison of different implementation sites (Faeth et al., 1994, page 10). Based on this scenario analysis, WRI was able to compare the different project proposals. They simulated how land was used in the project and calculated the expected carbon sequestration. This analysis allowed the WRI staff to translate a forestry project into a standard carbon sequestration number and so to decontextualize and compare the different proposals of projects from Thailand, Panama, Mexico, Nepal and the Western Amazon (Faeth et al., 1994). Unfortunately, the submitted proposals did not show the requested data. This was on the one hand due to a lack of administrative capacity by the project developers and on the other hand because "the information requirements to estimate carbon sequestration benefits are somewhat unusual and outside the normal experience of most project managers" (Faeth et al., 1994, page 64). To address this problem when asking for proposals, WRI sent information material to the projects, showing how to calculate carbon sequestration of forestry projects. Ultimately, WRI was able to simulate an amount of carbon sequestered and compare the projects based on their costs per ton of carbon (Faeth et al., 1994, page 8). For WRI, these carbon offset projects demonstrated that the theoretically calculated potential of forests to offset carbon did indeed work. They hoped to influence policy discussions with these projects but also acknowledged the limitations of their methodology. It was not yet matured and "more field experience was necessary as input to policy discussions" (Faeth et al., 1994, page 4). The demonstration was thus supposed to be part of a larger experimentation to construct and demonstrate the ability of forests to offset carbon. Therefore, the experimental collective of WRI, AES, CARE, US AID, local farmers and administrations had localized carbon offset in a specific forestry project and a specific greenhouse gas emitting power plant; they had manipulated an existing forestry project through implanting a calculation device that rendered the forest into a measurable carbon storehouse; and they had demonstrated the carbon sequestered and the costs per ton of carbon of this activity. Within a community of experts mainly in the USA, these experiments were discussed and the methodology refined. This community discussed the methodologies and instruments WRI had developed; they did not travel to the forests to observe how much emission they reduced but could use the charts and calculate with the numbers that had been recorded instead. WRI had thus invented a calculative tool through which the experimental collective observed the world, in Washington as well as at the local sites of the experiments. Here, the local field workers also used these tools. They filled it with the necessary numbers but neglected issues such as indigenous rights and sovereignty concerns.

Within the community, the overall model and its demonstration was accepted: forests worked as a carbon offset; forests in the tropics could offset carbon emission from power

plants in the US; and such carbon offsets could be calculated in terms of dollars invested per sequestered carbon. International carbon offsets were born.

The project found successors, especially in the US, in the early 1990s. Other US utility firms feared they would soon be under regulation from national carbon or energy taxes or any other form of greenhouse gas-related regulation and started to invest in forestry related carbon offset projects, mainly in Latin America. This fear was acute when the US Energy Policy Act was introduced in Congress in 1991. The draft required utility companies to offset their emissions by creating offset credits, and one possible option was to offset emissions reforestation and conservation of forests in countries abroad (Dudek and LeBlanc, 1992, page 4). When the law came into force in 1992, it was softened; offsets were now only a voluntary activity. However, this prospect lured US utility companies into forestry-related carbon offset activities, as they promised to be more cost-efficient than offsetting activities at home. Utility companies started investing in forestry-related carbon offset projects, which were implemented by environmental think tanks (WRI, The Nature Conservancy, The Rain Forest Alliance), by carbon offset consultants in close collaboration with the US Environmental Protection Agency (US EPA) and local NGOs. In total, however, not many such projects existed. In an overview article in 1994, Pearce identified 11 privately led forestry-based carbon offset projects (Pearce, 1994, pages 9–10).

The prospect to become regulated shifted the utilities' demand toward cheap carbon sequestration projects and away from other benefits carbon offset projects could generate. Compared to the first AES project, it was a new situation. AES had sponsored its projects mainly for public relations reasons and as a proactive means to influence national climate policy. That the projects achieved local development and environmental benefits was at least as important as their carbon sequestration potential. Forest conservation was a hot issue in the US, and investing in tropical forest conservation seemed to be a good public relation strategy (Brown and Adger, 1993, pages 4–5). With the discussion of offsets as part of an environmental regulation, the number of proposed projects increased, investors started searching for cheap projects, and more and more evaluations tried to monetize the projects in terms of US dollar per ton of reduced carbon using different methods (Dixon et al., 1993; Dudek and LeBlanc, 1992; Pearce, 1994), thereby simulating a price per ton of carbon at a range from US$1 to US$9 (Dixon et al., 1993, page 565). Roughly, these prices were a ratio of an estimated carbon sequestration potential and the invested money. These prices were never paid but remained simulations.

So far, these experiments were constructed and discussed only by, and within, a community of US forestry and environmental policy experts. But now and again, forestry offsets and the role of tropical deforestation had been discussed in combination with climate change. Personal connections existed between both discursive arenas. In project 88, the chapter on global air pollution was written by Dudek, who had studied and advocated forestry offsets as a response to climate change (Dudek and LeBlanc, 1990, 1992), and Trexler, who had developed the AES offset project at WRI and drafted the chapter "policy options available to address global warming" of the "World Resources 1990-91", in which he suggested "re-forestation policies that increase the uptake of CO_2 from the air by trees and other plants"

(WRI, 1990, page 24) as a policy option to address global warming. The first time these local experiments were explicitly advocated as practical implementations of joint implementation, however, was at the OECD conference "the economics of climate change" held in October 1993. We will turn to it later.

Publicly induced carbon funding experiment in Mexico

Two simulation projects were more closely connected to the international discussions on a global climate change regime and the idea of JI. They were implemented by the Norwegian government in Poland and Mexico and sought to analyze methodological and practical issues of JI (Government of Norway, 1997). Norway set up a specific climate change fund to implement the idea of JI in 1991 and prepared a partnership with the World Bank to implement these projects, starting shortly after the UN Conference on Environment and Development (UNCED) in Rio 1992. Norway's contribution to these projects was modest. It spent US$3m for a project in Mexico to install efficient light bulbs in households and US$3 Mio for the Polish coal-to-gas project (Heister et al., 1999). The World Bank, via Global Environment Facility (GEF) grants, contributed US$10m and US$25m respectively, the Mexican government funded US$10m and the Polish Government US$26m (Parson and Fisher-Vanden, 1997, page 8). The ILUMEX project had already been planned before the World Bank stepped in, but lack of funding prevented its implementation. ILUMEX was part of a number of activities conducted by Mexico's national utility company CFE to reduce residential energy consumption at peak hours. Energy consumption had grown, and in peak hours energy plants were not able to meet demands adequately. For CFE, reducing energy consumption was a promising way to overcome this problem (World Bank, 2006, page 11); furthermore it was a way of reducing local air pollution (Blanc and De Buen, 1994, page 3.2). CFE was looking for funders: the expected local non-greenhouse gas benefits of the project helped to overcome initial skepticism in certain departments of the Mexican secretariat of finance as well as the World Bank, the latter not having had experience in such projects and thus being initially somewhat hesitant in providing financial support for the project (Imaz et al., 1998, page 23). Only when Norway stepped in was the objective of the experiment refined, allowing the project to be implemented as a pilot for JI (Heister et al., 1999, page 243; Luzuriaga, 1995, page 248). Norway added another US$ 3m to the project to expand the number of distributed light bulbs by 200,000 to a total of 1.7m. The light bulbs were sold at a discount of 63%.

As mentioned above, the World Bank had provided funding via the GEF. The fund was set up to help developing countries achieve their commitments under the UN Framework Convention on Climate Change (UNFCCC) and to implement national actions to mitigate climate change (Mintzer, 1993, page 5). It bore the incremental costs of such actions in developing countries. To get a GEF grant, the ILUMEX project needed to demonstrate that it would be in the position to reduce or avoid greenhouse gas emissions. The grant would cover the costs of the project to reduce or prevent emissions, which could not otherwise be achieved, the so called incremental costs of the project (Mintzer, 1993, page 5). However, GEF was only recently established and no consensual definition and methodology existed in order to assess a project's emission reductions or the incremental costs of the

project. Nor did criteria exist to demarcate the projects spatial and temporal boundaries, nor to measure, quantify and monetarize the environmental benefits (Mintzer, 1993, pages 13–17). A further challenge was the lack of demarcation of what would have been done, had the project not been implemented (Mintzer, 1993, page 27). The only evaluation methodology that has been accepted already was to assess the incremental costs via a baseline scenario approach: it would compare the costs of a project reducing or avoiding emissions to the costs of the project without the part that reduces or avoids emissions (Mintzer, 1993, page 27).

Before the World Bank was prepared to fund the project, it required a feasibility study conducted by international experts, to ascertain the financial viability of the project (Sathaye et al., 1994, page 164), the participation of international evaluators in the project as well as the implementation of an evaluation methodology (Blanc and De Buen, 1994, page 3.7). Furthermore, in order to conduct the evaluation properly, the World Bank trained the Mexican staff (IIEC, 1992, page 21). For the Norwegian government, staff from CICERO evaluated the project. The evaluating team used the GEF's incremental cost methodology to calculate the direct emission reductions of the project based on the lower wattage of the efficient light bulbs compared to non-efficient ones, the number of replaced lamps and the average usage and the greenhouse gas emissions per lamp (Anderson, 1995, pages 6–7). They defined a baseline situation, in which the emissions of the existing lighting sector were projected into the future, and compared it to the new situation, a scenario that contained the efficient light bulbs (World Bank and GEF, 1994, Annex 3), concluding that the project would result in a CO_2 emission reduction of 120,000 tons per year (Selrod and Skjelvik, 1993, page 5). To demonstrate the cost-efficiency potential of the project, the evaluators used different methodologies to estimate the costs of reducing carbon that were discussed in literature and claimed that the emission reductions of the ILUMEX project would have a value of at least US$1.9m (World Bank and GEF, 1994, Annex 4, para. 6). For Norway's investment, this meant that the costs per ton of saved CO_2 emissions were between US$21 and 27; these were considerably lower than the costs to reduce CO_2 emissions domestically which were put at up to US$60 per ton of CO_2 (Selrod and Skjelvik 1994, 7–8).

The ILUMEX project demonstrated a specific climate governance arrangement and a specific translation of the JI concept. In this project, the Norwegian and Mexican government, together with the World Bank, agreed on a project to implement an energy efficient technology. The World Bank acted as a clearinghouse. It linked donor and host country and also supported the project with money from a multilateral fund. It was a bilateral funding arrangement. The international evaluators also played a key role. Alongside developing the methodology to evaluate the project, they also defined whether it would reduce emissions, by how much and for what price. With the use of technical instruments to measure and quantify emission reductions, they constructed boundaries of the political space and constructed carbon as an object of governance. They sent their reports to Washington where an expert panel of the World Bank drew on the evaluation's findings to decide whether the project should be financed or not. The governance arrangement was based on the principle of cost-efficiency and economists were authorized to construct and evaluate the project. In

contrast to what has been discussed in the international arena, in this project, there was no difference between the emissions of a developing country and a developed country. Mexico did not have any emission targets and was not suspected to have some in the short-term. Nevertheless, the project implemented in Mexico, but funded by Norway, would count as a Norwegian emission reduction activity. The pilot project thus modified the JI concept into a specific governance arrangement which would shift the authority to define and authorize the governance object to economics at large.

Alongside the Norwegian projects – the most prominent experiments – and the US carbon offset project, which would later play a prominent role in the debate, was a third experiment in the Netherlands. The Dutch Forests Absorbing Carbon Dioxide Emission Foundation (FACE), established in 1990, implemented six reforestation and conservation projects in the Netherlands, the Czech Republic, Malaysia, Ecuador and Uganda. These projects covered an area of 156,000 ha and were supposed to sequester the emissions of a 400MW coal-fired power plant during its 40-year lifespan (Moura-Costa and Stuart 1998, 193). Like the US projects, it targeted national regulation and was only later promoted as a potential "basis for the elaboration of criteria for the acceptation of forestation programmes within the FCCC" (Verweij, 1995, page 333).

Reducing climate change in negotiations: towards a pilot phase of Joint Implementation

A policy proposal for a cost-efficient governance arrangement

In the international negotiations, preparations for a convention started in 1990. At the first meeting of the International Negotiation Committee (INC), which drafted the convention, the US proposed a comprehensive approach. This approach required that the convention would not only focus on CO_2 but also on a batch of six greenhouse gases and that emission sources and sinks would be part of the agreement. It is the approach that was already discussed in the IPCC, as well as in the WRI report. It would give countries the flexibility to choose which sources and sinks of greenhouse gases they found most appropriate to use and regulate as a response to climate change, the US delegation argued (US EPA and US Dept. of State, 1991, page 80).

The Norwegian delegation particularly welcomed this proposal as "one important element of achieving cost-effectiveness" (Hanisch, 1991, page 4). At the third meeting of the INC, they further developed the proposal suggesting that parties to the Convention should be able to implement climate mitigation activities jointly. Norway suggested that countries' commitments should be delinked from the implementation of climate mitigation activities. It would allow countries with emission targets to invest in other countries where such activities would be more cost-effective. Governments could invest in e.g. energy systems of foreign countries with a less elaborated energy system than their own; making these systems more energy efficient would achieve the same environmental benefit as investments in energy efficiency at home, but at a considerably lower cost (Hanisch, 1991). This proposal resembled the suggestions in the study McKinsey had presented at the ministerial

conference in Noordwijk in 1989. Countries would first identify beneficial domestic options before they started joint mitigation strategies with other countries. An international clearinghouse would supervise these activities and secure their benefits. Going beyond the McKinsey study and also the US proposals at IPCC, the Norwegian proposal would also allow and enable countries without emission commitments to participate. If responsibility to climate change were to be delinked from implementation of activities, they argued, these activities could also then be implemented in developing countries which are neither responsible for climate change nor subject to any emission targets (Hanisch, 1991, page 5). This would be in the interest of developing countries as they "could benefit from investment funding for projects which would otherwise not be funded, projects which would bring other benefits as well… one could therefore perceive the principle of joint implementation as a basis for a new partnership, a win-win game" (Hanisch, 1991, page 5).

The idea was developed further in a think tank for climate and energy research, the Center for International Climate and Energy Research Oslo (CICERO), which the Norwegian government had established a year earlier. CICERO was a research and consulting institute associated with the University of Oslo with close contact to the Norwegian government and negotiation team. The leader of the Advisory Board was the then Prime Minister Gro Harlem Brundtland, already a famous figure for climate change policy at that time; the director-general was Ted Hanisch, former state secretary to the Prime Minister. Hanisch explicitly justified this approach with the financial savings the above mentioned OECD study had simulated for an international climate regime (Hanisch et al., 1992, pages 4–5). In an opening speech to a workshop organized by CICERO shortly after the proposal was made, Brundtland made clear that "cost-efficiency is of the utmost importance" for the Norwegian position in the international negotiations (Brundtland, 1991, page 3). To achieve it, Norway would further work for an agreement which would allow for investments in emission reducing activities in her neighboring countries. Brundtland argued that Norway would support such an approach as "it has been calculated that improvements per investment unit may increase by a factor between five and ten if the money is invested in neighbouring countries" (Brundtland, 1991, page 4)(Brundtland 1991, 4). Together with economists from the Tata Energy Research Institute, Delhi, and the Institute for Environmental Studies, Amsterdam, Hanisch and his colleagues from CICERO started advocating JI in the international policy arena, in workshops with negotiators of the climate change treaty, and at sessions of the INC (Hanisch et al., 1992, page 1). Here, they argued that in the long run, climate change mitigation action would increase costs. Like Brundtland, Hanisch argued that "[t]he search for cost-effective implementation mechanisms is therefore essential" (Hanisch, 1991, page 2), when he first mentioned JI in a policy note. JI would be one such cost-effective mechanism, they argued, using the calculation of the above mentioned OECD study. It would possibly halve the costs to stabilize CO_2 emissions, maybe even resulting in no net costs at all (Hanisch et al., 1992, pages 4–5). This proposal led to the economic simulations being translated into a concrete policy idea.

JI was a policy proposal that had adjusted the economic model of cost-efficiency with the political reality of responsibility. It enabled countries to exploit the differences in marginal

costs between countries without subjecting the host country to emission targets. When it was proposed in the negotiations, according to van der Gaast, it was "warmly welcomed" (van der Gaast, 2015, page 93). However, as the controversy at the eighth meeting of the intergovernmental negotiating committee (INC 8) two years later suggests, the delegates had just not fully understood this proposal yet. It found its way into the final UN framework convention on climate change (UNFCCC). Two articles referred to the concept, becoming the legal frame for JI activities (Figueres et al., 1996, page 4). Article 3.3 of the FCCC states: "Efforts to address climate change may be carried out cooperatively by interested Parties." And Article 4.2 further states that "developed country Parties may implement ... policies and measures (which limit their anthropogenic emissions of greenhouse gases) jointly with other Parties and may assist other Parties in contributing to the achievement of the objective of the Convention" (UNFCCC, 1992). The extent to which this instrument would affect the commitments of the Parties to the convention and to which the countries could share the benefits, was not defined. They mandated the INC to develop detailed rules and guidelines on JI. The Conference of the Parties (COP), the supreme decision making body of the UNFCCC, was supposed to decide these rules at its first session three years later.[7]

To date, discussions in international climate negotiations have focused on national targets and policies. With the economic idea of cost-efficiency entering the arena, however, and the economic simulations that emission reductions in developing countries would be cheaper also being brought to the table, a concept for a cooperative and comprehensive climate regime gained prominence. This regime was what Brundtland had demanded: "a new generation of international agreements… to make sure that investments are made in a way that ensures the maximum effect" (Brundtland, 1991, page 3)[8]; a climate governance arrangement that would bring an optimal pay-off of investments.

The Rio Conference came up with the UNFCCC, in which different responsibilities and commitments between developed and developing countries were defined. The former countries committed themselves to reducing their emissions and assisting developing countries in doing so; the latter only committed to reporting their emissions. In such a regime, Joint Implementation could not yield the simulated benefits, as Hanisch and his colleagues Pachauri, Schmitt and Vellinga argued. They had presented the concept of JI to the INC in preparation for the Rio conference. In this presentation, and in a subsequently published paper, they claimed that JI would work best if the participating countries were to have national quantitative emission projections (Hanisch et al., 1992, page 7). In such a case, the emission reduction of JI projects could be calculated against this projection. For the authors, the only problem concerned data and bookkeeping of the emissions.

However, the convention did not come up with a requirement for quantitative projections and it became clear that also the near future would not bring such national baselines for

[7] All nation states that are members of UNFCCC are represented at COP. They are called Parties to the Convention.

[8] See also the discussion of the implications of sustainable development for international relations in the report of the Brundtland Commission (Brundtland Commission, 1987, paragraph 39ff.)

developing countries. So the problem was how joint implementation could yield its simulated positive effect in such a regime and avoid the problem of the emission reductions of JI activities being offset by higher emissions in other countries. For the economic model to work, that is to exploit the differences in costs to reduce emissions, it was necessary that developing countries participated. To achieve this participation, the authors proposed a pilot phase, in which countries "with no specific commitments intending to contract joint implementation will have to produce national strategies and related emissions scenarios as part of their development/ restructuring plans, including how energy needs are to be met" (ibid.). Gradually in the pilot phase, these countries were able to develop more specific commitments. They would come up eventually with the necessary institutions that could make the model work.

However, opponents – mainly in developing countries – opposed joint implementation exactly because of this trajectory. They insisted on the principle of common, but differentiated, responsibility and claimed that joint implementation would impose the development path of developing countries (Torvanger, 1993). In such a system, developing countries would have to subject themselves to a national emission plan, which they had successfully prevented from being included in the convention. Within this new situation, an adjustment of the concept of joint implementation was required. One year later, at the OECD conference on the economics of climate change, such an adaptation became apparent.

According to Jones's presentation (Jones, 1993), in the months after the Rio conference, a specific understanding of JI as a project investment mechanism had gained the most attention. In such a mechanism, emissions would be calculated at project level and compared to a baseline of the project's business as usual emissions (Torvanger, 1993, page 2). This would not impose on the general development path of the host country, as no national emission plan was necessary. Countries facing high greenhouse gas abatement costs could invest in countries facing low abatement costs, and still the mechanism would result in global cost-effectiveness. Thus, JI would contribute to the substitution of specific new and environmentally friendly technologies. How investments and benefits of the project would be shared among the partners would be open to negotiation (see also: Hanisch et al., 1992, page 11). The host country had to accept the project to ensure that such projects would not interfere with its sovereignty. Such a project investment mechanism seemed to be a workable adjustment of the paper world of economics and the real world of climate governance. One could start to experiment with it. Jones suggested criteria for joint implementation, which would bring it the closest to an optimum of global cost-effectiveness (Jones, 1993, page 4).

JI in the international negotiations: conflicts and a pilot phase

Jones' paper further illustrates the discursive attempt made to problematize the issue of joint implementation as an economic-scientific problem. Jones distinguishes between the principle of cost-effectiveness, the environmental goal of the convention and the aim of equity (Jones, 1993, page 3). He argues that cost-effectiveness should only be the principle to achieve the other goals. While international negotiations should resolve the share of

costs individual countries would face and the level of abatement they want to achieve, the principle of cost-effectiveness should be regarded as a fact that can be applied to any level of abatement and any form of burden sharing. What makes this argument important is that JI as an approach to reduce global costs of achieving greenhouse gas emission reduction would apply to any goal and burden sharing. What we can see here is an attempt to separate, discursively, the discussion on joint implementation as an instrument to achieve emission reductions cost-effectively, and the political discussion on the goals and commitments of the countries. This separation allows discussing and developing JI without referring to the controversially disputed issue of commitments and to apply it to both, countries with and without commitments.

At the same OECD conference on the economics of climate change, Pachauri, who had been intensively advocating JI from the outset proposed its possibility to circumvent the political discourse. He claimed:

> Perhaps the greatest advantage of joint implementation is that it constitutes a simple extension of the existing commitments under the Framework Convention and would not require the tedious process of a whole new set of negotiations over targets, allocation, etc. (Pachauri, 1993, page 4).

For Pachauri, joint implementation provided a chance to move on to a climate governance arrangement without making allowances for all actors and interests in the international negotiations. Pachauri saw in JI an opportunity for developing countries to get more out of the convention than they had to date. JI would result in more financial and technological support for developing countries overall. And instead of waiting until a global agreement had been found, JI would be a chance to move on immediately. It would help to achieve more than if climate change were to be addressed only in international negotiations and more in terms of measurable emission reduction per invested money. How much more, and for whose benefits, was a question of the criteria that would govern JI. These criteria would be developed by experts and "[t]he parties to the Convention will have to adopt certain 'climate effect' criteria to be met by all projects eligible for joint implementation" (Pachauri, 1993, page 4). The experts could then develop criteria secluded from the public.

When Norway proposed Joint Implementation at the third meeting of the INC, developing countries and possible opponents lacked the necessary competencies to analyze it fully. Before INC 8 two years later, when Joint Implementation was on the agenda for the first time, delegates from developing countries mourned that due to lack of resources they could only scarcely study the concept of joint implementation. As we saw, on the contrary, developed countries had already undertaken many efforts to investigate it. This exclusion raised many concerns from developing countries (Heintz, 1994, page 181); not before INC 8 were they able to introduce a differing and contradicting interpretation to the international negotiations. They feared JI would help industrialized countries to continue their carbon-intensive consumption patterns; highlighted technical problems with accounting greenhouse gas emission reductions; argued that forestry projects would impact negatively on host countries' development path; were afraid that JI would not result in

additional funding for developing countries; and, finally, were concerned that JI activities would pick the cheapest option and leave developing countries with the more expensive ones (van der Gaast, 2015). From this different perspective, especially funding became a hotly debated issue. The convention did not explicitly state that funding for JI activities should be additional to the financial commitments of developed countries. To date, proponents in the discussion on JI had advocated that it would result in financial and technology transfer for the host country for which the investing country would get credits in return. Increasingly, opponents realized that this would be a flaw in the system, as a summary of interviews with delegates by Heintz shows: "Developed countries (listed in Annex II) have committed themselves in the Convention to pay for necessary action by developing countries; it is not fair for them now to demand carbon credits in return for such payments" (Heintz, 1994, page 182). So, opponents of Joint Implementation understood the concept not as a technical mechanism that could be discussed in terms of efficiency, calculation and accounting problems and without reference to commitments. Instead, they saw it as an issue of fairness and equity. They resisted an economic-technical frame, calling for a political one. They did not see the underlying political questions as having been solved. As a result, they were not prepared to leave it to expert circles to develop criteria, nor to bilateral agreements to reap the benefits of projects.

However, during preparations for INC 8, these concerns did not find much attention. For this meeting, the secretariat was requested to prepare a document to initiate a discussion on the criteria for JI activities. Based on the available materials and the convention, the secretariat suggested an interpretation of joint implementation. It suggested that Joint Implementation would refer to Annex 1[9] countries only, as they were the ones who made commitments and assumed that the major share of Joint Implementation activities would be implemented between two or more Annex 1 countries. However, the document did not preclude any activities between Annex 1 and non-Annex 1 countries. An Annex 1 Party could also provide financial resources for an activity in a non-Annex I country and claim this financing as joint implementation. To avoid financing of JI activities from being double counted as financial commitments and JI, the secretariat suggested a separate reporting of both activities (INC 8, 1993a, paragraph 11). It furthermore suggested that countries participating in JI activities could share credits of the project and should negotiate sharing them individually. These credits should not create "any commitments beyond those currently contained in the Convention" (INC 8, 1993a, paragraph 21). The document proposed some criteria of eligibility for joint implementation activities. These referred to the project level, methodologies and accounting procedures, as well as to the dissemination of results. The secretariat was quite aware of the complexity of such criteria and assumed its development would take time. This decision process, it stated,

[9] Annex 1 countries include the industrialized countries that were members of the OECD (Organization for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT Parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States (UNFCCC, 2015). These countries have made commitments to reduce their emissions and to support non-Annex 1 countries to respond and adapt to climate change.

> should take into account experience gained by various Parties in seeking opportunities to cooperate in pursuing the objective of the Convention. Some countries are already exploring such opportunities and may be able to share their experience with the Committee (INC 8, 1993a, paragraph 14).

The reference to existing activities was included on the insistence of the Dutch delegation, which complained that discussions to date had lacked practical experience, thus making "the debate about the role of joint implementation and the criteria that should be developed to ensure a proper application a somewhat theoretical exercise"' (the Netherlands in: van der Gaast, 2015, page 96). The Dutch team drew attention to the activities of the Dutch Electricity Generating Board and its experiences with acid rain reduction and tree planting projects.

The framework suggested by the secretariat was quite similar to the economic-technical framing mentioned above. Countries could make use of JI anywhere as it would not influence the participants' commitments. One could relatively easily distinguish between financial contributions as part of the commitments and financial contributions as part of Joint Implementation activities, as the former were general and the latter specific. A suitable accounting system would ensure that host countries would benefit from JI, getting additional funding. Thus, crediting should be allowed. JI was perceived as a straightforward and uncomplicated instrument.

However, at the meeting, this proposal document and its implications were heavily discussed with 59 submissions from individual countries, the EU and G-77[10]. Developing countries opposed their inclusion in JI en bloc (van der Gaast 2015). Malaysia, for example, did not see the benefits of JI for developing countries. Previous experience showed that it would not result in a transfer of funds and technology, as "these activities involve only small amounts of fund which are restricted to the investments of the projects themselves only and little transfer of technology" (Malaysia in: INC 9, 1993, page 46). Nauru submitted a research paper written by scholars from the University of California and, among others, Bill Hare from Greenpeace. In it, they developed a detailed argument against the use of JI between Annex 1 and non-Annex 1 countries. They concluded that JI would only be of benefit to some developed countries in the short term, reduce resource flows from developed to developing countries, distort the development path of developing countries, and be ineffective (Nauru in INC 9, 1993, page 49).

Nauru's submission showed how much expertise was already important to participate in the process of developing JI. In order to provide a substantial contribution to the debate, Nauru had mandated various experts on climate change and joint implementation from science and NGOs to draft a 15-page research paper. The authors traced back the origin of JI, investigated two possible JI systems – one cap-and-trade like permit system, and one open offset system – and argued that the former would not be compatible with the convention. Reviewing literature and analyzing the convention the authors came to the

[10] G-77 (the Group 77 at the United Nations) is a coalition of developing countries in the UN with the aim of enhancing its negotiation capacity of the UNFCCC. Today, it comprises 134 countries.

conclusion that a JI system between Annex 1 and non-Annex 1 countries would not benefit developing countries (Nauru in INC 9, 1993, pages 49–64). This was a rare opportunity for developing countries to investigate in-depth the concept of joint implementation. The controversial discussion did not lead to a decision on JI, but only to an acknowledgment of "the complexity as well as the far reaching political implications" of JI (INC 8, 1993b, paragraph 50) and a commitment to continue the discussion with new and further insights and experience at the next meeting.

Following INC 8, supporters of JI started a "diplomatic offensive to establish a viable program" (Cass, 2006, page 118). One important element was a workshop that the Woods Hole Research Center organized in January 1994 in Bermuda. The Center invited members of the INC Bureau, as well as governmental and a few non-governmental representatives, all of whom were sympathetic to JI. They took the criteria the secretariat had put on the table as a first step to discuss how a credible JI system could be put in place. The discussion was under the assumption that to achieve the convention's objective, both developing and developed countries would have to do their share. Developed countries needed to comply with the commitments they made; developing countries had to be enabled to also reduce emissions through a transfer of technologies and resources. In the view of the organizers, joint implementation would enable this transfer and thus contribute effectively to meeting the convention's objective (Ramakrishna, 1995, page 3). Critical voices were not present and, secluded from interruptions, the discussion continued as to how a global JI system that would involve developing countries could be finally achieved. Presenters were confident that the concerns could be met with proper criteria and, ultimately, JI would be of benefit for all parties involved, developed and developing countries alike. They assumed that they could overcome concerns with regard to a properly developed methodology that takes into account the development priorities of developing countries.

At this workshop, participants also had the chance to discuss the idea of a pilot phase for the introduction of JI. Vellinga and Heintz from the Institute for Environmental Studies at Vrije Universiteit Amsterdam again presented this idea. They had studied this issue for two years and had already proposed such an approach at various occasions and INC meetings (see Hanisch et al., 1992). Being unconcerned with the actual interpretations of Joint Implementation and the discussions of its benefits and misfits, Vellinga and Heintz suggested to develop a global JI system in a phased approach. A pilot phase would help to build confidence among member states and to develop formal rules and procedures. Based on new scientific information and reviews of the experiences made in the pilot projects, the system would be adjusted until finally a global trading system could be installed (Vellinga and Heintz, 1995, page 11). For such a pilot phase to work sufficiently, they argued that the COP should not adopt a set of criteria, but only indicate a direction in which JI would go. This would leave the pilot open enough to come up with a wide range of experiences which could then be taken into account by the COP. The other presenters shared this idea of an experimental, phased approach. Due to newness and complexity, it would be necessary to learn by doing, they argued (Ramakrishna, 1995, page 46). As such an experimental phase should encourage testing of a variety of projects and institutional

structures, they stated, it would be necessary to design the pilot phase as openly and flexibly as possible. The presenters proposed that the further development of JI should be restricted to within the actor dimension. Decisions on JI should not be made within the UNFCCC, they argued, but by experts and scientists.

In the draft document the secretariat prepared for the next INC session, INC 9, we can find several of these ideas. They had developed possible criteria for JI and none of them prohibited JI activities between developed and developing countries. Instead, the secretariat suggested that the benefits of such activities should be shared among the parties involved, for example in the form of credits. It also took up the idea of an experimental phased approach:

> It could, for example, start with an experimental phase for the period until the COP has established definitive criteria. In this period, experimental activities could take place to build a broad foundation of experience, on the basis of initial guidance by the Committee and possibly later by the COP, and without prejudice to the criteria to be adopted by the COP" (INC 9, 1994a, paragraph 47).

And it moves on:

> The committee may consider whether it sees merit in a phased approach, and if so, whether, for the period until the COP has established definitive criteria for joint implementation, it could endorse experimental activities between Annex I Parties and between Annex I Parties and other Parties (INC 9, 1994a, paragraph 48).

Opponents got support by European countries (e.g. Belgium on behalf of the EU, in INC 9, 1993, page 11) who agreed that there are technical problems with JI regarding accounting, reporting and crediting as well as political problems as JI might undermine the Convention. Germany for example mentioned

> It would be harmful for the further development of a strategy on climate protection which is backed by as many countries as possible, if the developing countries gained the impression that the developed countries were desirous of using Joint Implementation for avoiding fulfilment of their own obligations to protect the climate (Germany, in INC 9, 1993, page 37)

To avoid this impression, Germany pointed to the centrality of financial and technological transfer in a JI system. Other countries like Canada, Japan and Australia were highly in favor of JI between Annex 1 and non-Annex 1 countries and only saw technical problems of measuring and operationalization. In other words, these were problems that could be overcome by "an effective system of monitoring and verification" (Canada, in INC 9, 1993, page 15).

Countries being interested in JI, such as Denmark, Belgium, Norway, the Netherlands, Japan and the USA welcomed the proposal for a pilot phase and bilateral pilot projects to overcome these problems (INC 9, 1993, pages 11, 21, 24, 43, 65, 74). They assumed that in these pilots, practical experience would show what worked and how. Following the evalua-

tion of the pilot phase, they assumed that final criteria could be laid down. The practical experience gained would then allow the countries "[t]o address and reach conclusions on the above listed issues [design and measurement issues, F.S.] and thus arrive at criteria" for Joint Implementation, Norway claimed (Norway, in INC 9, 1993, page 74). Norway was already making experience in Mexico and Poland, as we saw above, and hoped to influence the discussion with these experiences. For the USA, a benefit of the experimental approach was its learning potential: "It may be difficult to answer every question at the start; we expect to learn as we go" (USA, in INC 9, 1993, page 101). To learn and "help establish an empirical basis for considering approaches to joint implementation internationally", the US Initiative on Joint Implementation (USIJI) was announced, to which we will come back later.

While at INC 9 debate still continued as to whether non-Annex 1 countries should generally participate in JI, a lot of discussion centered on the idea of a pilot phase, which provoked much interest amongst most Parties. A closer look into the statements of the Parties made at INC 9 illustrates the faith they had put into such an experimental phase: not only would it help to better understand the complex problems of Joint Implementation, but it would also help to overcome resistance and give JI credibility, its proponents hoped. The hope was thus that, via the experiment, criticizers could be convinced and a state of governance achieved which could not be accomplished by political negotiation alone, namely a JI system covering both developed and developing countries (INC 10, 1994a).

Interestingly, even those countries who opposed JI between developed and developing countries did not oppose a pilot phase among both, as long as the principle of "common but differentiated responsibilities" was being met. Argentina for example forcefully stated that Joint Implementation can be undertaken only by and among Parties with commitments. Similar to Nauru's analysis for INC 8, Argentina contested the assumption that JI would be overly cost-effective, as it would pose opportunity costs to the host and delay technological innovations (Argentina in: INC 10, 1994a, pages 3–5). Instead of fully opposing a global JI system, Argentina declared some principles to be considered when experimenting with such a system. This shift towards debating the boundaries of an experimental pilot phase was apparent in several contributions at INC 9 (INC 10, 1994a). Argentina was concerned with what should be included in the pilot phase – and thus open to the experiment – and what should be left out. Argentina for example suggested that discussions about credits should be excluded and that developed countries should comply with the goal of allotting 0.7% of their GNP for development aid before they could start with JI activities. Australia claimed that for such a pilot phase, the involvement of the private sector would be critical and operations should not be complicated by complex approval procedures and institutional arrangements (INC 10, 1994a, page 7). And Greece claimed on behalf of the EU that any pilot phase should not include crediting, as this would undermine the credibility of JI (Greece on behalf of the EU, in INC 10, 1994a, page 35).

After the intense and controversial debate of JI, Parties at INC 9 could not find a compromise on the question whether it should also involve non-Annex 1 countries, whether it should involve crediting and what its criteria should be, but agreed to consider a phased approached beginning with a pilot phase for introducing JI, and requested the secretariat to compile further information to this regard. The secretariat should develop information about objectives, a list of possible criteria and institutional arrangements for the pilot phase (INC 9, 1994b, paragraph 66). This decision meant that there was general agreement to distinguish between the political implications of Joint Implementation and its technical elements.

We have seen that, on the one hand, the political implications of JI were mentioned and acknowledged, but on the other hand there was growing interest in pilot projects and programs to learn about technical problems. Such pilot schemes were advocated, as they would allow a scientific investigation and evaluation of what works and what does not. Those who introduced the idea hoped that such a scientific approach would eventually lead to the acceptance of criteria, which could not so far be achieved. It was the idea that the negotiation on the political implications at INC and COP could be separated from the scientific investigation on the technical issues in experimental pilots. For the latter to work, it was just important to decide on principles and criteria within which open experimentation could start. Thus, through a seclusion of the decision-making process to the confined walls of experiments Joint Implementation would then finally be able to come into being.

The documentation the secretariat prepared for INC 10 marks a point in the development of a pilot phase. This note only addresses issues related to a pilot phase, its objectives, criteria and institutional arrangement (INC 10, 1994b). The question of how a pilot phase should look like had now fully replaced the political question of whether to introduce JI or not. This was all the more remarkable, given the fierce concern critics had voiced.

The secretariat's note summarizes quite interestingly the rational for a pilot phase:

> The concept of joint implementation is a new and, as yet, untested approach to addressing a global environmental problem in a cost-effective manner. In view of the controversies surrounding it, and the short time remaining before COP 1, reaching consensus on a fully elaborated scheme, including on the criteria for its application, may be difficult to achieve in time for COP 1. In this context, the Committee has shown interest in a phased approach, beginning with a pilot phase (INC 10, 1994b, paragraph 11).

The secretariat claimed that a pilot phase would be a chance to move on with a politically demanding issue. There was just not enough time to find agreement on joint implementation until COP 1 which was scheduled nine months later. It had the opinion that the newness of JI would be one important aspect as to why there was no agreement on it. A pilot phase would give the opportunity to learn about this new approach although there is no agreement. It would outsource joint implementation from international negotiations to the secluded experiments where it could be tested and refined. In the end,

the experiences gained in the pilot phase would help "[t]o move forward in addressing the political implications of the subject in a step- by-step manner, without prejudice to the next steps" (INC 10, 1994b, paragraph 12). Thus, via experimentation, it hoped to solve not only technical issues but also eventually clarify the political implications and find a final agreement. In light of uncertainty, controversies and the pressure to act, the secretariat thus suggested an experimental process hoping that by circumventing the political process and addressing the issue in an experimental process, a solution could be found. Furthermore, the document also defined JI as an approach to address climate change in a cost-effective manner. It was a proposal to accept cost-effectiveness as the central principle for JI and thus to silence the controversial discussion I discussed above.

At the tenth meeting of the INC in August 1994, Indonesia remained the only country that criticized Joint Implementation directly. It renewed the position G 77 and China originally held that alternative approaches were needed. But even this last opponent now stated and emphasized minimum requirements for JI. It "should benefit developing countries, providing for technology transfer and capacity building" (ECO, 1994). Those countries initially skeptical towards JI gave in to the proposal of a pilot phase (ECO, 1994).

The eleventh session of the INC was the last before COP 1 where criteria for JI were to be adopted. However, the Parties were still far away from any form of consensus. They could not come up with more than the recommendation that COP 1 should continue to consider criteria for joint implementation. While some developing countries had started to call openly for JI, China exerted pressure, bringing them back to the common opposing position (Michaelowa, 2000, page 22). The Group G77 plus China highlighted in a draft text for the conference that joint implementation should only be eligible for Annex 1 countries, not mentioning a pilot phase at all. The EU and the USA proposed a pilot phase open to any interested Party as an appropriate way of developing the concept (INC 11, 1995).

At the first conference of the Parties to the UNFCCC in March and April 1995 in Berlin, developing countries' opposition to the concept remained strong. It is said to be on account of Costa Rica that a consensus was found (Samaniego and Figueres, 2002, page 90): an official pilot phase to provide an opportunity to test the feasibility of JI projects, the Activities Implemented Jointly program (AIJ) was agreed upon, lasting until the end of 1999 (Begg et al., 1999, page 12). The Berlin mandate defined that AIJ projects needed to result in additional emission reductions calculated against a baseline, a contra factual business-as-usual scenario to assess the emissions that would happen without the AIJ project. They had to result in "real, measurable and long-term environmental benefits related to the mitigation of climate change that would not have occurred in the absence of such activities" (UNFCCC, 1995, Add. 1, Decision 5(d)). Participation in the AIJ programs was voluntary and both host and investor country had to approve the project. To get approval as an AIJ program, investments had to be additional to any planned development aid, the so-called financial additionality. Parties agreed to install an administrative layer at the UN, a secretariat to which project participants had to report their projects, as well as a subsidiary body that would give technical advice to the COP and secretariat (UNFCCC, 1995, Add. 1,

Decision 5(d)). After the conference, the political negotiations continued in the ad-hoc group on the Berlin Mandate with the aim of preparing a draft protocol with quantitative reduction commitments and a timeframe for achieving them. This process was planned to take two years and the draft was to be adopted at the Kyoto Conference in 1997 (Oberthür and Ott, 2000, page 80).

Conclusion

This chapter analyzed the reduction of a political issue, climate change, to an economically framed problem. It identified economic simulations of potential political responses to this issue. These simulations that were closely connected to the international negotiations on a new climate governance arrangement had reduced climate change to a matter of costs. They simulated that a response to climate change would be most cost-efficient if both developed and developing countries were to partake of this endeavor. Based on this economic model of governance, they ascribed developed and developing countries the responsibility to act and introduced greenhouse gases as the object of governance. Thereby, it excluded other matters of concern such as responsibility, consumption patterns and national development concerns. These simulations and their reduction of the macrocosm were contested. I identified one alternative simulation which questioned the scientific basis of such an economic framing. Instead, it proposed a problematization of climate change as a matter of responsibility.

This economic framing materialized in in-vivo experiments. Afforestation projects in Latin America and energy efficiency projects in Mexico and Poland tried to demonstrate that this economic model works in-vivo. Actors from developing countries invested in projects in these countries testing whether and how much emissions such projects reduce and at what cost. They were guided by the economic model of marginal costs, assuming that abatement costs in developing countries were lower than in developed countries. These projects reduced materially the enigmatic world of climate change into a controllable set of light bulbs, monitoring charts, greenhouse gases, trees and power plants. They invented calculative tools to measure, quantify and monetarize carbon emissions and turned local projects into experiments for a global climate governance arrangement. Industry, consultancies and NGOs invested resources and money into these projects. In their role as private investors, they became a subject of governance. Methodologies to measure and compare greenhouse gas emissions and to calculate its costs became a technology of governance.

Delegations in the international negotiations on a climate governance arrangement seized on the demonstrations of these in-vivo and in-vitro experiments with climate governance. Particularly the USA and Norway promoted a problematization of climate change as a matter of cost-efficiency. Based on the economic model of marginal costs, Norway suggested a governance arrangement that would ensure efficient climate governance. This proposal reduced the international negotiations to the sole matter of costs and excluded central concerns like responsibility for climate change and national sovereignty. This economic problematization was not successful yet. Several states opposed this reduction and insisted on another framing of climate change, that of responsibility. As a compromise, countries de-

cided after intense negotiations to experiment with this economic model on a larger scale. This experiment was supposed to present valuable evidence on the benefits of a climate governance arrangement based on efficiency. Within this pilot phase, countries could test whether it worked without being disturbed by the enigmatic activities that were going on in international negotiations.

6
Constructing governance experiments: USIJI, AIJ and an emerging experimental constituency

> The initiative [Joint Implementation] is a new and untested instrument in international climate policy and the notion of joint implementation is now the subject of amplification and interpretation not least in the current international climate negotiations. (Nordisk Ministerråd and Bohm, 1994, page 1)

This chapter covers the process of constructing economic climate governance arrangements in experiments, experiments with the concept of Joint Implementation (JI). First, it discusses how a transnational constituency assembles that constructs and develops such experiments. Within this constituency, the economic model of abatement costs was accepted as a guiding model of climate governance. It influenced the framing of joint implementation thanks to personal connections and through influential non-governmental and international organizations. It further adjusted the concept of JI and increasingly framed it as a private investor market. Second, this chapter analyzes how the US tested and developed in an in-vivo experiment a governance arrangement that rested on private investments. The section shows how a reality was constructed within the US experiment in accordance with this framework. The USA used the experiences made in this experiment to request during the international negotiations a framing of JI as a private investment market. Third, this chapter discusses the global experiment with JI. It illustrates how an experimental boundary of this experiment was constructed and how this rendered the enigmatic world measurable and comparable. It highlights how actors successfully inscribed this very framing of a private investment in the experimental setting.

Assembling an experimental constituency and constructing a rationality

An experimental constituency emerges

The developments in the political arena of the Intergovernmental Negotiating Committee (INC) were accompanied by increasingly intensified discussions on the principles, criteria and meanings of JI in an emerging transnational constituency. In the USA, England, Norway, the Netherlands, Sweden and India, research activities intensified. Members of this constituency consisted of experts from academia, politics and business who were concerned with JI and willing to develop it further. They simulated, experimented, tested and designed JI systems and discussed them in publications and at conferences. In their interaction, they aimed at constructing a JI arrangement that worked. This constituency assembled around the "vague idea of efficiency gains related to a global common good" (interview T3) as one of my interview partners called it. This constituency "was a small community of people which was staunchly committed and thought market mechanisms

were reasonable, as climate change mitigation is a global public good" (interview T9, translation FS). In this subchapter, I show how this efficiency goal became accepted by this constituency and how it thus contributed to a JI design that included developed and developing countries.

The constituency became transnational in 1994, when the first book on Joint Implementation was published and the first international JI conference took place in June 1994 in Groningen. Both activities were sponsored by the Dutch Ministry for Housing, Spatial Planning and the Environment "whose basic orientation has been to promote JI as widely and as quickly as possible" (Yamin, 1996, page 81). The book was edited by authors from the Institute for Environmental Studies of the Vrije Universiteit Amsterdam and the Institute of Social Studies International Services. It addressed the legal, economic and practical issues of JI. In this book, Arts and her colleagues closely read the convention to distill the legal implications and the objective of JI, highlighting the need to address climate change as soon as possible. They claimed that it would not do to wait until proper regulations are in place. Instead, they encouraged pilot and experimentation projects (Arts et al., 1994, page 47). The authors discussed the legal and economic aspects of JI and acknowledged that "numbers of meanings of JI are possible, given the language used in the Convention but", according to Yamin, "the legal discussion in Part 1 tends to gloss over this fact" (Yamin, 1996, page 81). The book was widely circulated and had been prepared to influence the discussion and negotiation on JI (ibid.); the Dutch negotiation team distributed summaries of the study at the INC meetings.

In this book, the legal discussion concerned the question of whether JI should refer to any form of joint action or only to those in which "one State Party carries out its obligations under the Convention partly in the territory of another State" (Arts et al., 1994, page 65). The convention mentioned "policies and measures" (UNFCCC, 1992, Art. 4.2(a)) which states could implement jointly without further specification. To understand the legal implications of the convention, the authors traced back the origins of JI in international environmental law by identifying different possible precedents. They came up with the suggestion to understand JI in the spirit of the Montreal Protocol as a mechanism that allows one country to fulfill its obligation in, or by, another country (Arts et al., 1994, pages 11–12).

A momentum in the development of a transnational constituency was the first international conference on joint implementation. Hosted by the Dutch Ministry of Housing, Spatial Planning and Environment in Groningen, discussions on the issue were an attempt to collect existing expert knowledge, also on JI, and to construct a transnational constituency of experts to influence the ongoing negotiations on JI. This conference brought together more than 160 participants, policy makers, scientists, business people and representatives from NGOs, offered them a platform to share their experiences, and inform about recent developments. One of my interview partners highlighted this conference as one where the "critical mass" of experts gathered for the first time, people who have been influential afterwards and partly still are (Interview T9).

At this conference, participants discussed a wider range of issues relating to JI: the concept, its institutional setting, its policy implications and practical application. While some critics were present, most of the participants advocated JI as a cost-effective means of addressing climate change. Mostly, they saw a chance in a global JI system that also included developing countries. Concerns were raised by presenters from developing countries and from environmental NGOs, as to whether JI would really deliver the promised benefits to developing countries, "[doubting] the genuineness of the change of heart among industrialized nations particularly in view of the massive transfer of state of the art technology to the South that is possible under NSJI [North-South Joint Implementation, F.S.]" (Maya, 1995, page 209). To ensure this 'change of heart' to some extent, developing countries and also environmental NGOs started to demand the so-called additionality criterion (Hare and Stevens, 1995, page 83; Maya, 1995, page 212), which would ensure that JI activities were in addition to the financial and technological commitments developed countries had made.

This additionality criterion linked to a further prominent debate at the conference which was still rather at the fringes of the international negotiations: the participation of private actors in Joint Implementation. Bert Metz, Director of the Climate Change Programme at the Dutch Ministry of Housing, Physical Planning and Environment stated:

> JI may provide opportunities to raise new funds from public as well as private sources. If current development assistance funding would remain reserved for other than environmental needs - as explicitly advocated by the FCCC - additional financial sources would be a prerequisite for further progress. In this respect the only realistic source of additional finance one can think of would be the private sector. If the proper incentives can be created through JI there is a real possibility that private sector capital flows from Northern to Southern countries will increase in order to support the necessary investments in environmentally friendly technologies (Metz, 1995, page 164).

So, for Metz, JI was not just a way of reducing emissions in a cost-effective manner, but also of tapping into new sources of capital to address climate change. He openly claimed that developed countries would not be willing to spend more and that if developing countries insisted that current development aid should not be used for climate mitigation activities, he assumed that the only way to acquire resources would be the private sector. The political implication was enormous: private actors were being urged to take the lead in addressing climate change via investments in environmentally friendly technologies; not only should they implement governmental activities, but actively invest in their own. To do so, governments were expected to design a JI system that had incentives for private actors to participate. The spirit of an emission trading system, which interested Metz greatly, is evident.

Representatives from business and actors with practical experience in carbon offset projects took the opportunity of this conference, and the uttered interest in private actor participation, to present their ongoing activities with forest carbon offset projects and their

interest to move JI into a business opportunity. The Business Council for Sustainable Development (BCSD) identified JI as an opportunity for eco-efficiency technology cooperation and emphasized that it could encourage business-to-business action for sustainable development and climate mitigation as a supplement to international negotiations. To explore what companies could do within JI, BCSD had launched the project "Catalyzing a Market for Joint Implementation Projects". In this project, it "discovered that business has already been extremely active in developing GHG offset projects and sorting out potential projects, all of which will provide valuable learning within the JI context" (Leslie and Verdugo, 1995, page 225). These projects were mainly the carbon offset activities of US utility companies, which BCSD presented at the First International Conference on Joint Implementation in June 1994 to a wider audience of experts. Besides these forest activities, Leslie and Verdugo also presented activities like waste management, energy efficiency, renewables, fuel switching, sustainable agriculture and methane reduction/recovery as possible ways of offsetting emissions (Leslie and Verdugo, 1995, page 225).

At this conference, participants presented different interpretations of what JI could be. They suggested that it as a mechanism for technology transfer, a private investor arrangement, a form of emissions trading, or a form of carbon offsetting. These interpretations differed in the role they ascribed to public and private actors; whether it would increase the amount of emissions developed countries would be allowed to emit; and whether it would result in a tradable commodity (see Table 1).

	Technology transfer	Private investor market	Emissions trading	Carbon offset
Role of public and private actors	Private actors implement projects; public actors invest	Private actors invest and implement	Public and private actors invest and get credits in return	Public and private actors invest and get credits in return
Increase of amount of emissions	No increase	No increase	No increase	Projects increase the total amount of emissions the investing country is allowed to emit
Tradable commodity	No	Not necessarily	Yes	Not necessarily

Table 1: Interpretations of Joint Implementation

Within all these interpretations, JI would allow developed countries to fulfill their obligations to the convention through investments in projects in other countries. Thus, the concept of a North-South governance arrangement was undisputed.

The conference indicated increasing interest in Joint Implementation from various backgrounds, but also showed the difficulties and problems actors had when practicing with JI projects. The forest projects had to face the problem that no criteria or procedure existed that would define whether a project offsets carbon or not (Trexler, 1995, page 241). Every project developer had its own procedure, criteria, calculative devices, monitoring and evaluation processes leading to incomparable results. Already the different definitions of forest types and their characteristics that existed resulted in a wide range of simulated carbon stored per hectare (Brown and Adger, 1993, page 14). The conference was thus also a platform for practitioners to demand regulatory standards to move ahead with their activities.

At the end of the conference, the participants agreed on a statement that promoted the use of JI to address climate change as a supplement to domestic action. It stated that the experiences with existing activities show the potential of joint implementation as "one of the possibilities at the national and international levels to achieve the objective of the Convention in a cost-effective manner" (Jepma, 1995, page 8). The statement perceived JI in the widest possible sense with regard to possible participating countries. "JI refers to a form of North-North, North-South, and South-South cooperation between two or more Parties … for jointly pursuing action designed to reduce or absorb emissions of greenhouse gases" (Jepma, 1995, page 8). For JI to work properly, participants saw the need for objective and verifiable criteria, which the Conference of Parties (COP) should establish. To facilitate international negotiations of these criteria they demanded that "in the meantime, however, international cooperation to reduce or absorb emissions of greenhouse gases should be encouraged to gain further experience with the merits and demerits of JI" (ibid.).

Interestingly, the controversies at the conference were not mirrored in a balanced way in this statement. The critics' concern regarding the participation of developing countries, the crediting of activities as well as the cost-effective potential of JI did not find its way into the statement. Instead, the statement showed a picture of unanimity among experts that JI really had the potential to reduce emissions, was cost-effective and should finally develop into a system that allowed for crediting. When they were finally published in conference proceedings a year later, the issue had developed already into the decision of COP1 to start a pilot phase. The statement also indicated attempts of the expert constituency to frame the further development of JI as a technical issue. For such a system to work it needed "objective and verifiable criteria (through monitoring)" (Jepma, 1995, page 8). If the criteria and a system to monitor them were established, crediting would be of no problem. This differs from the political concerns raised by negotiation teams from developing countries in the INC. They rejected the idea of crediting, because they feared that developed countries would not take their share in the convention. This fear was not echoed in the expert statement. Monitoring and objective criteria would ensure that everyone would take their share and that the system would work. The decision for criteria should also not be left to the political process of the negotiations itself. This would take too long and could fail as the Parties did not yet have enough experience with actual JI activities. The statement demanded that they move on with actually experimenting with JI, as the experience one

would gain would build confidence and facilitate the international negotiations, so that the Parties would finally agree to start JI. The confidence in scientific expertise and methods was what ultimately guided the statement.

The conference thus had several functions. Discursively, it helped to establish an economic-scientific understanding of JI – a mechanism based on cost-effectiveness that works if properly monitored and developed in experiments. Politically, on the one hand, it created a constituency of experts who advocated JI, showcased already existing experience, as well as the benefits and problems of these experiences, and promoted different projects and approaches. On the other hand, it represented the existing experience with JI to policy-makers and simultaneously demonstrated that experts were available to further develop JI. Thereby, it excluded critical voices which had been presented at the conference, but which had not been represented in the statement.

To make use of the momentum the conference had created, the organizers, together with the Dutch government, subsequently initiated the Joint Implementation Network which issued a regular newsletter that soon became an important information platform for JI experts.

Secluded construction of reality in in-vitro experiments

For members of this constituency, JI was a question of scientific research. They discussed statistics, data and instruments, how they could be improved, interpreted and what the implications would be. Their discussion was thus secluded from the "enigmatic reality" (Callon et al., 2009, page 50). They discussed the emissions that could be potentially reduced and the respective costs of projects and constructed diagrams which should represent real situations (see Figure 3).

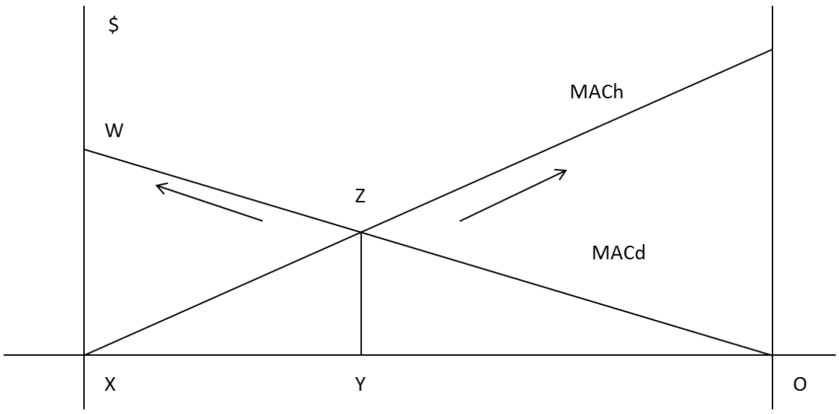

Figure 3: marginal abatement cost of joint implementation **(Pearce, 1995, page 5)**

With this diagram, Pearce presented a reality of JI as a governance arrangement that would contribute to cost-minimization of climate change mitigation. According to the diagram, the optimum reality would be the one in which the donor country reduced emissions at home first, until the costs thereof surmounted the costs of reducing emissions in host countries, as illustrated by point Z. Then, the country would be able to donate to projects

in host countries. Resulting from this diagram, a "fairly self evident [sic]" (Pearce, 1994, page 1) reality emerged:

> if the donor avoids cutting emissions of X tonnes at cost C, and invests in cutting emissions in the host nation by X tonnes at cost C(<1), then there are cost savings of (1-)C and no worsening of global environmental quality (Pearce, 1994, page 1).

This was the economic model the experimental constituency started to perform. The Nordic council of ministers, for example, set up an ad-hoc group to assess the potential of JI to combat climate change. As JI was a "new and untested instrument in international climate policy" (Nordisk Ministerråd and Bohm, 1994, page 1), it mandated Bohm from Stockholm University to study its potential and limitations. He generally showed the benefits in terms of cost-effectiveness. However, with regard to a JI system with developing countries, he identified severe problems and recommended intensifying its testing:

> Given the potentially serious problems with using JI over a wide set of different projects in DCs [developing countries, F.S.], an evaluation of the practical value of JI can hardly be done before a large number of pilot projects have been tested in actual practice. Several delegations to INC as well as proponents of JI (see, e.g., Dudek et al. [EDF], 1993b) have stressed the need for such tests (Nordisk Ministerråd and Bohm, 1994, page 47).

In practice, it was not as simple as Pearce's diagram assumed, with initial projects revealing difficulties in realizing the simulated benefits. Thus, it was necessary to conduct further experiments to adopt the model to the real world. Here, Bohm explained, there were many different project types and countries, as well as differences among projects of the same type. He demanded that JI thus needed to be tested in a large number of projects. Such a quantitative and comparative approach could evaluate whether potential problems were really significant. However, Bohm assumed that there would only be limited interest in experimental activities. Thus "it will be particularly important that the test program is efficiently organized" (Nordisk Ministerråd and Bohm, 1994, page 48). The selection of JI projects "would need to be determined according to criteria for an 'optimal' test program" (ibid.).

Such an experimental approach to develop a global JI augured to test objectively whether the potential problems and benefits of such a system were true. However, the practical problems of such an experimental program were obvious: the necessary experiments were in-vivo ones. Thus, for the sake of scientific objectivity, pilot projects would have to be installed in different developing countries and different projects. These countries, however, were only partly – if at all – interested in hosting such projects.

The emerging constituency was small, "everybody knew everybody for a while" (interview T2) and they regularly met at conferences and collaborated in research. Their research was secluded materially and discursively from the macrocosm. On the actor dimension, however, it had strong links to it. At the above mentioned conference, both scientists and

practitioners were present and in politically influential organizations like the International Panel on Climate Change (IPCC), the United Nations Environment Program (UNEP), World Resources Institute (WRI) and Organization for Economic Co-operation and Development (OECD), they promoted their research to politicians and practitioners.

The Washington based NGO, (WRI), published in collaboration with UNEP and the United Nations Development Program (UNDP) an important and comprehensive source of current "conditions and trends in the world's natural resources and in the global environment" (WRI, 1994, page x). It was published in English, Spanish, French, Arabic, German, Japanese and Chinese and was widely read and influential in the debate. The 1994 report investigated ways of how developing countries could reduce their energy consumption. According to the authors, diverse new energy and energy-saving technologies were available to developing countries. However, lack of institutional, financial and human capacity made their implementation and use in these countries "not likely to evolve without sustained international cooperation" (WRI, 1994, page 175). To assist developing countries to enable sustainable development, the authors claimed, the North had a three-part role to play: as a developer of renewable energy and energy efficient technologies, as a technical assistant and financer of the South in using these technologies and as a role model using these technologies at home. In this context, the report promoted the Global Environment Facility (GEF) as a funding mechanism, but also highlighted JI as an innovative source of funding. It would give incentives to utilities in the North to offset their increase in emissions by financing energy efficiency projects in the South (WRI, 1994, page 176).

In the Fall of 1995, the IPCC released its second assessment report on the impacts of climate change. In the executive summary, IPCC highlighted that "the most cost-effective options can be most successfully implemented on a joint or cooperative basis among nations" (IPCC, 1995, page 52). The executive summary did not further specify how such joint implementations should look like and who should participate in them. But in the report of Working Group III on the economic and social dimension of climate change, the authors sought to clarify its format. Despite the controversy at the Ad-hoc Group on the Berlin Mandate (AGBM) on the interpretation of JI, they claimed that it was commonly understood as "the idea that industrialized countries might invest in projects in other countries, particularly developing countries, to reduce or sequester greenhouse gas emissions" (Bruce et al., 1996, page 112). Any JI system that does not include both developed and developing countries, they argued further, would be inefficient (Bruce et al., 1996, page 30). While they were aware of potential problems in such a system – particularly power asymmetries between developed and developing countries – they refrained from explicitly proclaiming JI as the best instrument to address climate change. Nevertheless, implicitly they did so and contributed to its economic framing, as they distinguished the discussion of equity and the discussion of JI on purely economic terms.

By now, the economic model of abatement costs had found a broad range of supporters as a frame for experiments on climate governance arrangements. An emerging transnational constituency adjusted this model to the macrocosm and developed methodologies to implement this model. However, as was already indicated and further analyzed in the next

section, by adjusting this model to the macrocosm, actors expanded this model. Increasingly, actors pushed for the inclusion of private partners into the new governance arrangement.

While the IPCC report acknowledged the equity concerns, the discussion on the merits and shortfalls of JI was an economic discussion resulting in the assumption that JI was a system that enabled the trading of credits. Working Group III of the IPCC claimed that JI "is equivalent to bilateral 'trading' in emissions" (Bruce et al., 1996, page 415) and considered it as a possible step towards an international tradable quota system for greenhouse gases, albeit only for countries with a commitment for an emission target (Bruce et al., 1996, page 405).

The OECD contributed to the discussion on JI inter alia through studies. One of them, "Joint implementation, transaction costs and climate change" was written by the Environmental Defense Fund's Daniel Dudek and Duke University's Jonathan Wiener. In this paper, the authors discussed various design options of JI to reduce transaction costs. Interestingly, this paper was published in a series "designed to make available, to a wide readership, selected technical reports" (Dudek and Wiener, 1996, page 2). As JI was intensively debated at COP, also among members of OECD, the OECD secretariat was urged in its foreword to highlight that this paper was only an intellectual game. "This paper does not address the question of whether or not JI should eventually be implemented, or in what particular form. It merely reflects on the premise that, if a JI system were eventually to be agreed at the international level, governments might wish to reduce the transaction costs associated with operating that system" (Dudek and Wiener, 1996, page 3). Its authors were advocates of a global emission trading system, which was reflected in this paper. They claimed that the theoretical efficiency of JI could be seriously underminded by transaction costs. Even more, "transaction costs, implicitly or explicitly imposed, are probably the single most serious threat to the eventual emergence of a JI market" (Dudek and Wiener, 1996, page 52), they claimed. To reduce them significantly, they recommended policy makers to build up an infrastructure that would allow the commodification of carbon and create a functioning market (Dudek and Wiener, 1996, pages 6–7). Differences between a JI system and a tradeable permission system for them seemed only to be marginal:

> Many of the same principles underlying a trading system would also apply to JI … The major difference would be that JI represents only bilateral trading opportunities, whereas trading systems offer multilateral opportunities for realising cost savings. Under JI, participants would invest in specific emission abatement projects, whereas under a trading system, participants could purchase fungible disaggregated permits, each of which represents "shares" in the market's abatement activity "portfolio" (Dudek and Wiener, 1996, page 9).

So the main difference was that an investor could not sell and trade the credits his investments had generated to a Party from a third country. But as in an emission trading system, an efficient JI system relies on credits and on property rights. It would allow the operation of brokers, stock exchanges and venture capital funds to reduce search costs (Dudek and

Wiener, 1996, page 52). From this pure economic framing of JI, the authors concluded that JI should not be restricted to Annex 1 countries and that the market should not be limited by any other regulation.

IPCC, OECD, UNEP were quite influential political organizations in this discourse; WRI and EDF had also been already very active. Economists had been able to use these organizations' influence to promote an economic rationality of JI and a design that would include developed countries as investors and developing countries as hosts of projects.

Secluded construction of a governance experiment: The US Initiative on Joint Implementation

The US Initiative on Joint Implementation (USIJI) was the first and most elaborated national JI program. In this subchapter, I will focus on this program to identify the practical on-the-ground work of JI experiments. It shows that for the experiments to work, various actors were involved in developing criteria, evaluating proposals, developing local projects and initiating local administration. Interestingly, it shows how the USIJI program is guided by the central aim to encourage private investors to finance JI projects. The US government did not provide funding for the projects.

Constructing the experiment

In June 1993, the White House hosted a workshop on global climate change with two sessions on JI. 30 invited guests and 75 attendees from government, environmental and business groups joined the session examining issues surrounding JI and possible criteria for any such program.

In October 1993, USIJI was launched as a "voluntary pilot program to improve understanding and practice of joint projects demonstrating a range of approaches to reduce or sequester net greenhouse gas emissions" (ELI, 1997, page 23). It was part of the US Climate Change Action Plan, in which the Clinton administration called for voluntary domestic greenhouse gas emission reductions to return emissions levels to that of 1990 by 2000. Besides JI, this plan consisted of 50 new or expanded initiatives to reduce emissions, such as energy efficiency standards and cooperative programs with industry. Preceding it, the Clinton administration had already unsuccessfully attempted to introduce new taxes on energy (Royden, 2010, page 420). In December 1993, the US submitted it as an input to the ninth session of the INC. In developing USIJI, the US administration consulted the utility companies who had already experience in carbon offset activities in Latin America (see chapter 5). They stated that incentives to invest in USIJI could be public relations, response to offset state obligations, or means of offsetting potential future requirements.

The development of the criteria was followed by a period of public consultation and the program, with the final ground rules, became operational in June 1994. Three months later, in a workshop on project proposal preparation, the program was presented to approximately 200 private sector participants. The criteria were distributed and the first round of

proposal considerations announced (ELI, 1997, page 24). In February 1995, the first round of proposals for JI projects to the USIJI ended with 30 projects being proposed and seven being accepted. Three of them focused on emission reduction, the other four were forestry projects to sequester carbon.

Organizationally, the initiative consisted of an evaluation panel, staffed with executives from the US Department of Energy, and the Environmental Protection Agency. They were empowered to accept projects and was authorized to certify the projects' emission reduction, and a secretariat that managed the day-to-day operation, the implementation of the application and the review procedures of the project proposal (GAO, 1998, page 4). Furthermore, the staff organized capacity building and technical assistance workshops in every world region to support the necessary institution building in host countries (US Dept. of State, 1997).

To be accepted, applicants had to submit a project proposal that was evaluated by external technical experts and accepted by the evaluation panel. The initiative defined nine criteria against which a project was evaluated and which focused on how the emission reduction of the project could be measured, reported and verified. Further criteria determined whether projects supported the objectives of the UNFCCC and the potential greenhouse gas and environmental effects outside the project's boundaries. These criteria were guided by the principles that the projects would meet the development goals of the host country, provide emission reductions that would not have occurred in the absence of the project, and that were real and measurable (GAO, 1998, page 5). A project had to be accepted by the host country and the emission reductions needed to be assessed against a baseline (US Dept. of State, 1997).

The purpose of USIJI was to:

> encourage the rapid development and implementation of cooperative, mutually voluntary projects between U.S. and foreign partners aimed at reducing net emissions of greenhouse gases, particularly projects promoting technology cooperation with and sustainable development in developing countries and countries with economies in transition to market economies" and to "encourage private sector investment and innovation in the development and dissemination of technologies for reducing net emissions of greenhouse gases (USIJI in: INC 9, 1993, page 106).

This was a significant departure from what had been so far discussed in the international negotiations; first, because it explicitly stated that JI should be implemented in developing countries and, second, because it encouraged participation of the private sector. The main incentive for private investors to participate was that they would gain formal recognition of their efforts in reducing climate change and the possibility to establish a new market for their products in the host country. Participants could use the USIJI logo, benefit from the technical assistance the program provided, obtain access to information about market opportunities and establish relations with governments and business in foreign countries (USIJI). It was mainly a trade policy instrument (Michaelowa, 2000, page 21).

Nevertheless, private partners had to be convinced to participate. Governmental staff workers organized workshops for US companies, where they promoted USIJI and showed how companies could make proposals. In brochures and on its website, they provided information on how to deal with USIJI projects legally. Occasionally, they contacted specific companies directly and urged them to enter into the USIJI process.[11] Furthermore, the first project that was accepted under USIJI can be traced back to US AID, which mandated the Center for Clean Air Policy (CCAP) to conduct a capacity building program for energy and environment in the Czech Republic and Slovakia. As part of this program, CCAP organized workshops to identify possible projects for JI activities. One such project was a fuel switching project in Decin, Czech Republic. It converted a plant from burning soft coal to burning natural gas. The project had already been planned and a feasibility study conducted, promising a potential emission reduction of 65%. But it lacked funding. CCAP identified USIJI as a viable financing option for this project and successfully persuaded three US utility companies to invest US$ 200,000 each (CCAP, 1994, page 9). In return for their investment, the companies were promised to get a fifth of overall emission reduction as carbon offset.

The US government presented USIJI in the international negotiations as an input to the ninth INC meeting in December 1993. Here, the US government was asked why it had started a JI program for investments in developing countries, if these countries had strong reservation against JI itself. The government responded: "In our view, initial concerns such as those mentioned [developing countries' concerns, F.S.] can be overcome as we demonstrate the practical advantages of well-designed programs, both for developing countries and for industrialized countries" (USA in: INC 9, 1993, page 113). It hoped that practical experience would finally and clearly demonstrate the benefits and clarify any open issues.

Before the practical advantages could be shown, however, several practical problems had, in fact, to be overcome. To be accepted, submitted projects needed the approval of the host country. While this seemed to be a straightforward requirement, in practice, it sometimes posed problems to project implementers. Aagain, the Decin project exemplifies this: when Czech and US project partners wanted to start the project, the Czech Republic had no agency that would be responsible for such projects and that had the authority to close the deal. US partners approached the city of Decin and managed to receive project approval. However, when, two years later, the Czech Republic started its own JI program, then called the AIJ program, a central agency in Prague was responsible for accepting JI projects and it withdrew approval, delaying the whole project (Lile et al., 1998, page 15).

The Decin project was a small project to improve local air quality. Switching the fuel of the district heating plant from coal to gas was supposed to reduce air pollution; Decin, however, lacked the necessary finance to implement it. Negotiations in the international arena on JI had just started, and the domestic development of USIJI was in full swing. Thus, CCAP identified JI as a possible financing source for the project and convinced utility companies

[11] One example was a waste-water treatment project in Poland. Department of Energy staff believed that the US company would get approval for the project more easily if it had USIJI approval, and thus tried to convince them to apply for this program (Lile et al., 1998, page 12).

to commit investments in this project. The project developers and investors assumed that JI – when approval had finally been given – would be a mechanism that would attract private sector participation, allow for crediting and cover a basket of greenhouse gases not only CO_2. None of this had been decided when the Czech Ministry of Environment signed a letter "welcoming the project as a pilot JI project" in April 1994 (CCAP, 1994, page 10). Indeed, international negotiations had just started to move off in a different direction. The experimental constituency thus implemented with this project a very specific understanding of JI. The experiences made with it provided the background for the US delegation's position in the negotiations on JI.

Besides a lack of responsible agents, a second problem US project developers faced was the lack of interest in and awareness of climate change, as a wind energy project in Northern Chile developed by the international NGO International Institute for Energy Conservation (IIEC) and a local copper producer illustrates. IIEC was searching for project sites in Chile to develop USIJI projects because a study conducted jointly by a US wind developer and a Chilean university had shown the potential of wind-driven power plants in Northern Chile. In order to comply with its approval procedure, IIEC needed a local partner to implement a project. In Chile, however, awareness of and interest in climate change, UNFCCC and JI were limited. In extensive discussions with different electricity generation and distribution utilities, it encountered both cautious interest and skepticism regarding potential GHG emission reductions. So to create interest, IIEC worked on raising public awareness on these issues. When it had finally persuaded the copper producer to become the local partner of the project, its lack of required knowledge was to be the next hurdle. To address it, USIJI sponsored a technical assistance mission to Chile. US wind energy experts flew in to build capacity and estimate the baseline emission. The project needed approval by the Chilean government but, again, necessary capacities were missing. So part of IIEC's activity in Chile was to convince Chilean government agencies to set up the necessary institutions (Leonard et al., 1999, pages 228–229). Due to these experiences, Lile et al identified the host country approval process as an important hurdle for becoming USIJI projects, but one that diminished over time when host countries had developed their own programs (Lile et al., 1998, page 19).

These programs did not evolve out of the blue. USIJI staff and organizations like the Center for the Sustainable Development in the Americas (CSDA) conducted capacity building programs in host countries to promote the establishment of national programs. CSDA held workshops in Guatemala and Costa Rica on establishing national JI programs and developed a manual "Implementing JI/ AIJ: A Guide for Establishing National Joint Implementation Programs" (Figueres et al., 1996) that identified key issues a country should take into consideration when setting up a national JI/ AIJ program. It was distributed widely among developing countries and promoted JI as a program that would attract foreign capital, involve access to modern technologies, leverage projects that provide local environmental benefits, help the developing country to have a comparative advantage in the production and export of greenhouse gas offsets and help to achieve development goals like poverty alleviation and energy supply (Figueres et al., 1996, page 7).

The CSDA guide illustrates well how these activities advanced the specific framing of JI was. This guide promoted JI as a win-win-win situation for the investor country, the host country and the global environment. While it was labeled neutrally, as capacity building and technical assistance, it forcefully promoted the need to further develop the AIJ pilot phase into a system that would allow for crediting. In the section called "background and key concepts", this guide describes JI as "arrangements through which an entity in one country partially meets its commitment to reduce greenhouse gas levels by offsetting some of its domestic emissions through a project it finances in another country" (Figueres et al., 1996, page 4). This definition makes it a matter of fact that not countries, but entities within a country, participate in JI – at the international negotiations, this was just one possible approach. In this section, the guide also states:

> Crediting is absolutely critical to the success of JI. It represents the only strong market incentive the private sector will have to invest in international emissions-reduction projects. The absence of credits during the pilot phase has affected the magnitude, number, and the quality of projects currently being implemented. The decision not to recognize credits in the post-pilot phase would essentially reduce JI to altruistic technology transfer (as identified in Article 4.5 of the Convention), which most likely will not significantly help reduce GHG emissions globally (Figueres et al. 1996, 5).

The interpretation of JI was that it would only work when the private sector participated on a large scale and that crediting was a necessary incentive for such participation. Although it was presented as a matter of fact, there was not yet much evidence for this claim. Parties had not yet reported their activities to the UNFCCC, and even the activities under USIJI differed in their reporting, so that it was not clear as to whether the absence of crediting would hinder implementation. Interestingly, the argument was that without crediting, JI would essentially be nothing else than the implementation of the commitments to transfer technologies to developing countries. It was, thus, a specific framing of JI that contrasted explicitly from framing it as a form of technology transfer which was being discussed in the international negotiations at that time.

This discussion shows that in USIJI, which was presented in the international negotiations as an experiment to test JI and an opportunity to learn from practical experiences, a certain model of JI had already been reified before it had started. Central elements of USIJI were private participation, crediting and investments in developing countries and countries in transition. This differed tremendously from the international negotiations. In the international negotiations, participation of developing countries was heavily discussed when USIJI was introduced; private participation had not yet been addressed, and for various critics, crediting was in no way acceptable. It was not a neutral experiment but, quite the contrary, a means to advancing a specific framing of JI. Its pilot character gave it legitimacy to move beyond what had been decided so far: "Our program will be open to all countries to promote a broad array of joint implementation projects and to gain experience in a variety of sectors and regions of the world" (INC 9, 1993, page 111).

The USA tried to influence the international negotiations by means of experimentation. One of my interview partners who was actively involved in USIJI and the international negotiations described the intension of USIJI in the following way:

> We weren't just in it to experiment; we were in it to stimulate the work of other parties. Once the other parties hooked up on it, which they did, then we dialed back and we focused on the convention. Because our goal was of course to make the three trading mechanisms work, CDM, JI and ET. And so that's why our pilot had a limited amount of life (Interview T13).

USIJI was not a method to learn about the benefits and problems of a new governance arrangement, but a method to demonstrate that it works and to convince others to also work on it. Therefore, members of USIJI went to Europe to discuss their experience with practitioners and scientists. They lobbied for JI and constructed alliances with the aim of expanding it.

Constructing facts

Evaluation and assessment was an integral part of USIJI, and over the course of time, experts assessed the specific projects under USIJI (e.g. Watt and Sathaye, 1995) and its overall performance. Two problems were addressed: on the one hand, technical problems concerning monitoring, evaluation, reporting and verification issues (e.g. Dixon, 1998; GAO, 1998, page 7; SBSTA 7, 1997; Vine and Sathaye, 1997); on the other participation and funding problems relating to the incentive structure of the program (e.g. Figueres et al., 1996; Parson and Fisher-Vanden, 1997, page 15).

Watt and Sathaye evaluated ten projects, of which some were submitted under USIJI, and identified a trade-off between reliable data and methodologies for calculating emission reductions and transaction costs. The more complex the estimation methodology for projects was, the more expensive the project was in terms of costs per ton of carbon (Watt and Sathaye, 1995, page 26). According to the authors, several other projects that were developing used very simple estimations of their emission reductions to keep down costs further, but would likely not pass evaluations. Those projects with more complex and probably more reliable emission reduction calculations faced the problem that they had to spend heavily upfront on the estimation of the emission reductions without having a guarantee that the project would ultimately receive funding. To address the funding and program additionality requirement, project developers had to argue which part of the project would be implemented with USIJI-related funding. Had projects been already planned and only adjusted to the requirements of USIJI, project developers quite randomly calculated the share of emission reductions that was due to USIJI (e.g. Watt and Sathaye, 1995, page 29).

A further problem projects faced was to estimate the emission reductions the project would offset. When project developers prepared proposals, they had often no site-specific data on emission sources and sinks. So, to comply with the requirement in some cases, they used default data from regional, national or international sources (Dixon, 1998, page 15); in other cases they did not make transparent were the data came from. Even if they had col-

lected suitable data, they had to develop a reference scenario to show the effect of the project. Depending on the available data, they either modelled it as a continuation of a past trend; identified factors that would likely influence future emissions; or selected a control area outside the project as a reference (Dixon, 1998, page 16). These different approaches toward data collection and baseline setting made a comparison of the projects impossible.

With regard to methodologies and the monitoring and evaluation process, the experimental USIJI unfolded its potential for learning quite well. Project developers identified the practical problems of setting project boundaries, calculate and measure emission reduction and argue for additionality of projects. However, the experimental mode did not help to find decisions. The projects differed widely, so that a comparison was not possible. While individual projects claimed a specific cost to reduce carbon, the differences among the projects made it impossible to evaluate their relative cost-effectiveness. In a report for the UNFCCC secretariat, the head of USIJI hoped that with the projects reaching maturity and research continuing, the comparative effectiveness would become clearer (Dixon, 1998, page 11).

Besides the technical problems with methodologies and reporting, evaluators identified a further problem. The submitted projects did not receive enough funding and did not become operational. As of July 1998, only 13 of 30 projects accepted so far were fully financed (Lile et al., 1998, page 7). For proponents of crediting, it was a clear signal that without crediting and participation of private actors, the instrument would be doomed. For example, in a report sponsored by US EPA, Parson and Fisher-Vanden argued that because of the absence of crediting possibilities, incentives for private partners to invest in AIJ projects was lower than their perceived risk and the transaction costs they had to bear. And due to a lack of private interest in the mechanism, potential host countries and investor countries also did not develop national programs (Parson and Fisher-Vanden, 1997, page 15). For these authors, it was also possible that the absence of crediting would threaten the whole experiment, as the sampling would be unrepresentative:

> One consequence is that current projects are likely quite unrepresentative of those that would occur under much larger mobilization of private finance, in their technical characteristics, the type of investor they attract, and the character of investors' motivations and involvement in implementation. Pilot phase experience alone may thus be a misleading guide to the functioning of a larger-scale JI system (Parson and Fisher-Vanden, 1997, page 14).

Despite all efforts, some evaluators bemoaned a low participation, thereby indicating a fundamental problem in this approach (e.g. Figueres et al., 1996; Mintzer and Dixon, 1999, page 412; Parson and Fisher-Vanden, 1997, page 15): without crediting, there was no incentive for private actors to participate. This interpretation of the experiment was used by analysts, as well as in the international negotiations, to demand JI crediting. In comparison to earlier demands for crediting that were voiced at the INC sessions, this time, the request was backed by empirical evidence. In a document USIJI prepared for the UNFCCC secretariat in January 1998, for example, Robert Dixon, the head of USIJI, concluded that "… it

is clear that in the absence of credits, investments in JI projects will not reach the level necessary to fully realize the potential of this concept" (Dixon, 1998, page 3). He stated this claim as a conclusion of the hitherto experiences with the USIJI program.

However, as we have seen, USIJI was conceptualized as a program in which private actors would carry the burden of investments and get credits in return. They would have to invest in projects, bear the risk, and pay for the development of the project. The US government only financed workshops and information material. When COP1 prohibited crediting, the remaining incentive for private partners to participate was public relations, the ability to open up new markets for green technologies and the hope that investments would pay off in a future regime. This was obviously not enough. Considering this, the interpretation that JI would not work without crediting was not surprising, but incorrect. What did not work was a JI system that was built on private investments. In the early years, JI had a different meaning. But its interpretation had gradually shifted towards a system based on private investments, in which the demand for crediting was appropriate.

What we saw, thus, is that, in constructing the experiment USIJI, a specific framing of JI as a private investor market arrangement was inscribed. Private actors should invest technologies to reduce emissions. The market would govern which approaches are the most feasible and experts from state agencies would only evaluate the different proposals. This was the rationality in which evaluation and interpretation was conducted. This evaluation concluded that JI did not work, as long as the private investors would not receive any form of credit in return for their investments. The data basis for this claim was not large: after three rounds of submissions, only 25 projects were accepted in 1998. Nevertheless, the claim that crediting was necessary became dominant. It was translated from the experimental sites into the real world, as a representation of an objective fact.

Constructing a global in-vivo climate governance experiment: The Activities Implemented Jointly pilot phase

At the first Conference of the Parties (COP1), the Activities Implemented Jointly (AIJ) pilot phase was decided. Under this pilot phase, Parties from developed and developing countries could jointly initiate and develop climate mitigation projects. This section discusses how this experiment was constructed and focuses on the construction of the experimental setting. It shows how, in this construction, actors attempted to inscribe an economic rationality.

Over the coming years, delegates discussed the reporting format that would standardize the information each project and each national program would present to the UNFCCC secretariat. These negotiations were central for constructing the experiment setting. With this uniform reporting format, actors constructed the boundary of the experiment. The reporting format defined what the experiment tested and what was excluded. Thus, it defined how the macrocosm was reduced in way that the experiment was a valid representation of it.

After COP1, international negotiations continued in the Ad-hoc Group on the Berlin Mandate (AGBM), as well as at the meetings of the subsidiary bodies. The discussions at AGBM meetings focused increasingly on quantitative emission targets, and JI was increasingly considered as an instrument to maintain flexibility in achieving these commitments. This discussion was especially forced by the USA, which clearly preferred a tradeable permit system (ENB, 1996c, page 12) and hereby opposed many developing countries that spoke heavily against reliance on market-based schemes. Developing countries feared a power-asymmetry between trading partners which would favor the wealthy countries and solidify inequality. Furthermore, they saw several practical questions as unsolved (ENB, 1996c, page 13).

COP1 decided that the Subsidiary Body for Science and Technological Advice (SBSTA) would establish a framework for reporting on the global and national benefits of AIJ and would prepare a synthesis report of these activities (UNFCCC, 1995 Dec. 5/CP. 1)[12]. At the SBSTA meetings, intense discussion ensued with regard to the format of reporting these activities and the comprehensiveness of measuring the carbon emission levels. The central conflict was between comprehensive information about the activities and transaction costs. The more accurate the monitoring is, the more expensive it becomes, and the less attractive and cost-efficient JI would be.

At its second meeting, SBSTA adopted an initial framework for reporting. It defined who reports, the frequency of reporting, and the content. Parties reported to the COP1 describing the project, governmental acceptance, compatibility with national economic development, benefits derived and calculation of the contribution of AIJ projects (ENB, 1996b, page 9). Delegates acknowledged the importance of the reporting format for the potential to learn from the pilot phase, as only what was reported could be considered in the evaluation of the report, and thus result in learning.

What should be accounted in the reports was of particular importance. And its construction was thus a venue to negotiate again the aim of the experiment. The USA, as well as Germany, used the occasion also to request reporting on crediting:

> The United States is aware that there is no crediting for AIJ in the pilot phase. In the spirit of learning, however, we suggest that those countries who have considered crediting report information to the SBSTA. This information should consist of information on the hypothetical allocation of greenhouse gas emission reduction or sequestration that would accrue to the reporting Party as a result of AIJ as well as information on the procedures and rational leading to this hypothetical crediting allocation (USA in: SBSTA 2, 1995, page 5).

In the AIJ pilot phase, the USA saw an opportunity to come back to this discussion and to test and explore crediting issues in a noncommittal manner. This quote shows how they

[12] COP1 established SBSTA as a body to link scientific, technical and technological assessments and the information provided by competent international bodies with the policy oriented needs of the COP (ENB, 1996b, page 1).

used "the spirit of learning" as an excuse to move beyond what had already been decided: crediting was excluded from the AIJ pilot phase. As the pilot phase's purpose was, however, to learn, hypothetical crediting should also have been reported. The US was already experienced in crediting activities and now had to fight to get them recognized. Furthermore, the US delegation demanded that private sector activities should be part of the national information. "Governments can support technology transfer, but they are not the main engines for advances and innovations" (ENB, 1996b, page 11), they argued.

The discussion on a reporting format continued. When, a year later, at the joint fifth meeting of AGBM and fourth SBSTA session, the secretariat considered crediting AIJ activities, this caused intense protest from developing countries. Critics still saw crediting as an attempt of developed countries to stay away from commitments. This assumption was backed up by the experience that most technology transfer so far was undertaken within the AIJ framework. Crediting these activities would thus reduce the commitments of developed countries (ENB, 1996a).

At the fourth session of SBSTA, delegates decided for a uniform reporting format to be applied by each project and by each national program. This reporting format consisted of eight different topics: the description of the project, its governmental acceptance, compatibility with economic development strategies with the host country, benefits of the projects, calculation of the emission reductions, financial additionality, contribution to capacity building and technology transfer and additional comments (SBSTA 4, 1996). It did not explicitly mention crediting as a topic to report but it also did not exclude it. And indeed, when the US reported on their program to the UNFCCC secretariat, they highlighted the necessity of crediting for JI to work:

> While the USIJI Program is pleased with the progress of USIJI and the AIJ pilot phase, it is clear that in the absence of credits, investments in JI projects will not reach the level necessary to fully realize the potential of this concept (Dixon, 1998, page 3).

The report continued, claiming that the projects accepted within the framework of the US program provided useful information as a starting point to develop criteria for crediting these activities.

The reporting format was supposed to set the experimental boundaries, to define what should be included and what should not. However, as this anecdote illustrates, this boundary had not yet been accepted. The format left a lot of space for interpretation, and Parties used this space to influence its further adjustment. Thus, the experimental setting which the reporting format defined did not yet give enough guidance on how to do the experiment. Actors needed instead to convince others of their interpretation.

Parties and project developers did not use the format consistently. The SBSTA had evaluated the submitted reports and concluded that AIJ did not reach the expected results. Only 12 Parties had developed national programs, and only 39 AIJ activities involving 11 countries had submitted reports. 57% of the estimated carbon reduction or sequestration was

expected to come from forestry projects, 34% from fugitive gas projects and 9% from energy projects. The report concluded that AIJ was approached cautiously, not at least due to a lack of information about the program. Besides this quantitative analysis, SBSTA tried to analyze the benefits and effects stated in the national reports. However, they had problems in doing so, as the reports submitted did not reveal the data basis for the calculation and underlying methodologies (SBSTA 7, 1997).

This report initiated interpretations of AIJ, the reporting format and the benefits this arrangement delivered. Analysts investigated some projects that were reported to the UNFCCC secretariat in depth, and identified that at the time of writing the report, most AIJ activities lacked funding and thus only existed on paper (Dutschke, 1998, page 16). Only a few projects could actually provide more than mere simulations of future emission reductions. Furthermore, the report noted that "insufficient information exists to determine additionality and costs for many current projects" (Trexler, Kosloff 1998, 6). The reporting format thus needed adjustment; in particular more information was necessary to evaluate the experiment.

Some analysts also noted that the reporting format was not equipped to test the key assumptions of JI. The first synthesis report was thus not able to prove them; to prove inter alia the key assumptions of whether the costs per unit of emission reduction in host countries was lower than in 'donor' countries; whether the total potential of cost-effective JI projects was relevant to climate change mitigation objectives, and whether JI enhanced financial and technology transfer between Parties (Trexler and Kosloff, 1998, page 8). Furthermore, practical details, such as how to define a baseline, distribute benefits between donor and host countries, and how additionality could be ensured, were also not clarified. However, this analysis was not echoed during the international negotiations, but remained within academic circles.

At the international negotiations, Parties were primarily concerned about the geographical distribution of AIJ, its contribution to sustainable development and capacity building in host countries, its environmental benefits, its contribution to technology transfer, and its costs (SBSTA 10, 1999, page 25). In the second synthesis report of the AIJ pilot phase in October 1998, the secretariat concluded that interest had grown in AIJ, but that reliable data was still lacking. The reports did not reveal the methodologies to calculate costs and benefits of the program. "This pertains in particular to data on the costs and the amount of GHG abated or sequestered as well as on cost-effectiveness" (COP 4, 1998, paragraph 4 (c)). Parties had agreed at the fourth SBSTA session that they would change the reporting format depending on the experiences made (SBSTA 4, 1996) – as was the case in subsequent meetings. . The initial reporting format did not accurately define what had to be reported in each topic, and Parties negotiated inter alia on a refinement of methodologies, technology categories, and a definition of benefits deriving from AIJ projects (ibid.).

In the second synthesis report, the modest participation of the private sector was discussed for the first time. It states: "…incentives appeared to be inadequate, thus leading to hesitation on the part of the private sector to engage in significant investment .The modest in-

volvement of the private sector in projects which are not publicly subsidized remains apparent" (COP 4, 1998, paragraph 12). The report concluded that AIJ did not provide enough incentives for the private sector to invest in AIJ projects and saw it as a problem. The report concluded that the shortage of projects was partly due to the absence of private investments. The framing of a private investment arrangement had thus found its way into the scientific evaluation and was presented as a scientific fact – even though private participation was not implicitly included in the experimental setting.

The negotiations I discussed here were important, as they concerned the experimental boundary of AIJ, and, thus, the elements of the macrocosm that would be taken into account in the experiment. The reporting format, methodologies and definitions enabled the experiment to work. Problems appeared when they were applied to the macrocosm, and they were steadily adjusted. In this process of developing and adjusting, a new framing was inscribed: a framing of the governance arrangement as a private investor market.

Conclusion

In experiments with governance arrangements, specific rationalities of the arrangement are constructed, as this chapter showed. It covered the process of how in-vivo and in-vitro experiments further developed the concept of JI. The chapter first analyzed how a transnational constituency emerged around the issue of JI, and how it developed a particular rationality. Its emergence was initiated by the attempt to push forward this concept, and from the very beginning, most members shared an economic understanding. The constituency developed an economic model of marginal abatement costs and proposed it via different influential publications and in influential organizations. In this process, the initial diversity of economic concepts was narrowed down and a concept that highlighted the role of private investors in a JI arrangement became dominant.

Second, this chapter captured the construction process of a national in-vivo experiment. The US experiment translated this private investor frame into a political program. It was supposed to test and demonstrate how such an arrangement would work. Therefore, a lot of work had to be invested to turn the enigmatic world into this experiment: private actors had to be identified, convinced, paid and trained to invest in and develop projects; national agencies had to be set up to authorize and approve the projects; and methodologies that reached a compromise between costs and reliability had to be developed. As a result, this experiment provided facts. Experts evaluated the data the experiment delivered and could claim that JI would not work without private investors. The experiment had turned an economic model into reality.

Third, this chapter discussed how this economic model turned into a scientific fact in the negotiations of the Parties of the international climate convention. Like other national experiments, the US experiment was secluded from the international negotiations, and Parties negotiated on a reporting format that would link these experiments to the convention. Parties had to report their national experiments to the convention. The UNFCCC secretariat reviewed them for the purpose of learning. They were the inscriptions delegates discussed

and interpreted when they negotiated on the international experiment. They tried to standardize these reports in a uniform reporting format, which was supposed to define what was included in the international experiment and what was excluded. Throughout the development of this reporting format and the evaluation of the data, the rationality of JI as being a private investment also stabilized as a scientific fact in the international negotiations.

In the construction phase, the initial concern of the right framing of JI was overcome. When Parties had accepted to reduce the macrocosm to experiments of JI, they wanted to learn whether such a governance arrangement would work. Developing countries rejected such an arrangement, fearing that they would have to carry the burden of climate mitigation activities not the developed countries. When the experiment was constructed, however, this fear was taken increasingly less into account. The data the experimental constituency discussed and evaluated did not reveal any information about it; the experiments they constructed were not equipped to test it. The idea of JI being a technology transfer as had been proposed earlier did not find its way into the development of methodologies and actual experiments. However, concern about it was only marginal. In the experimental constituency, the theoretical benefits of JI and the necessity of efficiency were broadly accepted. Critical concerns were excluded. Thus, over the course of constructing the experiment, initial concerns were silenced – not because they were solved empirically, but because they lost support.

7
Expanding the Experiment: Developing the CDM between Kyoto 1997 and Marrakesh 2001

> The relative optimism at Kyoto was soon replaced by pessimism in the subsequent process as it became clear that the Parties interpreted the Kyoto Protocol very differently… four years after the adoption of the Kyoto Protocol, it seems the Parties finally agree on what it means. The Kyoto mechanisms are thereby seemingly accepted by all major parties (Andresen et al., 2002, page 3).

Many analysts see the Kyoto Protocol as the starting point of the global carbon offset market, as it surprisingly allowed the crediting of emission reducing activities in developing countries. However, as one of my interview partners stated: "Several people [delegates at Kyoto] had not realized that they just decided for a market mechanism. Particularly from developing countries there were many who thought that it is a subsidiary system or so" (Interview T9, translation FS). In this chapter, I will analyze how, after Kyoto, the construction of a global private investor market continued. I argue that the important development toward a market – which the Clean Development Mechanism (CDM) later became – can be found in the experiments of particularly the World Bank, in the discursive framings of the Organization for Economic Co-operation and Development (OECD) and the United Nations Conference on Trade and Development (UNCTAD) and in the material expansion of Activities Implemented Jointly (AIJ) pilot scheme. These experiments and actors expanded the governance arrangements that had been constructed in the earlier experiments. Within this process of expansion, the governance arrangement of national programs and public investments was modified into a global private investor market arrangement.

A year after the Kyoto Protocol, the World Bank launched the Prototype Carbon Fund (PCF). With the PCF, the World Bank constructed alliances between, on the one hand, an experimental collective that continued to work with the existing AIJ, United States Initiative on Joint Implementation (USIJI) and the like, and, on the other hand, powerful and financially potent economic and public actors. The OECD and UNCTAD continued in their discursive activities to expand the rationality of a private investor governance arrangement. And the Parties to the Convention expanded on the material dimension of the experiments. Based on these expansions, a new governance arrangement finally came into existence; a performation of the economic model of abatement costs with its adjustment of tradable credits.

The chapter is organized along the following lines. I will start with an analysis of the international negotiations after Kyoto. These culminated four years later in the Marrakesh Accord, in which the Parties decided on the modalities and procedures of the CDM. I will then show how the World Bank and the OECD attempted to expand experiences they had

made in AIJ to the macrocosm. On the discursive dimension, they expanded a certain interpretation of their experiments; on the actor dimension they widened an experimental constituency that took a market framing for granted; and on the material dimension, they developed further the methodologies and procedures constructed in AIJ and the other experiments within the context of the CDM. At the end of this phase, the general principle of the CDM that emission reductions are cheaper in developing countries than in developed countries and that, thus, emissions could be reduced through investments in developing countries, was taken for granted, as well as the principle that these investments are done mainly by private actors. The experimental process had been performative.

Expanding the experiment discursively: International negotiations after Kyoto

The Clean Development Mechanism

At the Third Conference of the Parties (COP3) in Kyoto 1997, Parties agreed to a legally binding protocol to reduce emissions globally by 5.2 per cent. Annex 1 countries, OECD countries, as well as countries with economies in transition, committed themselves to quantifiable emission targets, while non-Annex 1 countries and developing countries, were exempted of making commitments. Specific emission targets were set for 37 industrialized countries and the European Union. The Kyoto Protocol defined three flexible mechanisms – Emissions Trading, Joint Implementation (JI) and CDM – that would enable developed countries to achieve their commitments abroad. Emissions Trading was an instrument that allowed countries with commitments to sell and buy fractions of their allowable emissions; Joint Implementation was an instrument that allowed investments in projects in so-called "countries with commitments"; and the CDM enabled investments in projects in non-Annex 1 countries and "countries without commitments" (UNFCCC, 1998, Art. 6, 12, 17).

In Article 12 of the Kyoto Protocol, the CDM is defined as a mechanism that assists non-Annex 1 countries in achieving sustainable development, and Annex 1 countries in achieving their commitments through investments in projects that reduce or avoid emissions in developing countries (Benecke et al., 2008, page 8). This mechanism would operate under the COP and a not yet defined Executive Board. Projects under the CDM would generate emission reductions certified under not yet agreed principles. Projects would be located in non-Annex 1 countries, and the certified emission reductions added to the emissions an Annex 1 country was permitted to produce (Werksman, 1998, page 153). The investments an Annex 1 country would make in a project in a non-Annex 1 country would thus contribute to its compliance. Instead of investing in domestic emission reduction projects, it could now invest in such projects abroad.

For many analysts, the CDM was a surprise (Werksman, 1998). In early 1997, the Brazilian government had submitted a proposal for a Clean Development Fund (CDF) to assist developing countries striving for sustainable development. The CDF was linked to emission targets for developed countries and a compliance mechanism. It would be financed by developed countries that did not fulfill their emission targets. For each ton of carbon they

emitted over their assigned amount of emissions, they would have to pay US$3.33 (Mintzer and Dixon, 1999, page 409). The US delegation welcomed this proposal, interpreting it as a "flexible financing instrument" (Werksman, 1998, page 151). The USA wanted to have JI in the Protocol and saw in this proposal an opportunity to construct an unusual alliance with the G-77 Parties. In corridor talks, Brazilian and US delegates together developed this proposal further, resulting in the CDM, a project-based mechanism between developed and developing countries that allowed the inclusion of the private sector.

Within just 48 hours, the Brazilian proposal evolved into an article on the CDM. However, it was not at all clear what the CDM actually was and what it would become. The Parties had decided for a mechanism that allowed fulfilling emission reduction commitments abroad. But it had not decided as to how these activities were to be shared between the Parties, whether the mechanism would result in a commodity, or how many emissions Parties could reduce abroad. At this time, it was not clear whether the CDM would take the road towards a market-based approach or rather towards an interventionist approach based on public sector development assistance (Werksman, 1998, page 153). It was even not clear when, and if, Parties would indeed decide on rules that allow for crediting. Dixon, for example, feared in mid-1999 that investor enthusiasm would dampen as Parties could not reach an agreement (Mintzer and Dixon, 1999, page 416). These issues were decided over the next four years until the seventh Conference of the Parties finally decided on the detailed rules of this mechanism in 2001. The next section covers negotiations on these issues, arguing that particularly the Parties' interpretation of their experiences in AIJ helped to develop the CDM into a private investment governance arrangement, in which carbon became a tradable commodity and countries could fulfill only a defined share of their commitments abroad.

After Kyoto, controversial discussions continued during the international negotiations. The Kyoto text gave little guidance as to how the Parties could achieve the overall goal of reducing emission reductions by 5.2%. The decision for the three flexible mechanisms ignited efforts to interpret their meaning, particularly surrounding modalities and procedures for accounting emissions reductions, how States could make use of these reductions against their commitments (van der Gaast, 2015, page 119), as well as the type of technologies eligible for CDM and JI. These discussions were closely related to the further development and evaluation of AIJ and the experiences Parties had made in this experiment.

Developing the CDM into a private investor market

After the third Conference of the Parties in Kyoto, discussions centered on the expansion of AIJ to the CDM. The question was whether AIJ was an experiment for the newly founded CDM. Various developed countries interpreted AIJ as an experiment that had tested a governance arrangement they wanted the CDM to become. They thus tried to expand the projects, methodologies, agencies and general experience they had made in AIJ into the CDM. As they had to convince developing countries, they continued a discussion on the relation between AIJ and JI that had started shortly before Kyoto – albeit now in different terms. A few months before Kyoto, G-77 plus China insisted that AIJ was not the

same as JI. The experiences gained in AIJ could not be translated to JI, they claimed. The crux of JI was that it should only apply to activities between Annex 1 countries and might allow for crediting; AIJ on the contrary also allowed for the participation of non-Annex 1 countries' on a voluntary basis, but without crediting. What COP 1 had decided, G-77 plus China argued, was not a JI pilot phase, but an AIJ pilot phase, "which is an entirely different notion from that of Joint Implementation" (SBSTA 6, 1997, paragraph 4).

In the first year after Kyoto, the United Nations Framework Convention on Climate Change (UNFCCC) secretariat compiled information on experiences and expertise with the cooperative mechanisms AIJ, CDM, JI and emissions trading. Mandated by the Chairman of the Subsidiary Body for Scientific and Technological Advice (SBSTA), the secretariat started surveying work of governmental and non-governmental organizations on this issue. It got responses by 20 organizations many of who had been active in the AIJ pilot phase, for example the United Nations Environment Program (UNEP), UNIDO, the World Bank, CSDA, TERI India and WRI.

This compilation resulted in the secretariat providing a note as input to the eighth meeting of the SBSTA. In this note the secretariat elaborated on the experiences of the AIJ pilot phase and how they could be used for the development of the new flexible instruments. It noted that for the development of the CDM, it was possible to "draw upon the results of technical work under way in the pilot phase of AIJ" (SB 8, 1998, paragraph 18). As technical work, they demarcated experiences in AIJ with regard to the approval process, methodological questions, determination of baselines, capacity building and research. However, with regard to the "core issue" of the CDM, crediting, AIJ could not provide any experience and knowledge (SB 8, 1998, paragraph 37). The secretariat thus suggested a differentiation between the technical issues of AIJ which could be used for the CDM and the issue of crediting, which was a new issue to be addressed in future negotiations.

With this note, it also suggested a definition of the CDM as a mechanism that was primarily based on private investments and crediting of carbon emissions and thus differentiated it from AIJ:

> JI and the CDM are intended to be financed mainly by new private investment, attracted by the prospect of access to emission reductions "offshore" ('emission reduction units' and 'certified emission reductions', respectively) at lower cost than those available domestically. Public finance may also be engaged through these mechanisms, as appropriate (SB 8, 1998, paragraph 17(b)).

This interpretation saw the CDM as a private investment arrangement based on the economic model of marginal costs. CDM and the new JI were described as mechanisms that use differences in costs of emission reductions domestically and abroad to reduce emissions cost efficiently. This suggestion resulted from a workshop organized by OECD and the International Energy Agency (IEA) a few months earlier (see next section). It was the starting point for discussions on this definition which were to last for the next two years.

A few months later, the secretariat repeated its argument when it evaluated AIJ. In its second synthesis report, it suggested using experiences from AIJ to develop the design and operational issues of the new flexible instruments, particularly with regard to methodologies. This would avoid "unnecessary duplication of effort" (Second synthesis report, Oct 1998, para 4).

Taking up this distinction in April 1999, the UNFCCC organized a workshop on the flexible mechanisms, which addressed the technical issues the secretariat had identified. In this "technical workshop", political issues were to be kept "on the back burner" (ENB, 1999) as the then UNFCCC executive secretary, Michael Zammit Cutajar, stated in his opening speech. It was supposed to address technical issues and to be a means of avoiding the unwieldy bodies of the Convention. The agenda of this workshop was to move forward with these technical issues and to find pragmatic solutions. These issues were negotiable, Cutajar stated, and he mentioned a trade-off between complex and perfect solutions on the one hand, and simple and applicable solutions on the other. 100 participants – including experts from the Parties and representatives from governments, UN agencies, and intergovernmental and non-governmental organizations – attended the workshop. Experts from consultancies, think tanks, academia and intergovernmental organizations presented issues on the governance of CDM, about validation, verification and certification, about additionality, baselines and funding. The experts presenting at the workshop all had experience with AIJ projects. Based on these experiences, they made suggestions for an institutional set up of CDM/JI, presented methodological problems that occurred in AIJ projects, and potential solutions (ENB, 1999).

Parties tried to set the agenda for the development of the design and methodologies of the CDM. They negotiated on how far AIJ resembled the Kyoto mechanisms CDM and JI, and how much could be learned from these experiences. The USA argued that "[t]he Activities Implemented Jointly pilot phase has provided the international community with an empirical basis on which to elaborate the project-level flexibility mechanisms included in the Kyoto Protocol" (USA in: SB 10, 1999a, page 94). Based on this empirical basis, it repeated its statement that AIJ demonstrated that a lack of crediting would discourage private actors to participate, that transaction costs should be minimized (ibid.) and that the construction of methodologies in the CDM should take this into account. Instead of overly rigorous project evaluations which would discourage participation, the process should be pragmatic and expedient. Other Parties, such as Australia, also claimed that "AIJ has demonstrated that, for the Kyoto project-based flexibility mechanisms to work effectively, the private sector will need to be engaged through appropriate incentives" (Australia, in: SB 10, 1999a, page 6). The EU adopted the secretariat's argument, claiming that although there were clearly differences between project-based Kyoto Mechanisms and AIJ, "there are a number of areas where lessons learned during the AIJ-pilot phase could be usefully employed in the design, development and operation of the project based mechanisms under Art. 6 and 12 of the Kyoto Protocol" (Germany on behalf of the EU, in: SB 10, 1999a, page 29).

At this workshop, only the Alliance of Small Island States (AOSIS) countries submitted a statement arguing that there was not yet enough evidence to decide on the performance of AIJ. For AOSIS, particularly the scope of technologies in the AIJ projects was disappointing; too many sequestration projects and too few energy and transportation projects did not provide a basis for learning, they claimed. Without projects in these sectors, it would not be possible to learn from AIJ. Thus, instead of using the experiences for CDM, AIJ need to be comprehensively reviewed. The information AIJ provided so far was not particularly revealing and it might have caused "tremendous potential problems that could be replicated in the CDM unless a cautious approach is taken with the AIJ pilot phase review" (Samoa on behalf of AOSIS, in SB 10, 1999a, page 86).

At this workshop, Parties negotiated on the discursive expansion of AIJ. Parties presented their experiences with, and interpretations of, AIJ. They argued that AIJ provided an empirical basis that demonstrated the need for private investors in a future CDM arrangement. This argument was presented as a fact. Others, however, contested this presentation. For them, there was not yet enough evidence for this interpretation. The empirical basis was not comprehensive and the evaluation not systematic enough to enable such a discursive expansion of the experiment. The experiment did not yet make a representative demonstration of the macrocosm.

While the discussion continued as to whether and to what extent AIJ was an experiment for CDM/JI, a shortage of time to come up with rules and procedures accelerated a debate on methodological and technical issues. Parties started discussing principles, modalities, rules and guidelines for the flexible mechanisms. The EU submitted a first draft, in which they made use of the experiences made in AIJ on methodologies and procedures. For the CDM, it suggested a procedure of validation and certification which was first introduced in the USIJI experiment and later adopted in the procedures of national AIJ programs in the EU. In the validation phase, a validator would assess whether the project's baseline and its financial and environmental additionality would meet the requirements laid down in the rules of the CDM. In the certification phase, a certifier would verify how many additional emission reductions a project had generated and issue certificates for these emission reductions. It also suggested that the credits CDM projects generated could be traded in exchange (Germany on behalf of the EU, in: SB 10, 1999b).

The underlying logic, that the CDM creates a tradable unit, had not yet been accepted by many developing countries. India stated that "the Protocol has not created any asset, commodity or goods for transfers or exchange" (India, in: SB 10, 1999b, page 32). It insisted that such a commodity would entrench global inequality and thus be unacceptable. The methodologies developed so far in AIJ did not solve this problem, and as long as they were not better equipped to ensure equity, India voted against further developing the CDM.

Parties had scheduled to come to a decision on modalities and procedures for CDM, JI and emissions trading at the sixth Conference of the Parties (COP 6) in November 2000. However, at the end of 1999, more and more observers and delegates realized that it would not be possible to find an agreement in the following year. Thus, the assumption grew that the

first years of the CDM – i.e. from early 2000 until rules for the CDM were adopted – would resemble a further pilot phase. Although the Parties did not explicitly decide whether AIJ was an experiment for CDM/ JI or not (Jepma, 1999, page 1), it was in fact one: actors already constructed the CDM based on their AIJ experience and the methods and procedures that had been developed in AIJ; national agencies and programs developed for AIJ changed into CDM agencies and programs. Over the course of negotiations, and based on these experiences, the draft modalities and procedures had become far more concrete, especially with regard to accounting greenhouse gas (GHG) emissions. Here, Parties had successfully argued with their experiences made in AIJ and could move towards some form of consensus. And also the interpretation of the CDM being "basically private-sector driven" (Japan, in: SB 13, 2000a) had found more and more supporters.

COP 6 in The Hague failed to come up with a final consensus due to a continued dissent on the inclusion of forestry and land-use change activities (van der Gaast, 2015, page 76). Latin American countries and the USA prominently and repeatedly argued for an inclusion, while the EU and G-77 and China opposed it. Three months after COP 6, in March 2001, US President, George W. Bush, announced that the US would withdraw from the Kyoto Protocol. It was fundamentally flawed, he claimed, as it did not set any quantified emission targets for rapidly industrializing countries (van der Gaast, 2015, page 74). In this new situation, the Parties met in June 2001 in Bonn for the second part of COP 6, COP 6-2, broadly considered to be the rescue of the Kyoto Protocol (van der Gaast, 2015, page 77) as well as a "turning point in the debate on these carbon markets. The conference marked the end of the basic debate on the commodification of climate change and the beginning of the technical construction of carbon credits as a new commodity" (Miranda et al., 2002, page 70). While there were still same minor issues to be solved at the seventh Conference of Parties (COP 7) later in 2001, at COP 6-2, Parties had finally agreed on the central critical issues, "supplementarity, eligibility, share of proceeds, the composition of the executive board, and sinks and nuclear facilities in the CDM" (ENB, 2001, page 14).

With the Marrakesh Accords, the CDM became operational. It was decided how, and to what extent, Parties could use it to comply with their quantified emissions, which project types would be eligible, how to calculate GHG emission reductions, on the role of the executive board and the Conference of the Parties and on the project cycle, the procedure to validate, verify and certify CDM projects. The Parties decided that the CDM should be a globally applicable private investment mechanism that was based on cost-differences between developing and developed countries. Thus at this point in time, the controversies that had dominated the negotiations for the last 10 years were silenced. The marginal cost abatement model and its accompanying efficiency had become an uncontested rationality; private investors were accepted as governing subjects; baseline and additionality as well as an approval procedure conducted by experts was accepted as the governing technology. The abatement costs model had finally performed a global climate governance arrangement based on accounting technologies, as well as investor and host countries.

Expanding the experiment in its material and actor dimension

This section focuses on the experimental collective. I analyze how this collective tried to expand a private investment framing after Kyoto, which it took for granted. It used its experiences with AIJ to interpret the CDM as a private investment arrangement; developed methodologies in which this model was reified; promoted projects; and built alliances with other international organizations and public agencies.

International organizations developing methodologies

After Parties adopted the Kyoto Protocol, experts and analysts started to interpret it. The most prominent role with regard to the CDM was played by the international organizations OECD, UNCTAD and the United Nations Industrial Development Organization (UNIDO). They immediately started to organize workshops and conferences and to publish reports aiming at dominating the discourse and positioning themselves as relevant experts.

Three months after Kyoto, the OECD and the IEA organized a Forum on climate change; its proceedings were published as a report entitled "Moving forward and setting priorities after Kyoto". The Protocol had left analysts with several unclarified issues, among them the new mechanisms. The Forum's objective was to "review the Kyoto Protocol to consider international priorities and analytical work to support implementation of the Protocol" (OECD and IEA, 1998, page 4) and to deepen the understanding of the new mechanisms of the Protocol and technology co-operation with developing countries. The Forum was attended widely by more than 200 participants, government representatives, as well as industry, international organizations, environmental NGOs and trade unions.

With regard to CDM, JI and emissions trading as the three new mechanisms, participants identified three key issues to be resolved – environmental credibility, the participation of non-state actors, and linkages between the mechanisms (OECD and IEA, 1998, page 6). At the Forum, participants discussed the negotiation history leading to Kyoto and interpreted the intent of the CDM as a "multilateral fund that would be financed by private investors in exchange for greenhouse gas credits. This formed the basis of the language now found in Article 12 of the Protocol" (OECD and IEA, 1998, page 7). This was already an important interpretation of article 12 of the Kyoto Protocol. There, it says: "Participation under the clean development mechanism, including in activities mentioned in paragraph 3 (a) above and in the acquisition of certified emission reductions, may involve private and/or public entities, and is to be subject to whatever guidance may be provided by the executive board of the clean development mechanism" (UNFCCC, 1998 Art. 12 (9), emphasis added). Neither was a multilateral fund mentioned, nor the fact that it should be primarily financed through private capital. The US had been fighting for the permitting of credits and the use of private capital for some time as we saw, and the CDM was considered to be the result of some backdoor bargaining between the US and the Brazilian delegation. The Forum came to this conclusion due to its interpretation of the history of these negotiations. Nevertheless, it was still not at all clear, what the CDM would ultimately turn

into. However, as a consequence of this interpretation, large parts of the Forum were devoted to the question of private participation.

The session on the new mechanisms endorsed the principles of environmental effectiveness, economic efficiency, and equity as a starting point for discussing them. This meant that, with regard to environmental effectiveness, the mechanisms should be credible and transparent; with regard to economic efficiency, the mechanisms should provide cost-effectiveness benefits; and with regard to equity, the mechanisms should "maintain open access to the market for trading and crediting" (OECD and IEA, 1998, page 8). The newly adopted flexible mechanisms provided an opportunity for the experimental collective to expand discursively a specific interpretation of the experiments that had so far been made. Over the last years, particularly the OECD had tried to frame JI and AIJ as an instrument to attract private investments. We saw in the last chapter how this interpretation was supported by experiences mainly within the USIJI experiment. At this Forum, actors who had pushed for such interpretation now moved on to interpret the CDM in this regard.

Based on their experiences made in AIJ, participants reviewed the Kyoto Protocol and presented analyses that had been carried out so far on existing experiments. Drawing on these experiences and analyses, they presented their interpretation of the CDM as a private investment fund as fact and promoted their individual experiences and experiments they had made with a market approach. The World Bank for example presented its carbon investment fund – which later turned into the prototype carbon fund – and promoted it as a

> vehicle for directing investments in emission reduction projects in developing countries leading to carbon offsets… The Fund is proposal for a market-based, cost-efficient structure that could provide a possible mechanism to facilitate trading under the clean development mechanism. This vehicle could accumulate data and experience for establishing and verifying baselines and in this way could contribute to drastically reduce transaction costs (OECD and IEA, 1998, page 12).

In front of 200 experts on international climate governance, the World Bank promoted the PCF, which it was developing at the moment, as a possible way of how to move forward with the mechanisms. It highlighted the benefits of the PCF as using and establishing a cost-efficient structure, allowing for potential trading and for learning to reduce transaction costs. This presentation was also an attempt to find support and supporters for this mechanism.

The OECD environment directorate and IEA also wanted to discuss at the conference "whether experiences from the AIJ pilot phase of "activities implemented jointly" can be used to shape the design of joint implementation and the clean development mechanism under the Protocol" (OECD and IEA, 1998, page 8). At that time, AIJ was not terminated, but its future was undecided and the new mechanisms had not yet been developed (see above). In this situation, it was an open question for the experimental collective as to how both were related to one another. The narrative, which describes the development of CDM today, portrays the CDM as having its origins in AIJ. This narrative was being negotiated at that conference. And so at this conference, there was no common understanding among

the participants of how far the mechanisms adopted at Kyoto were new, or a continuation of the AIJ pilot project.

The question of to what extent AIJ and the new mechanisms were related to one another continued in the following months, and the openness that was created allowed for new experimentations with baselines which differed from those under AIJ. The principles that were discussed and promoted to design the mechanisms at the OECD/IEA Forum built the basis for discussions at further meetings and for the design of new baselines.

UNIDO organized a CDM expert meeting in October 1998. It was not part of the official technical negotiations, but with representatives of the SBSTA, the UNFCCC secretariat and government delegates being present alongside representatives of international negotiations – 35 participants in total – it was personally very close to these negotiations. It was the first conference to be entirely devoted to the CDM, illustrating the growing interest that the mechanism was causing. The meeting was held under the title of "New partnership for industry in developing countries", which emphasized quite well the aim of this meeting: Participants discussed the possibility of technology transfer under the CDM, the extent to which it would help developing countries to leapfrog technologies and the role UNIDO and industry partnerships could play to achieve these issues (IISD, 1998). At this conference, participants continued to highlight the need for private sector participation. SBSTA chairman Kok Kee Chow not only emphasized the importance of the private sector for the successful implementation of the CDM; moreover, he invited the private sector to contribute to its development (IISD, 1998, page 4). Participants identified one way to contribute to its development, namely the support of developing countries in setting up CDM administrations. Based on the experience Costa Rica had made in its AIJ Program, participants stressed the need for duly designed national administrations to address the needs of the private sector. Without administrations that were supportive of private actors, the latter would not be interested in investing in such a system.

At this conference, discussions continued on how much one could learn from AIJ to develop the CDM. While some participants described their experiences under AIJ and how they could be used under CDM, others feared that the CDM would be just a new AIJ. Franz Tattenbach for example, a delegate from Costa Rica who had constructed a national emission trading system in the country, hoped to move the CDM into a fully-fledged global carbon market, and not just simply an AIJ with credits (IISD, 1998, page 7).

Soon after this conference UNIDO set up an ad hoc working group on the CDM in cooperation with the United Nations Conference on Trade and Development (UNCTAD), the United Nations Development Programme (UNDP) and UNEP. This group met three times between September 1998 and Mach 1999. It included participants from governments, NGOs, consulting firms, utilities, industry associations and international organizations. This group continued on the framing of the CDM as a catalyst for private investment. It started with the claim that the "CDM creates a commodity (GHG/carbon equivalent units) and aims to provide mutually shared benefits for investors and hosts. As a mechanism intended to channel private sector investment towards climate friendly projects, the CDM

aims to support the development of a new set of international arrangements for public/private partnership" (Stewart, 2000, page 1).We have seen in the above sections that such interpretation was still disputed in the international arena. However, the authors diagnosed that such interpretation had gained ground in international forums, and through their report they tried to develop on this interpretation. They claimed that there was a lack of private CDM project capital, which would continue to persist until policies, rules, procedures and institutional arrangements were installed that regulate investments (Stewart, 2000, page 8). They suggested that these rules could be developed into a "learning-by-doing" approach. Private investors should start with early CDM projects. Experiences in baseline-setting, monitoring and certification of emissions reductions made in these projects should then provide insights for the negotiations. It was thus an advancement of Kok Kee Chow's invitation to private actors to assist in developing the mechanism, a suggestion for a bottom-up development of rules. The rationale was to move towards an operational mechanism as soon as possible. It had become more and more clear that the CDM could not be properly regulated by the end of 1999. However, for the ad-hoc group, the CDM's advantage compared to the other mechanisms was that it could start by January 1, 2000. For the other mechanisms, JI and emissions trading, banking was not allowed. Thus, they would only generate credits from 2008 onwards.

While there had still been some dispute about the learning AIJ provided for CDM, "[i]t was agreed that early CDM project initiatives should build on experience and knowledge acquired during the AIJ pilot phase"(Stewart, 2000, page 45). Particularly baseline setting and monitoring, as well as experiences in the sharing of project values among investor and host country, were elements one could use in the CDM. Interestingly, however, the reason as to why early CDM activities were to be built on AIJ experiences was that these experiences were already available. Participants accepted that they worked, despite a lack of systematic evaluation.

It was the starting point for intensive activities, mainly by the OECD, UNEP and IEA, to develop workable baselines for CDM projects. Over the next years, the Annex 1 research group (AIXG) and the OECD analyzed baselines and baseline setting methodologies, starting with an analysis of experiences made under AIJ (Ellis, 1999), proposing standardized emission baselines (OECD, 2000), and conducting workshops to test and further develop this proposal (UNEP et al., 2001, page 20).[13] In this process, the principles outlined at the OECD "moving ahead" conference were inscribed into baselines. In the first publication, "Experience with Emission Baselines under the AIJ Pilot Phase", the authors argued that "any future recommended baseline method(s) should be set up in such a way as to balance the encouragement of widespread use of project-based mechanisms with the need to ensure that their use does not undermine the ultimate objective of the FCCC" (Ellis, 1999,

[13] The Annex 1 Expert Group (AIXG) consisted of government delegates and experts from Annex 1 parties and aimed to address analytical issues related especially to the commitments of Annex 1 Parties under the UNFCCC. The papers produced intended to inform member countries about climate change negotiations (OECD, 2000, page 8). Besides the production of analytical papers, AIXG conveyed workshops and side events at the COP negotiations to propose the introduction of feasible baselines for offset mechanisms (IISD, 2000).

page 7). The authors realized the regulatory nature of baselines and recommended setting them in a way that would reduce transaction costs while maintaining environmental integrity. Evaluating AIJ projects, they concluded that overrigorous baselines would discourage private investors from investing in the mechanism, as they would increase transaction costs, and baselines that were too lax would undermine the credibility of the mechanism. To address this dilemma, the authors suggested standardizing baselines. This would, they argued, reduce transaction costs while maintaining environmental integrity. In the major OECD publication on this matter, "Emission Baselines – Estimating the Unknown" (OECD, 2000) they suggested some standardized baselines for specific sectors.

To influence the negotiations with these insights and to find policy allies, UNEP, IEA and OECD organized a workshop on baseline methodologies in June 2001. Over 100 participants from 40 Annex 1 and non-Annex 1 countries, and encompassing representatives from governmental, international and non-governmental organizations, academia and business, attended. Kok Kee Chow, chair of the UNFCCC negotiations on the Kyoto Mechanisms, chaired this workshop. Its aim was to spread and discuss the insights from these baseline analyses and experiences and to start an enduring technical dialog to identify consensual and challenging areas with regard to baseline development. And indeed, workshop participants suggested developing standardized baselines as the best way to balance the trade-off between stringent emission baselines and low transaction costs for project participants (UNEP et al., 2001, page 7). The only point of dissent was with regard to concrete criteria, as well as about the question of whether baselines were sufficient enough to determine additionality (UNEP et al., 2001, page 18).

The proposed standardized baselines were developed within the framing of the CDM being a private investment mechanism. The equity principle mentioned in earlier documents – distributing the potential wealth of the CDM among all Parties –did not find its way into this calculation. The framing of CDM under the principles of environmental soundness and economic attractiveness had, by then, attracted such a comparatively large group of experts in the expert and international arena, that other framings were not discussed anymore.

This section has shown how an experimental collective expanded, in which a framing of the CDM as a private investment arrangement was taken for granted. The experimental collective increasingly sought to build alliances with private actors. Thereby the framing of an investment market increasingly turned to an understanding of a fully-fledged market in which carbon is commodified and could be traded. The collective also constructed methodologies based on the framing of a private investor market. These methodologies were supposed to reduce costs for the investors while maintaining the required degree of environmental soundness. They were based on methodologies and accounting procedures developed in AIJ. Expanding and aligning them with private actors meant that they were adjusted. In AIJ, methodologies to monitor and verify emission reductions were developed without reference to their costs; now transaction costs were incorporated into these methodologies, so that they would not discourage private investors.

Expanding governance arrangement through alliances with private investors: The World Bank Prototype Carbon Fund (PCF)

Already in 1996, the environment department of the World Bank proposed establishing a US$100 million carbon investment fund, the Prototype Carbon Fund (PCF). In February 1997, World Bank president James Wolfensohn approved the development of such a fund, which he made public at the UN General Assembly in June 1997. In consultation with stakeholders, prospective fund participants and clients, the World Bank worked out the fund's design, its governance structure, rights and responsibilities and portfolio criteria (Kelly and Jordan, 2004, page vi). In 1999, the World Bank established the PCF with the objective to pioneer CDM and JI and to disseminate the lessons learned. It was a public-private partnership consisting of six countries and 15 multinational corporations mainly from the electricity sector, and was capitalized with US$135m.[14] Operation of the Fund started in April 2000, and in October it published its first findings. By then, it had identified 25 projects eligible for PCF funding, of which five were endorsed by the host countries as CDM projects. To get PCF funding, those projects were subject to a validation and verification procedure adopted from the project cycle procedure that the UNFCCC subsidiary bodies were discussing for CDM. At this time, 11 projects had undergone this procedure until the validation phase (The World Bank, 2000, page 11). Based on this experience, PCF estimated the total costs for CDM-like procedures, and developed recommendations to be considered at official negotiations regarding the operational rules of the CDM. It recommended that the CDM and JI should start immediately, thus promoting a "learning-by-doing" approach for the development of policies and rules of CDM and JI. Its experience showed that the projects and their policy environments are diverse, and so it argued that any guidance to develop projects should evolve through practical experience, instead of in a complex upfront development that tries to do justice to the diversity of projects. Furthermore, it strongly argued that small scale projects should be treated differently. As transaction costs were too high for those projects, it suggested streamlining the validation and verification procedure (The World Bank, 2000, page 4).

The Fund described itself in the following manner:

> [t]he Prototype Carbon Fund (PCF) is a private-public partnership that aims to mobilize new and additional resources to address climate change and promote sustainable development. In addition, the PCF aims to provide an opportunity to "learn by doing" in the development of policies, rules and business processes for the achievement of emissions reductions under CDM and JI. The PCF believes that substantial learning will result from identification, preparation and approval of CDM and JI projects and intends to place funds in 15-20 projects and identify, pre-

[14] Participating governments are Canada, Finland, the Netherlands, Norway, Sweden, and the Japan Bank for International Cooperation (JBIC). Companies include BP Amoco, Chubu Electric Power Company, Chugoku Electric Power Company, Deutsche Bank, Electrabel, Gaz de France, Kyushu Electric Power Company, Mitsubishi Corporation, Mitsui & Co., Norsk Hydro, RWE, Shikoku Electric Power Company, Statoil, Tohoku Electric Power Company, and Tokyo Electric Power Company. Governmental parties paid US$10 Mio, private parties US$5 Mio each. In 2000, two more companies joined the fund, bringing the capital of the fund to US$145 Mio. (World Bank, 2001)

> pare, and approve these in the first three years of its operation (The World Bank, 2000, page 2).

The Fund aimed at making climate change attractive for private capital. Starting from this purpose, it offered an opportunity to practice learning by doing. This involved learning which policies, rules and procedures would work best to attract private capital. Part of the fund was PCFPlus, an information dissemination project. It tried to increase awareness as widely as possible the experiences it had made in the PCF. World Bank staff participated in the Conferences of the Parties and workshops at UNFCCC level; it aimed to build capacities in potential host countries and launched a website to inform an interested audience about its experiences. This project and the learning module was an important element of the PCF.

The PCF had two purposes. First, it promoted and experimented with a funding model; and second, through building alliances it translated the experimental experiences the World Bank had made with its AIJ projects to the realm of climate governance.

Unlike its AIJ experiments where the World Bank together with particularly Norway invested in single projects, the PCF saw the institution experiment with a global multilateral public-private model. Interested investors capitalized the Fund, which then identified, prepared and approved individual projects for funding. For this procedure, the World Bank installed a standardized procedure. Projects had to submit an idea, prepare a feasibility study, which included a baseline study and a monitoring and verification protocol. The project would then be validated and a carbon purchase agreement negotiated. If validation of the submitted documents was successful and an agreement found, the project would be approved and receive funding (The World Bank, 2000, page 7).

At different stages of the approval process, as well as in setting up the whole fund, the World Bank used its experiences it had made with its AIJ experiments. The World Bank was active in four AIJ projects and had tested how projects could monitor and report their environmental benefits and their additionality, as well as how much the approval and verification process of projects cost. It turned out that the operational costs of projects were higher than expected and, according to the World Bank's interpretation, made some projects unattractive. In the ILUMEX project for example "[t]he total project cost was about 23 million of which approximately 75% was used for the acquisition of the CFLs. If the project costs were entirely attributed to GHG reductions, one Mg of $C0_2$ would cost approximately $30 USA. The cost per unit of $C0_2$ becomes negative, however, if the value of the avoided electricity generation is considered" (Heister et al., 1999, page 248). US$30 was definitively too much to attract investors. At the time, a price of about US$10 per ton of carbon was discussed, making a project like ILUMEX categorically unattractive for investors. However, as Heister and his colleagues argued, the costs of emissions reduction depended on the evaluation frame. Project leakage, the effect of the project beyond its borders, was a hot topic in accounting for GHG reduction projects ever since the inception of JI, and the World Bank now had concrete figures relating to the effect. If the emission reductions of the project beyond its borders were considered, it would have in fact been an

attractive project. The investor would earn money when investing in the project. This experience fed into the development of the baselines.

The AIJ projects particularly demonstrated that bilateral deals would be costly and risky for the investing party, be it a government or a private investor. "Therefore, much thought has been put into the concept of a portfolio approach whereby financing for projects can be pooled into a fund mechanism. In this case, the transaction costs and risks can be minimized and diversified through a portfolio that de-links potential investors from specific projects and their risks" (Heister et al., 1999, page 276). The idea had been discussed for some time already. With the PCF, the World Bank offered an alternative to the individually financed projects.

The World Bank promoted this governance arrangement which was based on AIJ experience as an experiment that works, and it was "keen to transfer this know-how to the participants in the evolving GHG market, and, most importantly, to its client developing countries" (Heister et al., 1999, page 278). The World Bank promoted the experience and expertise it gained in AIJ and in the PCF as neutral information, seeing itself as an intermediary that translates the results from the experiments to the real world. Private investors and developing countries should benefit from what they had learned, it felt. However, as we saw, the experiments were based on the purpose of making emission reduction projects attractive for investors. The baseline methodology and approval procedure the World Bank tested in the PCF experiment were adjusted to the central principle to make climate change mitigation attractive for investors. They were designed to make investment less risky and to increase the return on investments.

With their orientation on the economic frame of business investors, the World Bank was able to expand its experimental results into the macrocosm. It was able to form alliances with big players, accumulate a comparatively large amount of investment capital and install itself as a knowledge hub in the field. However, this process was accompanied with a modification of the experimental results. The consideration of private participation now guided the evaluation of PCF. While efforts so far focused mainly on demonstrating that JI/AIJ projects worked and showcasing the methodological requirements necessary to make the system credible, the main concern turned towards achieving low transaction costs, while maintaining environmental integrity. The whole fund was established to reduce transaction costs and the requirement to attract private investments diffused into the technical aspect of baseline setting as well: "It's important to establish the right degree of rigor in baselining. Overly lax baselines will threaten the system's credibility and usefulness, and shift rents from high quality providers to low quality providers of offsets. Overly stringent baselines will discourage valid projects and drive up project costs" (Chomitz, 1998, page i).

Thus, with the focus on private sector investments being a requirement for the governance of emission reductions transaction costs – so far only been addressed peripherally – became a key issue. The last years had shown a lot of effort to argue that project-based mechanisms resulted in global efficiency gains. It was a discussion between the two principles of economic efficiency and responsibility. While the claim of efficiency gains was increasingly

accepted, it turned out that, in practice, this efficiency gain was not reflected in individual projects. For the World Bank, the AIJ experiences showed that there was a trade-off between the efficiency requirement and the requirement for environmental effectiveness. The World Bank argued that to make the CDM attractive in a wide range of countries and for a wide range of technologies, regulation had to strike a balance between them (Lecocq, 2003, pages 703–4).

With the Fund, the World Bank became a central authority in global climate governance. It administered US$180m; it identified, developed and approved projects; and it developed a procedure to govern emission reduction projects – all this based on an economic frame that expresses in terms like risk, transaction costs, investors and portfolio. With the PCF, the World Bank positioned itself in the global climate governance arena as an authoritative governance subject equipped with the relevant knowledge and power.

The PCF was important as it could link business with climate governance. While the extent to which the CDM would indeed generate tradable credits was still being disputed in the international negotiations, the PCF did already attempt to commodify emission reductions into CERs. With the approval procedure, it did not only discursively propose a way how this commodification could look like; it also practically introduced an institutional arrangement that translated the emission reduction into a commodity. The PCF guaranteed through its verification and certification procedure that the projects it sponsored would result in emission reductions and it assumed that, finally, these emission reductions could be used under the CDM or JI mechanisms. Thus, governments and private business invested capital in the Fund, hoping to get these certificates in return. With the procedure, which resembled what had been experimented within e.g. the USIJI, the credits were dislocated from the specific sites; and while there was no guarantee as to whether these projects would indeed result in some financial return, investors hoped that somehow, at the end of the day, this would occur. The World Bank started searching for projects that could reduce emissions, and via the PCF it offered the projects US$4 per Certified Emission Reduction (CER). It then transferred these CERs to the investors who hoped to use them to offset their emissions under the CDM in the future. This practical doing of projects, the size of investments, as well as the visibility the World Bank gave to the CDM, made the PCF very influential as one of my interview partners, who was involved in the international negotiations at that time, said:

> But they certainly had a big role. I mean I think what was really instrumental actually at the time was, the PCF was actually going out and they were trying to do projects… they were certainly very early in the game. And they were big. And; you know at the time they were big. So, yah, they have an influence not only in (2.0) getting early experience on what actually works but also has a contribution in terms of bringing visibility to the CDM and its good to have a prestigious group like that get interest into this thing. They are bringing some momentum (Interview T12).

This influence, however, also had a downside:

> I mean you mentioned the World Bank, they were clearly quite ambitious. They are … they do obviously have an interest in pushing themselves and their institution and they have very strong views but to their credit one must also say they were also really thinking about how that mechanism works. So you know you have, on the one side you have an organization which is pushing quite hard and trying to be very influential but on the other hand what they are providing is actually really useful for the mechanism. So that is why I say, at the end of the day it was all pretty constructive despite the fact that they have their agenda (Interview T12).

The PCF, as an experiment, became influential, because it provided workable solutions on a large scale as the first investor that collected money from different governments and business. But this experiment was driven by an interest to push the World Bank's interests and agenda in climate governance. The World Bank wanted the CDM to become an investment mechanism and was trying to push hard to make it start as soon as possible. They argued that a prompt start of the CDM, which would have allowed the crediting of projects from 2000 onwards without having clarified and decided rules, would have been possible if the Parties had accepted the learning by doing approach the World Bank suggested. Rules, procedures and modalities for operationalization, the World Bank argued, could best be developed when actually doing projects (The World Bank, 2000, page 2).

95 projects had been accepted within the AIJ program. These projects revealed results and were supposed to help learning about a potential JI mechanism. They were developed and implemented on a bilateral basis. The investing country either had a complex national program, like the USIJI, to which the projects reported and which evaluated the projects or only a few guidelines, as in several other countries. These projects still existed and created valuable insights into such a system. While the PCF build on these experiments, it was an experiment that tested an alternative governance arrangement, a multilateral arrangement with the World Bank being the central actor. It focused centrally on making the CDM and the new JI attractive for private investors, and it was quite successful. With its framing of JI and the CDM as an economic issue, as an investment with risks, and transaction costs one can calculate, it was able to attract major carbon emitters in a short time. While the discussion on the role of the private sector in CDM was in full swing in the international negotiations, as well as in academia, the World Bank had already successfully translated the political instrument into an economic one which was recognizable and usable for business actors. Investor companies such as RWE, Mitsubishi and Statoil could invest in the Fund, hoping for a rate of return of up to five per cent.

The PCF was an experiment with a carbon offset climate governance arrangement on a global level, an arrangement organized as a global multilateral fund. While AIJ was a framework for different national programs, which were connected via a reporting framework, the PCF had installed a globally applicable transnational procedure and institution. Private and public entities could invest in it, the World Bank identified projects, verified and certified them, and issued the certificates to the investors. With this procedure, it aimed to demonstrate that "investments under the project-based mechanisms of the Kyoto Protocol can earn export revenue for developing countries and countries with economies

in transition (EITs) and increase the profitability of cleaner, more efficient technology in energy, industry, and transport sectors" (Streck, 2004, page 315). This governance structure that was built on earlier experiences was the first of its kind and resembled well the procedure the Parties later adopted in Marrakesh for the CDM. It thus did not only demonstrate that investments work while implementing the CDM, as Streck argues, but it constructed this new multinational governance arrangement before it was decided at Marrakesh, demonstrated that it worked, and pushed for it to become codified in the modalities and procedures.

To sum up, the Prototype Carbon Fund was a mechanism to translate the experiences the World Bank had made with AIJ into a global climate governance arrangement. The World Bank had only so far accomplished a few projects in which they had tested and tried to demonstrate that joint implementation worked. To scale up these experiments and frame the climate governance arrangement as a whole, it was important to find allies that supported the idea of a global investment-based carbon offset governance arrangement. They were able to convince private and public investors to fund further projects for the purpose of testing and learning. To get them on board, however, they shifted the frame again towards the economy. Central concerns in setting up the project and in evaluating them were transaction costs and investment risks. As a consequence, the PCF evaluation demonstrated that projects should be regulated by market forces and not by political regulatory bodies, that emission reductions should be considered as a tradable commodity, and that emission reductions should be fungible between the different flexible mechanisms of the Kyoto Protocol (The World Bank, 2000).

Conclusion

This chapter discussed the process of how experimental activities were expanded into the macrocosm. Therefore, it covered the international negotiations after the Kyoto Conference, the activities of a transnational experimental constituency, and the experiment of the World Bank. Centrally, it showed the three dimensions in which actors tried to expand it. Discursively, actors tried to establish the experimental activities as facts; on an actor dimension, they build alliances with influential actors; and materially, they pragmatically used the material developed in the experiments for the construction of a new global governance arrangement. The resulting governance arrangement was an expansion of a particular and increasingly dominant framing of the arrangement, namely a private investor market arrangement. It was the adjustment of the economic model of marginal costs developed in the paper world of economics with the macrocosm.

This chapter illustrated that this expansion was not straightforward. While in the construction process there were some different framings discussed in the experimental constituency, only one frame successfully. Other framings were excluded. In this process, the experimental activities were also adjusted to the interest of new actors. They were adjusted to the interests of industry and private actors who demanded monetary incentives for participation. This adjustment happened in the construction of methodologies, as well as in the

construction of a multilateral fund which aimed at reducing transaction costs and investment risks.

Like in the other phases, the chapter also showed how the expansion of the experimental activities happened before a formal decision was made during the international negotiations. The World Bank constructed a multilateral public-private fund that invented a carbon commodity at the time India insisted that the CDM did not create a commodity; the transnational constituency defined the CDM as a private investor market before it was accepted in the negotiations; and in the negotiations, they accepted the expansion of methodologies in which a private investor market was reified, although they had not by that point decided for such a market yet.

8
Conclusion: A Theory of Governance Experiments

In the introduction to this book, I described two situations of international climate governance. The first one – in the late 1980s and early 1990s – saw a variety of proposals for a future climate governance regime. Climate change was about to be framed politically and possible alternatives were based on efficiency or responsibility. Possible policy responses ranged from markets to industry standards, from national to international programs, from technology transfer to sustainable development. These responses were already characterized by a close connection between science and politics, as seen in the Intergovernmental Panel on Climate Change (IPCC), and a technically framed discourse. The second situation in the early 2000s saw a global private investor market as a main pillar of the international climate regime, as laid down by the United Nations Framework Convention for Climate Change (UNFCCC). It was a new political order in climate governance; an order that rested on private investors, developed and developing countries, a rationality of efficiency, and a modernist attempt to regulate and measure the climate with accounting tools. This situation was characterized even more by a close interrelation of science and politics. Scientific models defined what could be measured, how and by whom, and thus defined what could be taken into account in this new order.

My research was triggered by the question how this new political order emerged.

Discussing governance, governmentality and performativity literature, I proposed a perspective that understands the construction of governance as a performative practice of constructing a new political order, which I called a "governance arrangement". These arrangements have an actor, and a material and discursive dimension, and I developed a model to analyze the emergence of governance arrangements in these three dimensions. Central to this model is the concept of secluded experimentation; these are practical interventions into existing arrangements with the purpose to test and demonstrate a claim secluded from an enigmatic world. This analytical model allowed me to conceptualize the development process of climate governance as a process of reducing the world into experiments, constructing experiments and expanding the experiments to the wider world. I introduced an understanding of politics which allowed me to interpret this experimental process as a process involving genuine politics. In the experiment new realities are constructed, not only existing realities observed, my argument went. Equipped with this model and its conceptual propositions, I then turned to my case study, the construction of the Clean Development Mechanism (CDM) in the period between 1988 and 2001. Guided by my research question of how a new climate governance arrangement was constructed in a process of secluded experimentation, I analyzed this period in which the CDM was constructed as a global private investor market.

In the second part of this study, I analyzed this process. I drew attention to the international negotiations about what in the end became the CDM and to different experiments in which public and private actors practically tested and demonstrated a market-based governance arrangement. Recurring controversies in the period were whether cost-efficiency should be the principle that guided climate governance; whether developing countries should participate in a climate governance arrangement; and whether climate governance should be organized around a market with private investors playing a central role. In the new governance arrangement, CDM, these controversies were solved. It was organized around cost-efficiency, the incorporation of developing countries and the market as a form of governance. I argued that this development happened in experiments in which a new market based governance arrangement was performed according to economic models.

Yet, the story does not end in 2001. After the Conference of the Parties (COP) adopted the rules that made the CDM operational, private and public actors at first tentatively, and later on massively, invested in this emerging carbon market. The first projects were inaugurated in 2004, the first trading took place in 2005, and by October 2012, more than 1 billion credits have been generated, representing more than 1 billion tons of CO_2 emission reductions; more than the annual amount of Germany's emissions (BMWi, 2012). For some years, there was a "gold rush" (Michaelowa and Buen, 2012), accompanied by intense controversies ignited over the concern of additionality of some projects. Researchers estimate that only a small proportion of projects were duly additional (Wara and Victor, 2008). Furthermore, particular projects came into the focus of critique, primarily hydropower and industrial gas projects. They were accused of violating human rights in general, the rights of indigenous people in particular (Carbon Market Watch, 2011; CDM Watch, 2012) and providing perverse incentives to generate more emissions (Schneider, 2011). In reaction to the critique over the last 15 years, the CDM has been continuously refined and adjusted. NGOs are present at meetings of the CDM's executive board and thus have a chance to voice their critique and even sometimes are able to introduce change in rules (Interview T4). Documents are made public, making the CDM comparatively transparent; participation of private actors is comparatively high (Stripple, 2010, page 75).

The CDM still exists, although many observers declare that it is dead (Interview T9, T12, T2, BT). Prices for carbon offset units rose for some years until 2008, since when they have constantly dropped. Nowadays, a Certified Emission Reduction (CER) costs about US$0.30, attracting no more investments to new projects. Thus, the CDM reflects a development we can observe in climate governance in general: since 2009, enthusiasm for carbon markets has declined (Acworth and Lövbrand, 2012, page 5); today the future of market-based solutions is uncertain (Lederer, 2013). This does not mean that they are no longer part of the portfolio of climate governance; new market mechanisms are discussed in international negotiations – albeit with slow progress in any direction (Höhne et al., 2015, page i). Particularly, in recent years, carbon markets have developed in regional and subnational levels. At these levels, markets have flourished (Höhne et al., 2015; Lederer, 2013).

This concluding chapter aims at developing a theory of governance experiments. Therefore I will, first, refine my analytical model based on my case study; second I will discuss this

theoretical model with regard to its political implications, its theoretical contribution and its empirical application. In the last part, I will discuss what we can learn from this study for the practice of governance experiments. I will suggest drawing attention to safeguards which would make further experiments more responsible.

Elements of a theory of experiments

In chapter 3, I proposed a conceptual framework to analyze the construction of new governance as a process of the performation of governance arrangements in experiments. This framework enabled the researcher to analyze this construction as processes of reduction, construction and expansion which need to be analyzed via discourses, actors and technologies. I used this framework for the analysis of the construction of the CDM. What can we generalize now from this study?

This question is particularly problematic when it comes to implementing case studies. Yin argues that one should refrain from trying to make an argument for a statistical generalization. A case study is not a small sample of a phenomenon, he insists. One cannot generalize from the case study to a larger population (Yin, 2005, pages 31–33). Instead, what a case study can offer is an analytical generalization. Analytical generalization implies an understanding of the empirical case as a test case for the model. It is not the case that can be generalized as a sample of a larger population – my case study is not generalizable to all carbon markets or all forms of climate governance – instead, it is the theory that can be generalized. To achieve this form of generalization, I developed a model which I used as a template with which I compared my empirical case. Enriched with a thorough understanding of the one case, I can now generalize this model into a theoretical model of the performation of governance arrangements in experiments.

Reducing the world

I analyzed how an economic model performed a global governance arrangement. In the first phase, an enigmatic world is reduced to controllable experiments that aim to test new forms of governance. In this phase, economic actors simulate climate governance in-vitro, calculate the costs of different scenarios, and conduct first small-scale in-vivo experiments. These experiments reduce the macrocosm of global climate governance into a controllable test field. In these experiments, the world is reduced to plants, trees and greenhouse gases, companies, states, consultancies and NGOs, and to an economic rationality.

The in-vivo experiments are small-scale projects that already exist and which are adjusted to the experimental objective. Actors seek for existing projects which they can modify, so that they demonstrate and test the economic model in the real world. This adjustment mainly works through the establishment of monitoring and reporting instruments. Once installed at these projects, the macrocosm is reduced to the elements the instruments are able to detect. The instruments the experimental actor installs differ from those of other experiments, and so does the reduction of the world. The concrete reduction that happens

in an experiment results from an adjustment of the economic model the experimental actor wants to install with the macrocosm at the experimental site.

These reductions are demonstrated to the macrocosm of existing governance. They are supposed to show how a future governance arrangement could, and should, look like. At that point in the process, alternative non-economic rationalities exist, which contest these demonstrations on ground of its underlying framing. Alternative in-vivo experiments are conducted that contradict the initial demonstrations. They are attempts of counter-performation (Blok 2011). As a result of the performation struggle in the macrocosm between the different experimental demonstrations (Callon 2007), actors formulate a compromise; they initiate further experiments as controlled attempts to test new forms of governance. These controlled experiments are attempts to seclude the construction of new governance arrangements from the political world. Instead of being the result of political bargaining, power and interests, decision-making is framed as a scientific process. With testing, monitoring and evaluation, a scientific process should reveal a best practice.

Actors reduce the world to experiments and thereby inscribe a specific framing into the experiments. Experiments can reduce the world differently, and what is tested in the experiment, i.e. how the world is reduced, is the result of negotiation. This negotiation concerns particularly the construction of monitoring methodologies and of principles which should guide the experiment. Both are supposed to regulate the experiment and the reduction that takes place in it.

Constructing the governance arrangement in secluded experiments

In the second phase, new governance arrangements are constructed in the experiments. They are constructed by an experimental constituency which just emerges in this context (cf. Voß, Simons 2014). This constituency is assembled around the experiments and in processes of exclusion and alliance building, it interprets and formulates the objective of the experiment. In publications and conferences, it interprets data of in-vitro simulations and in-vivo experiments. It interprets the data of the experiments and turns them into recommendations for particular governance arrangements. When it interprets and promotes its interpretations as scientific evidence, it constructs and promotes specific framings of the governance arrangement. Over the course of constituency building, model developing and recommending governance arrangements, a particular framing becomes dominant.

The constituency also constructs in-vivo experiments, where it adjusts the paper world of economic models to the real world (Callon 2007). Both – model and real world – need to be modified. Actors need to be convinced to participate and invest in the experiment; they need to be trained to act according to the model; methods need to be installed to measure the relevant data; and agencies need to be constructed to approve and authorize the experiments. Thereby, actors, agencies and methodologies are modified to test and demonstrate the working of a particular governance arrangement. Such an arrangement is materially constructed in these in-vivo experiments. Also the economic model is adjusted to the experiences. The constituency evaluates the in-vivo experiment and further develops the theo-

retical model. For example problems of monitoring are identified and translated into theoretical problem of transaction costs and incorporated into the economic model.

With the help of the in-vivo experiment, the constituency turns the economic model into a fact. The experiment provides empirical information, which the constituency interprets according to an economic rationality. Based on this interpretation, it recommends a new governance arrangement.

In the construction phase, actors devote particular energy to the construction of methodologies, accounting procedures and reporting formats. They are the instruments that reduce the macrocosm, control the experiment and enable testing of the new governance arrangement. What the methodologies enable to measure and the reporting formats enable to demonstrate, defines what can be learned. This information is the basis for the evaluation. Only through this process of evaluating, can information be turned into a scientific fact. Knowing this, actors are keen on constructing these instruments in a way that includes and excludes certain elements of the macrocosm. They try to inscribe an economic rationality into these instruments.

This process of constructing governance arrangements in experiments happens in seclusion, i.e. undisturbed from the political processes of international negotiations and undisturbed from the material and discursive contingencies of the macrocosm. Seclusion is a relative term. The US experiment for example was not secluded from the tedious process of domestic political negotiations, but from those of international negotiation. Once it was demonstrated at UN level, it was presented as an experiment, and the UN audience was excluded from the activities that had been introduced to the experiment to make it work. These experiments are also materially secluded from the macrocosm. The experimental constituency analyses the world through the instruments it constructed. It negotiates the interpretation of data these instruments generate and it refines and adjusts the instruments according to these interpretations.

These reporting formats and methodologies are also the instruments that enable actors in the macrocosm to regulate the experiment. They define the principles the experiment has to take into account; the objective they have to test; and how the world is reduced in the experiments and how it is expanded. Setting up the regulation of the experiment is thus the result of negotiations between those who want to restrict the experiment as much as possible, and those who want to give the experiments as much freedom as possible.

Expanding the governance arrangement

In the third phase, the governance arrangement expands. The arrangement, which the experimental constituency has constructed in experiments, leaves the confined walls of the experiment via three channels: the instruments are used outside the experiments, the actors who construct the experiments ally with new and powerful actors to construct new experiments, and the rationality that guided the experiments turns into a scientific fact accepted by relevant actors. In this process of expansion, the governance arrangement adjusts to the macrocosm. The experimental constituency looks for allies to gain access to funding and

other resources and set up the arrangement outside the experimental boundaries (Callon et al 2009). It is a necessary condition to make the expansion successful. Within this process, merely a few framings leave the experiment. Those which are not able to adjust to the interests of the new actors do not expand. This expansion thus limits the different activities that have been undertaken and discussed to a few ones which are also workable outside the experiment. The relative openness of different approaches within a guiding rationality that characterizes the experiments is reduced.

Those actors of the experimental constituency that are able to knit alliances also get authority on the experiments. To those outside the experiment, they provide information and experience. Thus, they are able to frame the experiment and push a specific version. They become an intermediary between the experiments and the macrocosm.

This process of alliance building involves the adjustment of instruments to the interests of the new actors. Actors outside the experiment have less interest in testing and demonstrating. In the case of economic actors, they provide financial resources if they get monetary results in return. An adjustment of instruments to this economic interest can enable a higher rate of return, and thus enable an increasing interest of these actors in the new governance arrangement. Instruments that take into account transaction costs as much as, or even more than, environmental benefits, may help in this regard. In the case of political actors, they provide political authority if instruments are adjusted to their political interests. In my case, we saw that instruments that restricted the use of emission reductions abroad and that provided additional funding, helped to increase the interest of political actors.

In the process of expansion, the experimental activities turn into scientific facts. Increasingly, evaluations and their interpretation of the experiments are accepted. Thus, the controversies within the experimental constituency over certain interpretations are silenced.

Expansion also has a pragmatic element. Methodologies, technologies and procedures that have been constructed in the experiments are taken toward new sites, because they are available. This channel of expansion is possible if these elements are successfully framed as technologies. Therefore, the controversies that accompanied their construction need to be black-boxed. Actors assume that these technologies work, although this might still be contested in scientific controversies.

Discussion

This model distinguishes between three phases in the process: a phase of reducing the world, a phase of constructing a governance arrangement in experiments, and a phase of expanding the arrangement into the macrocosm. While each process happens in each phase, this distinction highlights which process is dominant. With this phased model, I merge the literature on experiments in STS with the literature on experiments in governance and governmentality studies. The former provided the distinction of the process, as well as tools to analyze in-depth how new social order is constructed in experiments. Thereby it remains, however, on a micro-level, only studying specific local situations (e.g.

MacKenzie and Millo, 2003; Rheinberger, 1992). The processes do not demarcate phases. The governance literature on the contrary understands experiments as elements of an innovation process (e.g. Hoffmann, 2011; Jordan and Huitema, 2014). They are niches in which new forms of governance are developed and tested. However, they have little to say about how these experiments expand and result in innovations in the macrocosm (with a few exceptions, e.g. Paterson et al., 2014; Voß, 2007). These analyses focus on meso- and macro-level change and thus imply a time dimension in their analysis. Governmentality as a third strand of literature allowed me to focus my analysis on the construction of governance rationalities in these experiments and to understand the emerging governance arrangement as a new political order (see chapter 2).

Seclusion and the politics of governance experiments

I characterize the experiments as secluded to stress the constructionist element of experiments. Experiments do not uncover objective facts but construct a reality. In experiments, a lot of labor goes into the construction of instruments, the interpretation of inscriptions instruments produce, into the negotiation of principles that define the experiment, and into the modification of the world it is supposed to observe (cf. Knorr Cetina, 1995, page 148; Muniesa and Callon, 2007). An experiment is secluded from the world, as what is tested and demonstrated in the experiment is translated from the world. Translating implies a transfer of the world to another place, for example to a research department that simulates climate governance according to an economic model, as well as the conversion of an enigmatic form of the world to a controllable form (Callon et al., 2009, page 49). What is tested in the experiment is, thus, different from the macrocosm. In the experiment, an experimental constituency modifies the world, so that it can test certain characteristics. It is thus materially secluded from the world.

An experiment is also secluded from a wider public. The work that is carried out to make the experiment work is invisible, once the experimental results are accepted. Seclusion from the public is achieved through technicalization and the establishment of a small and very specialized group of experts. The discourse on new governance arrangements is framed as a technical process and separated from other politically framed concerns. An experimental collective negotiates the experiments and their results and the wider public only has access to aggregated numbers and charts that were already discussed among the members of the experimental collective; these numbers are presented as facts, and all the effort that was invested into producing them is hidden. To become part of the experimental collective, one needs to become an expert on the topic. As expert, one can attend, and is invited to, workshops and conferences and can contribute to the joint experimentation.

This argument is similar to the discussion about technologized and secluded politics (see e.g. Edkins, 1999; Page, 2001). However, in this discussion, an objectivity of facts is generally assumed. Technologized or secluded politics is thus 'only' problematic from a democratic point of view, as it withdraws decisions from public scrutiny. The experimental collective is not politically legitimated to decide on a collectively binding reality, is not accountable for the experiments, and does not even carry full responsibility for the process as

a whole (see for a discussion of legitimate governance: Kronsell and Bäckstrand, 2010). This problem amplifies when experiments are used strategically to advance towards a new governance arrangement. Political, economic and scientific actors can use experiments to move beyond what is discussed and permitted in the governance world, hoping to influence the discussion and to push it into a specific direction.

In a constructionist vain, governance experiments are even more problematic, as they do not reveal the truth. Instead, they construct a new political order as a result of powerful actors. A governance experiment is a process in which actors try to convince others of the validity of their claims. They demonstrate a certain claim and need allies to establish this claim as truth (cf. Collins, 1992; Shapin, 1988). Getting these allies on board implies a change of the experimental results. It is a continuous struggle over performation. What happens in a secluded experiment is thus politics in the sense of constructing a world we have to live in – not only a seclusion of decisions.

However, it is possible to move an experiment out of seclusion to some degree. This can happen in the form of regulations. Either the experimental constituency tries to push the governance experiment out of its seclusion by demanding more political regulation, or the actors in the macrocosm try to pull it out of its seclusion by standardizing and regulating what the experiment is allowed to test. The latter might be a case in which "orphan groups" (Callon, 2009, page 540) establish who see their interests in peril by the experiment. Local actors and indigenous people who are affected by the emissions, hydro and power plants and plantations of field experiments, constitute a new political group and demand the right to participate in the experiment, to suspend or even stop it. The recent history of the CDM provides several examples of such groups that emerge (Interview T1), as well as reforms of the governance system of the CDM that increased their access to the experiments (see for a discussion of the local stakeholder consultation process in CDM projects in China: Dong and Olsen, 2015). But also politicians, delegates and other political actors attempt to regulate the experiment, as my analysis showed. By negotiating on methodologies, reporting formats and accounting procedures, they standardize what the experiments are supposed to test, how they ought to reduce the world, and how to expand the experiment to the world. The former – attempts to push the experiment out of its seclusion – is a case we can find when actors in the experimental collective demand politics to regulate the boundaries of an experiment. They demand that olitics should regulate what can be tested and define a common standard. It is an attempt to reduce the variety of experiments and to solve the experimenter's regress (Collins, 1992) by means of political authority.

At the same time, some attempt to maintain or even intensify the seclusion is made. Therefore, actors problematize the issue as technical and scientific. Actors discursively try to install and maintain a boundary between the scientific experiments that reveals empirical basis for decisions and the political sphere that negotiates about interests. As a consequence, technical venues form where experts meet, discuss and further develop the experiments.

Contribution to Literature

I developed a perspective that focuses on the construction of governance. It thus shifts the focus of interests in climate and environmental governance studies from the international negotiations and the international architecture (e.g. Biermann et al., 2009) and the role of influential actors in these negotiations (e.g. Newell and Paterson, 2010a) to the experimental process. Contrasting governance literature, I understand governance as a political order. Therefore, I conceptualize governance as an assemblage of rationalities, actors and technologies. This assemblage has the ontological status of a reality for those involved in it. Governance is thus not only a mode to govern beyond or without government (Rosenau and Czempiel, 1992) or, more generally, an activity of politics. It is the result of social processes that are not restricted to political processes. An appreciation of the process of constructing such new political order is the result of a social theoretical framing that has its roots in science and technology studies (STS). It is an understanding of the co-production of science and social order (Jasanoff, 2004b). In such an understanding "the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it" (Jasanoff, 2004c, page 2). It enables the interpretation and taking into account of how knowledge-making is incorporated into governance and "how practices of governance influence the making and use of knowledge" (Jasanoff, 2004c, page 3).

I took the recent interest in governance and governmentality studies in experiments as a starting point to embark on the endeavor to combine these studies with studies in STS on experiments. With the help of literature on experiments in science (Collins, 1992; Rheinberger, 1992; Shapin, 1988) and the literature of performative economics (Callon, 1998, 2007; MacKenzie, 2009; MacKenzie et al., 2007), I developed a framework that made me understand governance experiments as a process of reducing the world, constructing a new reality in experiments and expanding this reality back into the world. In combining these strands, I contribute to a growing body of research that takes this focus to environmental governance (Lane, 2012; Lane and Stephan, 2015; Voß, 2007; Voß and Simons, 2014).

I combined the STS perspective with a governmentality perspective to deal with governance experiments instead of experiments in science and economy. What is experimented with, I then argued, are new arrangements in which some actors become governance subjects, others governance objects and in which technologies served as a means to govern. In contrast to governmentality studies, my perspective was thus able to analyze the construction of a new political reality in practice, without taking the shortcut of a hegemonic discursive explanation, a methodological pitfall governmentality studies often fall in to (cf., Bröckling et al., 2011, page 17). Quite the contrary, instead of assuming an a priori rationality, my model can analyze how a specific rationality is constructed in a governance arrangement. The analysis of one specific governance arrangement and its rationality does not, I suggest, exclude the co-existence of other forms of climate governance and is able to take into account the multiplicity of rationalities (cf. Blok, 2014).

Scholars in the realm of governance and particular environmental governance became interested in experiments in recent years (Bulkeley et al., 2012; Bulkeley and Castán Broto, 2013; Hoffmann, 2011; Overdevest and Zeitlin, 2014; Sabel and Zeitlin, 2008). For climate governance, they identified a shift in the model of global climate governance from a state-oriented multilateral process toward an experimental form of governance, consisting of a multitude of voluntary activities (Bulkeley et al., 2012, page 159). In the making of EU law, they identified an experimental orientation in which trial-and-error and diversity is central (Sabel and Zeitlin, 2008, pages 273–74). What this literature has in common is an understanding of governance experiments as a pragmatic way of overcoming institutional deadlocks. These experiments result in an evolutionary learning process, which will eventually lead to a transformation of society toward a better state of affairs, namely a more sustainable society. Underlying this perspective is a rational understanding of experiments being a means to identify the best solution to an existing problem (see chapter 3).

Based on this normative understanding, authors in climate governance literature restrict governance experiments to an institutional vacuum (e.g. Bulkeley et al., 2012, page 150). However, such a normative conception is not able to address the full range of governance experiments, as my study exemplifies. The experimental process I analyzed took place in the heard of institutionalized international relations. The UN developed a framework for the new issue of climate change, and within this framework, governments proceeded in filling it by doing experiments.

My study challenges a rationalist understanding of experiments. It showed that in governance experiments, problems are constructed together with a solution in the form of an accompanying governance arrangement. Climate change was an issue and the problem it developed into for governance, a problem of cost-efficient climate mitigation, was constructed in the experiments. In a process of problematization, the issue was made governable (cf. Blok, 2014). The construction of a problem and its solution was not a subsequent process, but a process of pragmatist governance (cf. Latour, 2007; Marres, 2007). Moreover, the experiments I analyzed were not rational. According to Sabel and Zeitlin (2008), governance experiments link policy decision-makers with real world experiences. My case showed instead that it only linked them with specific interpretations and constructed realities. Thus, my study showed that experiments are not an element of an evolutionary learning process in which the best one ultimately wins. Instead, experiments are part of a political process in which the experiment that gets the most support is accepted.

Such a political understanding of experiments also has consequences for a conception of real world experiments, as conceptualized by Groß and colleagues (Groß et al., 2005; Overdevest et al., 2010). For them, the benefit of experiments stems from its ability to act under uncertainty. In an experiment, it is possible to try out ideas of which no-one knows whether they work and how the world reacts to them. They justify an experimentalist approach with the chance to understand better how the world works. It is again a rationalist perception of experiments. My study showed that this understanding is generated in the interactions of an experimental constituency. This constituency was not able to explore how the world is, but applied instruments that constructed a reality based on the model

inscribed into it. The constituency performed this new reality with the help of accounting technologies. Governance experiments thus do not help to reveal how the world works, but construct a new world and political order. Thus we cannot anymore justify experiments due to its ability to act in times of uncertainty. It would, however, be foolish to abandon experiments from the toolkit of governance innovation processes at all. The diagnoses of uncertainty and non-knowledge, of insufficient central planning and the ability of experiments to shape and transform governance are accurate. To uphold experiments, I suggest instead governing them in a responsible way. I will come back to this in the last section.

This study applies the notion of performative experiments to the field of international climate governance. Hitherto, the performativity of economics has been primarily applied to carbon markets as a case for markets, not governance (with some notable exceptions: Blok, 2011; Lane, 2012). This implies a concern about how actors become economic agents in this market, how an economic frame is constructed, how specific materialities are employed to enable the market and how nature turns into tradable goods (Callon, 1998). My study showed that this perspective can also be fruitfully applied to analyze governance. It enables the drawing of attention to how actors become governing agents, how a governance arrangement is constructed, how specific materialities and technologies are employed to enable governance, and how nature turns into objects of governance. This is possible through a combination of the performativity perspective with a governmentality perspective.

In chapter 2, I argued that the notions of frame and rationality provide a good entry point for combining these perspectives. While frames are the laws of economy, as they enable and contain calculation, rationalities are the laws of governance, as they enable and constrain governing. From my perspective, rationalities are performed in the practice of the governance arrangement as the discursive dimension of governance arrangements. My study supported this argument. I could show how the rationality of efficiency was constructed in the process of secluded experimentation. In this process, the original economic model of marginal abatement costs turned into a "discursive field within which the exercise of power is conceptualized, the moral justifications for particular ways of exercising power by diverse authorities, notions of the appropriate forms, objects and limits of politics" (Rose and Miller, 1992, page 273). This discursive field justified investments of developed countries in energy efficiency projects in developing countries, the attribution of authority to private companies and greenhouse gas reduction as the object of politics.

The theory of governance experiments I propose here productively combines a process perspective to governmentality studies. It thus contributes to understand how "an environmental issue framed in moral terms" developed into an issue that "is now mostly discussed in economic terms of cost-benefit analysis" (Oels, 2005, page 197). However, in contrast to Oels, it does not explain this shift on a macro level as the successful implementation of a new governmentality but as the successful performation of an economic model in experiments on the micro and meso level.

Combining the governmentality perspective with the performativity of economics perspective reveals for the latter the politics of experiments. Experiments are a central element in

performativity studies. They enable the identification of misfits and overflowings and thus can initiate a learning process. Callon (2009), MacKenzie (2009) and Latour (2004) argue that it is impossible to know beforehand what works and what not as the translation of a statement into the world always reveals problems. A governance structure that reflexively takes into account these problems is therefore necessary (Callon, 2009, page 536). For these scholars, experiments are only means to establish an order that works. Researchers should thus analyze critically the subpolitics in which statement and world are adjusted. It would contribute to a civilization of the market, as it would reveal what is included in the economic framing, and what is excluded. Pragmatically, it would help to improve the market.

However, this is an apolitical notion of experiments. As I argued in chapter 2, experiments, and in particular governance experiments, are political, as they change the world we live in. As Blok shows, it is possible that actors oppose the world that is constructed in experiments (Blok, 2011). For these opponents, it is not the question how to make the world work which has been constructed in experiments but to prevent the creation of this very world. The relevant political analysis should not investigate the subpolitics but the co- and counter-performation of experiments (ibid.).

My study contributes to this claim. It showed that experiments can be used strategically to impose a change, and that this is not restricted to NGOs and other actors from civil society. Governments also make use of the performative potential of experiments when they lobby for experiments to test and explore new governance arrangements. They use them strategically to move in a direction they are not able to move to in the political negotiations. In my case, opposition against private investor markets in developing countries was high, but in experiments it was possible for its proponents to construct such an order.

My proposal of a combination of both strands of literature, performativity and governmentality is not supposed to cover the theoretical problems such a combination accompanies. The problems are on a social theoretical level and primarily concern the different focus on the macro and micro level and the accompanied understanding of the order of the world (see chapter 2 as well as Blok, 2014 for a comprehensive discussion). Despite these problems, over the last years scholars became increasingly interested in such a combination (Asdal, 2014; Lovell and Liverman, 2010; Stripple and Bulkeley, 2014a). They see an advantage in the combination as a response to the complex and hybrid nature of issues in the world – not only, but also, the issue of climate change (Stripple and Bulkeley, 2014a). I agree with this diagnosis and attempt to contribute to this theoretical journey with this study.

Empirical limitation of my model and further research

Having developed a theoretical model of a performation process in governance, I want to tentatively delineate an empirical field, in which this model could be further tested and refined.

The model analyses the process of how new governance arrangements are performed in experiments. It is thus, first of all, limited to cases in which new (or presumably new) gov-

ernance arrangements come into being. The experiments are intentional and controllable interventions. This limits the model to governance processes in which there is an attempt to introduce new governance reflexively. Reflexivity describes "social practices [that] are constantly examined and reformed in the light of incoming information about those very practices, thus constitutively altering their character" (Giddens, 1990). This does not mean that the process has to be a form of top-down governing from the beginning. Quite the contrary, as my case study showed. Experiments are conducted by different actors, public as well as private, and on different levels. They are undertaken before there is a political regulation. They test and demonstrate a possible new political order with the aim of changing the existing one. These experiments, however, address policy. At some point in time, politics take up these demonstrations and initiate further governance experiments to reflexively innovate governance.[15]

This understanding of experiments makes my theory particularly suitable to processes in which science and scientific knowledge are important in the construction of new governance. The reliance on scientific models and calculative tools is extremely high in the climate issue, as well as in the whole domain of environmental governance. Unsurprisingly, most literature on governance experiments are either in the field of environmental governance and management (Bulkeley et al., 2012; Groß et al., 2005; Hoffmann, 2011; Overdevest et al., 2010; Overdevest and Zeitlin, 2014) or in the field of European bureaucracy (Sabel et al., 2012; Sabel and Zeitlin, 2008) which is also closely connected to experts and technocratic politics. Similarly, my case study was in a highly technocratic field. Potential further applications of this theory are thus other areas of climate and environmental governance.

My theory analyses how economic models become performative. However, all science is performative (Callon, 2007), thus it is not restricted to economics. Other potentially influential disciplines are political science, particularly governance literature (cf. Voß and Freeman, 2016) and law.

The extent to which this model also works in fields that can rather be characterized by social movement engagement – such as the current issue of migration – needs further investigation. Mirroring the model with fields in which science and technology play a lesser role sheds light on the danger this model implies and its limitations. It might reduce the emergence of new governance arrangements to the co-production of science and politics, or at least overemphasize them. While this emphasis lies in the theoretical roots of this study in a constructionist perspective (Jasanoff, 2004a; Knorr Cetina, 1995), for a comprehensive picture of the construction of new governance arrangements, a thorough engagement with social movements and civil society might be revealing. In this regard the limitations of this study stand out.

[15] Over the last years, some scholars have introduced a sociological approach of reflexive innovation into the mainly economically inspired discourse of innovation (Hutter et al., 2011; Schubert, 2014; Windeler, 2015). It was one major topic of the graduate school "Innovation Society Today: reflexive creation of novelty" at the Technische Universität Berlin. My notion of reflexivity and reflexive innovation is particularly influenced by discussions within this school.

The theory of governance experiments I propose here allows us to ask what, and who, has not been considered in the experimental process. It illuminates the role of the experimental constituency which constructs the experiments. This constituency develops the calculative technologies that enable governing the climate; it evaluates and designs the experiments; it has access to the experiment and the expert discourse around it and represents the experiments in the wider world.

Due to its importance in the experimental process, further research could focus on the experimental collective and on the seclusion of the experiment. It can, first, focus on particular actors in this collective, and analyze in more depth how they reduce, construct and expand the experiment. Which organizations are particularly active in which process? Which difficulties do they face when reducing the world to experiments and expanding the experiments to the world? Second, it can focus on the collective and analyze how the collective is constituted, how actors gain access to the collective and how access is denied. It can focus on change in the actor constellation and analyze how this changes the experiment and its rationalities? A focus on the relation between the experimental constituency and actors in the macrocosm can reveal how actors in the experimental constituency become representatives of the experiment? Third, an analysis can investigate the seclusion of the experiment and how it is maintained. How is the seclusion maintained between the experiment and the real world? Which role does seclusion have for moving towards a new political order? How is the seclusion of decisions used as a political strategy? Under which conditions does an experiment move out of its seclusion? Lastly, one can also analyze the factors that enable and restrict reduction, construction and expansion.

This model also provides an analytical tool to understand how different rationalities interact. Bäckstrand and Lövbrand (2007) identify three competing types of rationality in environmental governance, green governmentality, ecological modernization and civic environmentalism. The model I propose here understands this competition as a performation struggle and draws attention to this struggle in the construction of experiments. In my study I only occasionally addressed this struggle. A systematic analysis how different rationalities compete in and through experiments would provide enriching insights into what Blok calls co- and counter-performation (Blok, 2011).

It also provides an analytical tool to take into account the material world and how it produces effects. In my study, I limited the analysis of materiality to governmental technologies. I showed how they defined and contained the world and thus restricted and enabled experiments. However, it would be particularly interesting to analyze how the materiality of things, of plants and trees has an effect for the construction of experiments and thus the construction of new governance.

Responsible governance experiments

I argue in line with Groß et al. (2005) and Callon (2009; Callon et al., 2009) that experiments are a pragmatic way of acting in situations of uncertainty. One cannot know before trying how the world will react and in experiments one can identify effects, bugs and reac-

tions and take them into account for further action. It is a reflexive mode which neatly fits into the work of the graduate school "Innovation Society Today: the reflexive construction of novelty", of which this study is part of. Nevertheless, my study illustrates the central dilemma of governance experiments: the dilemma between openness for new experiences and a lack of democratic or any other form of political accountability and responsibility.

Governance experiments need to be open to construct new and workable solutions. However, this openness can, and will be, used to test and develop governance arrangements which are implicitly or explicitly prohibited or not desired by the accountable political authorities. The problem this dilemma poses is its irreversibility. Within the experiment, new sociomaterial arrangements are constructed which might take on a life of their own. One cannot just terminate the experiment and turn back time as if nothing happened; especially not if the intention is to demonstrate that something works and to stimulate the use of the experiment in other occasions. Actors had developed experience and expertise in these projects; technologies had been brought into being. However, for the concept of in-vivo experiments, this dilemma is central. It is not only impossible to fully control the experimental setting, but it is also impossible to control the injection the experiment presents. Callon (2009) draws our attention to the actors that emerge in reaction to the experiment, but restrict it to those negatively affected. For those who emerge in positive reaction to the experiment, Voß and Simons (2014) suggest the term constituency, a collective of actors which develops an interest in the object of the experiment, carbon markets, and tries expanding its use to other sites and domains. The procedures used and the methods developed in experiments also take on a life of its own. They become a blueprint for new developments. These actors and technologies cannot be controlled and even if the experiment is terminated they are out there, a new real world has been constructed.

This central dilemma is unavoidable, so what is the consequence? How can we regulate the experiment in a way that it remains open enough to construct new and workable solutions while ensuring that it does not create a "golem" (Collins and Pinch, 2012) or "zombie" (Lane and Stephan, 2015), an autonomous but mindless creature that lumbers and stumbles on, turning all governance into markets?

What derives from my argument so far is that it should not be left to the experimenters to decide on the experiment. Such an approach would seek for a rational calculation of the experiment like risk-assessment and cost-benefit analysis (Jasanoff, 2012, page 4). What we saw in this study, however, is that a supposedly rational calculation is the result of power and politics. Such a technocratic approach to experiments thus loses its argumentative foundation with a constructionist perspective. Instead, I propose to adopt an approach toward governance experiments that has been discussed for some time already with innovation in technologies. To say it with Winner: "what is needed is a process of redirecting our technological systems and projects in ways inspired by democratic and ecological principles" (Winner, 1993, page 376).

Such a redirection can be found in the precautionary principle and the concept of collective experimentation.

We can borrow a central principle from the realm of science and technology policy, i.e. the precautionary principle. The precautionary principle is a normative guide for policy-making (Stirling, 2007, page 312). It seeks "to prevent people from becoming unwitting experimental subjects" (Stilgoe, 2015, page 43). While this principle has been criticized by some for its scientific approach to decision making, such a narrow focus on science is neither necessary, nor desirable. Instead, we can better understand it as a principle that aims at protecting human health and the environment comprehensively, i.e. by taking into account the perspective of non-scientific knowledge. Latour demands provocatively "No *innovation* without representation" (Latour, 2004, page 17), meaning that every citizen should be engendered to participate in science and technology. How can we translate this philosophical claim to the case of governance experiments?

Following Latour, Callon and Stilgoe, I argue that we should pursue those governance experiments as collective experiments (Callon, 2009; Callon et al., 2009; Latour, 2004; Stilgoe, 2015). Simulating, testing and constructing governance experiments should not be left to economics. Economics reduces governance to cost-efficiency and thereby excludes legitimate concerns like concerns for equity and responsibility. Efficiency has gained prominence as a social law for governance but is only the result of performative practices of economics (Lane, 2012). It is thus crucial to add other disciplines with other principles into the construction of governance experiments. The main challenge in such an interdisciplinary experiment, however, will be to not reduce the non-economic disciplines and their concerns again to economic models and models of accountability. Equity, indigenous rights, human rights, as well as environmental degradation, cannot be expressed entirely in calculable terms; the result need not be a graph of optimal allocation of all these principles. What is needed is, instead, a "shared space" (Stilgoe, 2015, page 198) in which all disciplines are equally able to construct, test and demonstrate governance experiments.

My study demonstrated the centrality of environmental research institutions and think tanks in the construction of new governance arrangements. From the perspective developed in this study, their research and experimental activities are of special concern. It is here that the claim for responsible experiments finds its addressees. Some, if not most, of these institutions already accommodate different disciplines from natural and social sciences. However, they "are often marked by divisions not only between the natural and social sciences, but between alternative interdisciplinary perspectives associated with the different environmental social sciences and their particular articulation of the logic of ontology" (Barry and Born, 2013, page 29). To overcome this division has to be a major step towards responsible governance experiments.

Collective experimentation furthermore means "finding ways for people to move from being subjects to being experimenters in themselves or, at least, being able to have a say about the direction of experimentation" (Stilgoe, 2015, page 202). This applies both to the field experiments in which plants are constructed in anticipation or response to governance, or as action toward influencing governance, as well as to the design activities of new forms of governance in the political negotiations. Carbon Market Watch is a good example for the latter. It is a watchdog NGO that participates with technical expertise in the process

of governing the CDM. It participates in the experiments by mandating scientific reports, analyzing decisions and providing information about local projects and local concerns. By providing new facts and deploying technical expertise (cf. Parthasarathy, 2010) Carbon Market Watch successfully participates in the governance experiments and has been able "to have a say about the direction of the experimentation". Carbon Market Watch cooperates with research institutes and indigenous groups to develop a "counter science" to change the existing governance arrangements with "the aid of the entire arsenal of scientific measurement, experimental and argumentative instruments" (Beck, 1992, pages 162–163).

Carbon Market Watch is a small NGO mainly operated by one woman. However, as Stilgoe rightly puts it, not only individuals should be made responsible for and included into experiments but also institutions (Stilgoe, 2015, page 201). It is important that in the international negotiations as well delegates continuously act on tearing down the wall of secluded governance experiments. They have to be aware of the fact that experiments do not reveal an objective truth but construct a certain reality. Thus, they should devote particular attention to the experiments, how they are constructed, and how they are evaluated.

In a few months, the Conference of the Parties (COP) to the UNFCCC will meet for the 21st time. Observers expect a new framework to evolve from this conference. Probably it will involve new market mechanisms to address climate change. And it is likely that a new round of experiments will follow. If practitioners, delegates and observers do not fall prey to the lure of these experiments, to their promise to identify rationally *the* solution, then we will have already gained a lot. And if the experimental collective who reduces the world, constructs the experiment and expands a governance arrangement is equally aware of the single perspective it realized in the experiment, and the problems and realities it constructs, then we will have traveled even further along the road towards a responsible shape of the politics of governance experiments.

Appendix

List of official documents which I analyzed to understand the international negotiations on the experiments JI, AIJ and CDM

1. (Hanisch, 1991)
2. (UNFCCC, 1992)
3. (INC 8, 1993a)
4. (INC 9, 1993)
5. (INC 9, 1994a)
6. (INC 9, 1994b)
7. (INC 10, 1994a)
8. (INC 10, 1994b)
9. (SBSTA 2, 1995)
10. (INC 11, 1995)
11. (UNFCCC, 1995)
12. (SBSTA 4, 1996)
13. (SBSTA 6, 1997)
14. (SBSTA 7, 1997)
15. (COP 4, 1998)
16. (SB 8, 1998)
17. (UNFCCC, 1998)
18. (SB 10, 1999a)
19. (SB 10, 1999b)
20. (SBSTA 10, 1999)
21. (ENB, 1999)
22. (SB 13, 2000b)

List of documents which I analyzed as first priority documents to understand the experiments ILUMEX, AES, USIJI, PCF and the economic simulations

23. (Stavins, 1988)
24. (WRI, 1990)
25. (WRI, 1994)
26. (Agarwal and Narain, 1991)
27. (US EPA and US Dept. of State, 1991)
28. (Hanisch et al., 1992)
29. (Burniaux et al., 1992)
30. (Dixon et al., 1993)
31. (Pachauri, 1993)
32. (Jones, 1993)
33. (Selrod and Skjelvik, 1993)
34. (WRI, 1994)
35. (Faeth et al., 1994)
36. (Blanc and De Buen, 1994)
37. (Arts et al., 1994)
38. (Pearce, 1994)
39. (Heintz, 1994)
40. (Nordisk Ministerråd and Bohm, 1994)
41. (CCAP, 1994)
42. (Greenpeace Int., 1994b)
43. (Trexler, 1995)
44. (Jepma, 1995)
45. (Vellinga and Heintz, 1995)
46. (IPCC, 1995)
47. (Hare and Stevens, 1995)
48. (Ramakrishna, 1995)
49. (Metz, 1995)
50. (Figueres et al., 1996)
51. (Bruce et al., 1996)
52. (Dudek and Wiener, 1996)
53. (US Dept. of State, 1997)
54. (Government of Norway, 1997)
55. (Imaz et al., 1998)
56. (Chomitz, 1998)
57. (Dixon, 1998)
58. (OECD and IEA, 1998)
59. (Heister et al., 1999)
60. (Stewart, 2000)
61. (World Bank, 2001)
62. (UNEP et al., 2001)

List of further documents which were part of my analysis to accompany interpretations of the first two categories

63. (Brundtland Commission, 1987)
64. (IPCC, 1991)
65. (Dudek and LeBlanc, 1990)
90. (Parson and Fisher-Vanden, 1997)
91. (Vine and Sathaye, 1997)
92. (CIEL, 1997)

66. (IIEC, 1992)
67. (Brundtland, 1991)
68. (Dudek and LeBlanc, 1992)
69. (Haugland, 1993)
70. (Torvanger, 1993)
71. (Brown and Adger, 1993)
72. (Mintzer, 1993)
73. (World Bank and GEF, 1994)
74. (ECO, 1994)
75. (Verweij, 1995)
76. (Sathaye et al., 1994)
77. (Greenpeace Int., 1994a)
78. (Hajost et al., 1994)
79. (Moomaw, 1994)
80. (Torvanger et al., 1994)
81. (Leslie and Verdugo, 1995)
82. (Jackson, 1995)
83. (Watt and Sathaye, 1995)
84. (Maya, 1995)
85. (Luzuriaga, 1995)
86. (Anderson, 1995)
87. (ENB, 1996a)
88. (ENB, 1996b)
89. (ENB, 1996c)
93. (ELI, 1997)
94. (IISD, 1998)
95. (GAO, 1998)
96. (Trexler and Kosloff, 1998)
97. (Dutschke, 1998)
98. (Sathaye et al., 1998)
99. (Moura-Costa and Stuart, 1998)
100. (Lile et al., 1998)
101. (Michaelowa, 1998)
102. (Begg et al., 1999)
103. (Ellis, 1999)
104. (Michaelowa et al., 1999)
105. (Jepma, 1999)
106. (Leonard et al., 1999)
107. (Mintzer and Dixon, 1999)
108. (IISD, 2000)
109. (OECD, 2000)
110. (The World Bank, 2000)
111. (ENB, 2001)
112. (Lecocq, 2003)
113. (Kelly and Jordan, 2004)
114. (World Bank, 2006)
115. (USIJI)

List of Interviews

Interview	Mode of contact	Date	Duration
T1	Face-to-Face	April 22, 2013	0:58 hrs.
T2	Phone	Sept 11, 2013	0:54 hrs.
T3	Face-to-Face	Sept 18, 2013	1:04 hrs.
T4	Face-to-Face	Sept 19, 2013	0:42 hrs.
T5	Face-to-Face	Sept 20, 2013	1:18 hrs.
T6	Face-to-Face	Sept 25, 2013	0:54 hrs.
T7	Face-to-Face	Nov 26, 2013	1:15 hrs.
T8	Phone	Dec 3, 2013	0:22 hrs.
T9	Face-to-Face	Dec 5, 2013	1:13 hrs.
T10	Face-to-Face	Dec 6, 2013	1:37 hrs.
T11	Face-to-Face	Jan 31, 2014	0:59 hrs.
T12	Face-to-Face	Jan 31, 2014	1:20 hrs.
T13	Phone	Sept 9, 2014	0:49 hrs.

References

Acworth W, Lövbrand E, 2012, "The rise or fall of carbon markets? Assessing the state and direction of carbon market governance post 2012", Centre for Climate Science and Policy Research, Norrköping, Sweden

Agarwal A, Narain S, 1991, "Global warming in an unequal world: A case of environmental colonialism", Centre for Science and Environment

Anderson R J, 1995, "Joint implementation of climate change measures", http://agris.fao.org/agris-search/search.do?recordID=US201300105613

Andrade A D, 2009, "Interpretive research aiming at theory building: Adopting and adapting the case study design" *The Qualitative Report* **14**(1) 42–60

Andresen S, Kolshus H H, Torvanger A, 2002, "The feasibility of ambitious climate agreements: Norway as an early test case"

Ansell C, 2012, "What is a 'Democratic Experiment'?" *Contemporary Pragmatism* **9**(2) 158–179

Ansell C K, 2011 *Pragmatist Democracy: Evolutionary Learning as Public Philosophy* 1 edition (Oxford University Press, Oxford ; New York)

Arts K, Peters P, Schrijver N, van Sluijs P, 1994, "Joint Implementation from an International Law Perspective", in *Joint Implementation to Curb Climate Change* Eds O Kuik, P Peters, and N Schrijver (Springer), pp 3–27

Asdal K, 2014, "From climate issue to oil issue: offices of public administration, versions of economics, and the ordinary technologies of politics" *Environment and Planning A* **46**(9) 2110–2124

Bäckstrand K, 2006, "Democratizing Global Environmental Governance? Stakeholder Democracy after the World Summit on Sustainable Development" *European Journal of International Relations* **12**(4) 467 –498

Bäckstrand K, 2008, "Accountability of Networked Climate Governance: The Rise of Transnational Climate Partnerships" *Global Environmental Politics* **8**(3) 74–102

Bäckstrand K, Khan J, Kronsell A, Lövbrand E eds, 2010 *Environmental politics and deliberative democracy: examining the promise of new modes of governance* (Edward Elgar Publishing)

Bäckstrand K, Lövbrand E, 2007, "Climate governance beyond 2012: competing discourses of green governmentality, ecological modernization and civic environmentalism", in *The social construction of climate change: Power, knowledge, norms, discourses* Ed M E Pettenger (Ashgate), pp 123–147

Bailey I, Gouldson A, Newell P, 2011, "Ecological Modernisation and the Governance of Carbon: A Critical Analysis" *Antipode* **43**(3) 682–703

Barry A, 2002, "The anti-political economy" *Economy and society* **31**(2) 268–284

Barry A, Born G, 2013 *Interdisciplinarity: reconfigurations of the social and natural sciences* (Routledge)

Baur N, 2011, "Mixing process-generated data in market sociology" *Quality & Quantity* **45**(6) 1233–1251

Beck U, 1992 *Risk Society: Towards a New Modernity* (Sage Publications Ltd)

Beck U, 1996, "World risk society as cosmopolitan society? Ecological questions in a framework of manufactured uncertainties" *Theory, Culture & Society* **13**(4) 1–32

Begg K, Anderson T, Parkinson S D, Mulugetta Y, 1999, "Issues for the Clean Development Mechanism", Centre for Environmental Strategy, Surrey, UK

Benecke G, Friberg L, Lederer M, Schröder M, 2008, "From PPP to market: The Clean Development Mechanism (CDM) as a new mode of governance in climate protection" *SFB-Governance Working Paper Series* (10)

Bennett A, 2004, "Case study methods: Design, use, and comparative advantages" *Models, numbers, and cases: Methods for studying international relations* 19–55

Bevir M, Rhodes R A W, 2003 *Interpreting British Governance* (Psychology Press)

Biermann F, Pattberg P, van Asselt H, Zelli F, 2009, "The Fragmentation of Global Governance Architectures: A Framework for Analysis" *Global Environmental Politics* **9**(4) 14–40

Blanc A, De Buen O, 1994, "Residential Lighting Efficiency in Mexico: The Road to ILUMEX", in *Proceedings of the ACEEE Summer Study on Energy Efficiency in Buildings*, http://www.funtener.org.mx/joomla/dmdocuments/ACEEE-Ilumex.pdf

Blok A, 2011, "Clash of the eco-sciences: carbon marketization, environmental NGOs and performativity as politics" *Economy and Society* **40**(3) 451–476

Blok A, 2014, "Experimenting on Climate Governmentality with Actor-Network Theory", in *Governing the Climate* Eds J Stripple and H Bulkeley (Cambridge University Press), pp 42–58

Bloor D, 1991 *Knowledge and social imagery* (The University of Chicago Press)

Blumer H, 1986 *Symbolic Interactionism: Perspective and Method* (University of California Press)

BMWi, 2012, "Treibhausgasemissionen in Deutschland", http://www.bmwi.de/BMWi/Redaktion/PDF/E/energiestatistiken-energie-umwelt,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

Bodansky D, 2001, "The history of the global climate change regime", in *International relations and global climate change* Eds U Luterbacher and D F Sprinz (MIT Press, Cambridge, London), pp 23–40

Bogner A, Littig B, Menz W, 2014 *Interviews mit Experten: Eine praxisorientierte Einführung* (Springer-Verlag)

Boyd E, Boykoff M, Newell P, 2011, "The 'New' Carbon Economy: What's New?" *Antipode* **43**(3) 601–611

Braun M, 2009, "The evolution of emissions trading in the European Union: The role of policy networks, knowledge and policy entrepreneurs" *Accounting, Organizations and Society* **34**(3) 469–487

Bröckling U, Krasmann S, Lemke T, 2011 *Governmentality: Current Issues and Future Challenges* (Taylor & Francis)

Brown K, Adger N, 1993, "Forests for international offsets: economic and political issues of carbon sequestration", Centre for Social and Economic Research on the Global Environment

Bruce J P, Lee H, Haites E F eds, 1996 *Climate change 1995: Economic and social dimensions of climate change: Contribution of Working Group III to the second assessment report of the Intergovernmental Panel on Climate Change* (Cambridge University Press)

Brundtland Commission, 1987 *Our common future* (Oxford: Oxford University Press)

Brundtland G H, 1991, "A comprehensive approach to climate change policy. Opening address."

Bueger C, Gadinger F, 2015, "The play of international practice. Minimalism, pragmatism and critical theory" *International Studies Quarterly* (59) 449–460

Buhr K, 2012, "The Inclusion of aviation in the EU emissions trading scheme: Temporal conditions for institutional entrepreneurship" *Organization Studies* **33**(11) 1565–1587

Bulkeley H, Castán Broto V, 2013, "Government by experiment? Global cities and the governing of climate change" *Transactions of the Institute of British Geographers* **38**(3) 361–375

Bulkeley H, Hoffmann M J, VanDeveer S D, Milledge V, 2012, "Transnational Governance Experiments", in *Global Environmental Governance Reconsidered* Eds F Biermann and P Pattberg (MIT Press, Cambridge), pp 149–171

Bulkeley H, Stripple J, 2014, "Conclusion. Towards a Critical Social Science of Climate Change?", in *Governing the Climate. New Approaches to Rationality, Power and Politics* Eds J Stripple and H Bulkeley (Cambridge University Press, New York), pp 243–260

Bumpus A G, 2011, "The matter of carbon: understanding the materiality of tCO2e in carbon offsets" *Antipode* **43**(3) 612–638

Bumpus A G, Liverman D M, 2008, "Accumulation by decarbonization and the governance of carbon offsets" *Economic Geography* **84**(2) 127–155

Burniaux J-M, Martin J P, Nicoletti G, Martins J O, 1992, "The Costs of Reducing CO2 Emissions: Evidence from Green", OECD, Paris, http://www.oecd-ilibrary.org/economics/the-costs-of-reducing-co2-emissions_614012187236

Callon M, 1998, "Introduction: The embeddedness of economic markets in economics", in *The laws of the markets* Ed M Callon Sociological review monograph (Wiley-Blackwell, Oxford), pp 1–57

Callon M, 2007, "What does it mean to say that economics is performative?", in *Do Economists Make Markets? On the Performativity of Economics* Eds D MacKenzie, F Muniesa, and L Siu (Princeton University Press), pp 311–357

Callon M, 2009, "Civilizing Markets: Carbon Trading between in Vitro and in Vivo Experiments" *Accounting, Organizations and Society* **34**(3-4) 535–548

Callon M, Lascoumes P, Barthe Y, 2009 *Acting in an uncertain world. An essay on technological democracy* (Cambridge: MIT Press)

Callon M, Latour B, 1981, "Unscrewing the Big Leviathan: How Actors Macro-structure Reality and How Sociologists Help Them to Do So", in *Advances in Social Theory and Methodology*, pp 277–303

Campbell D T, 1969, "Reforms as experiments." *American psychologist* **24**(4) 409–429

Carbon Market Watch, 2011, "Barro Blanco Hydropower Project in Panama violates CDM Rules", http://carbonmarketwatch.org/barro-blanco-hydropower-project-in-panama-violates-cdm-rules-newsletter-12/

Cass L R, 2006 *The Failures of American and European Climate Policy: International Norms, Domestic Politics, and Unachievable Commitments* (SUNY Press)

CCAP, 1994, "Final Report to US AID", Center for Clean Air Policy

CDM Policy Dialogue, 2012, "Climate Change, Carbon Markets and the CDM: A Call to Action. Report of the High-Level Panel on the CDM Policy Dialogue"

CDM Watch, 2012, "Hydro Power Projects in the CDM. Policy Brief"

Chomitz K M, 1998, "Baselines for greenhouse gas reductions: problems, precedents, solutions", World Bank Carbon Offset Unit, Washington

CIEL, 1997, "12 Principles to Joint Implementation", http://ciel.org/Publications/12prin.html

Clarke A, 2005 *Situational analysis: Grounded theory after the postmodern turn* (SAGE Publications)

Collins H, 1992 *Changing order: Replication and induction in scientific practice* (University of Chicago Press)

Collins H, Pinch T, 2012 *The Golem: What You Should Know About Science* 2 edition (Cambridge University Press, Cambridge England; New York [N.Y.])

COP 4, 1998, "Review of the Implementation of Commitments and of other Provisions of the Convention. Activities Implemented Jointly: Review of Progress under the Pilot Phase (Decision 5/CP.1). Second synthesis report on activities implemented jointly. Note by the Secretariat"

Dean M, 2010 *Governmentality: Power and rule in modern society* (Sage Publications Limited)

Dewey J, 1984 *The Later Works, 1925-1953: 1929* Ed J A Boydston (SIU Press)

Dixon R, 1998, "Report on accomplishments and descriptions of projects accepted under USIJI for UNFCCC Secretariat"

Dixon R K, Andrasko K J, Sussman F G, Lavinson M A, Trexler M C, Vinson T S, 1993, "Forest sector carbon offset projects: Near-term opportunities to mitigate greenhouse gas emissions" *Water, Air, and Soil Pollution* **70**(1-4) 561–577

Dong Y, Olsen K H, 2015, "Stakeholder participation in CDM and new climate mitigation mechanisms: China CDM case study" *Climate Policy* 1–18

Dudek D J, LeBlanc A, 1990, "Offsetting New CO2 Emissions: A Rational First Greenhouse Policy Step" *Contemporary Economic Policy* **8**(3) 29–42

Dudek D J, LeBlanc A, 1992, "Preserving Brazil's tropical forests through Emissions Trading"

Dudek D J, Wiener J B, 1996 *Joint implementation, transaction costs, and climate change* (OECD)

Dutschke M, 1998, "Financing Sustainable Development The Case of Costa Rica", in

Dyck T, 2011, "Enforcing Environmental Integrity: Emissions Auditing and the Extended Arm of the Clean Development Mechanism" *Colum. J. Envtl. L.* **36** 259

ECO, 1994, "Climate Talks Geneva - August 1994. NGO Newsletter. INC 10" *ECO Newsletter* (5), http://www.ciesin.org/kiosk/ebs/Newsletter/econews/econews5.txt

Edkins J, 1999 *Poststructuralism and International relations* (Lynne Rienner Publishers)

Ehrenstein V, Muniesa F, 2013, "The Conditional Sink: Counterfactual Display in the Valuation of a Carbon Offsetting Reforestation Project" *Valuation Studies* **1**(2) 161–188

ELI, 1997, "Transparency and Responsiveness: Building a Participatory Process for Activities Implemented Jointly Under the Climate Change Convention", Environmental Law Institute

Ellis J, 1999, "Experience with Emission Baselines under the AIJ Pilot Phase", OECD, Paris

ENB, 1996a, "Report of the meetings of the subsidiary bodies of the UN Framework Convention on Climate Change", IISD

ENB, 1996b, "Report of the second meeting of the subsidiary body of the UN Framework Convention on Climate Change, 27 February - 4 March 1996", IISD

ENB, 1996c, "Summary of the Second Conference of the Parties to the Framework Convention on Climate Change", IISD

ENB, 1999, "Technical Workshop on the Mechanisms under Articles 6, 12 and 1 of the kyoto Protocol: 9-15 April 1999", IISD

ENB, 2001, "Summary of the Resumed Sixth Session of the Conference of the Parties to the UN Framework Convention on Climate Change: 16-27 July 2001", IISD

Engels A, 2006, "Market creation and transnational rule-making: The case of CO2 emissions trading", in *Transnational Governance. Institutional Dynamics of Regulation* Eds M-L Djelic and K Sahlin-Andersson (Cambridge University Press, Cambridge), pp 329–48

Faeth P, Cort C, Livernash R, others, 1994, "Evaluating the carbon sequestration benefits of forestry projects in developing countries", World Resources Institute Washington, DC

Figueres C, Hambleton A, Lay L, MacDicken K, Petricone S, Swisher J, 1996, "Implementing JI/AIJ. A Guide for Establishing National Joint Implementation Programs", The Center for Sustainable Development in the Americas; US Agency for International Development; Lawrence Berkeley National Laboratory

Figueres C, Streck C, 2009, "The evolution of the CDM in a post-2012 climate agreement" *The Journal of Environment & Development* **18**(3) 227–247

Fischer F, 2009 *Democracy and Expertise: Reorienting Policy Inquiry* (OUP Oxford)

Fischer F, Forester J, 1993 *The argumentative turn in policy analysis and planning* (Duke University Press Books)

Foucault M, 1997 *Ethics Subjectivity and Truth; the Essential Works of Michael Foucault, 1954-1984* Ed J D Faubion

Foucault M, 2005 *Analytik der Macht* (Suhrkamp)

Foucault M, 2009 *Security, Territory, Population: Lectures at the Collège de France 1977--1978* 1 edition Eds M Senellart, F Ewald, and A Fontana (Picador)

van der Gaast W, 2015 *International Climate Negotiation Conditions - Past and Future*, University of Groningen, Groningen, The Netherlands

GAO, 1998, "Climate Change: Information on the U.S. Initiative on Joint Implementation"

Garud R, Kumaraswamy A, Karnøe P, 2010, "Path dependence or path creation?" *Journal of Management Studies* **47**(4) 760–774

Giddens A, 1990 *The Consequences of Modernity* (John Wiley & Sons)

Goodman M K, Boyd E, 2011, "A social life for carbon? Commodification, markets and care" *The geographical journal* **177**(2) 102–109

Government of Norway, 1997, "Government of Norway National Programme on Activities Implemented Jointly", https://unfccc.int/kyoto_mechanisms/aij/activities_implemented_jointly/items/2089.php

Greenpeace Int., 1994a, "Greenpeace Briefing on Joint Implementation. Joint Implementation Criteria and INC 9"

Greenpeace Int., 1994b, "The Joint Implementation Pilot Phase: A critical approach", http://www.skeptictank.org/treasure/GP1/2INC94.TXT

Greiner S, Michaelowa A, 2003, "Defining investment additionality for CDM projects — practical approaches" *Energy Policy* **31**(10) 1007–1015

Gross M, 2010, "The public proceduralization of contingency: Bruno Latour and the formation of collective experiments" *Social Epistemology* **24**(1) 63–74

Groß M, Hoffmann-Riem H, Krohn W, 2005 *Realexperimente. Ökologische Gestaltungsprozesse in der Wissensgesellschaft* (transcript-Verlag, Bielefeld)

Gross M, Krohn W, 2005, "Society as experiment: sociological foundations for a self-experimental society" *History of the Human Sciences* **18**(2) 63–86

Grubb M, Vrolijk C, Brack D, 1999 *The Kyoto Protocol. A guide and assessment* (Royal Institute of International Affairs)

Hajost S, Ramakrishna K, Deutz A, 1994, "JI - A Different NGO View" *ECO Newsletter* (5), http://www.ciesin.org/kiosk/ebs/Newsletter/econews/econews5.txt

Hanisch T, 1991, "Joint implementation of commitments to curb climate change"

Hanisch T, Pachauri R K, Schmitt D, Vellinga P, 1992, "The Climate Convention: Criteria and guidelines for joint implementation" *CICERO Policy Note* **2**, http://www.cicero.uio.no/media/27.pdf

Hare B, Stevens A, 1995, "Joint Implementation", in *The Feasibility Of Joint Implementation* Ed C Jepma (Springer), pp 79–85

Hargreaves T, 2014, "Smart meters and the governance of energy use in the household", in *Governing the climate: new approaches to rationality, power and politics* Eds J Stripple and H Bulkeley (Cambridge University Press)

Haugland T, 1993, "A Comparison of Carbon Taxes in Selected OECD Countries", Organisation for Economic Co-operation and Development

He G, Morse R, 2010, "Making carbon offsets work in the developing world: lessons from the Chinese wind controversy", Freeman Spogli Institute for International Studies, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1583616

Heintz R, 1994, "Annex 1: Joint implementation in discussion", in *Joint Implementation to Curb Climate Change* Eds O Kuik, P Peters, and N Schrijver (Springer), pp 181–194

Heister J, Karani P, Poore K, Sinha C, Selrod R, 1999, "The World Bank's Experience with the Activities Implemented Jointly Pilot Phase", in *The U.N. Framework Convention on Climate Change Activities Implemented Jointly (AIJ) Pilot: Experiences and Lessons Learned* Ed R K Dixon Institute for Global Environmental Strategies (Springer Netherlands), pp 239–279

Hilgartner S, Miller C A, Hagendijk R, 2015, "Introduction", in *Science and Democracy: Making Knowledge and Making Power in the Biosciences and Beyond* Eds S Hilgartner, C A Miller, and R Hagendijk (Routledge, New York), pp 1–14

Hoffmann M J, 2011 *Climate Governance at the Crossroads: Experimenting with a Global Response after Kyoto* (Oxford University Press, New York)

Höhne N, Warnecke C, Day T, Röser F, 2015, "Carbon market mechanisms in future international cooperation on climate change", New Climate

Holm P, 2007, "Which Way is up on Callon?", in *Do economists make markets? On the performativity of economics* Eds D A MacKenzie, F Muniesa, and L Siu (Princeton University Press, New Jersey; Oxfordshire), pp 225–243

Honneth A, 1989 *Kritik der Macht: Reflexionsstufen einer kritischen Gesellschaftstheorie; mit einem Nachwort zur Taschenbuchausgabe* (Suhrkamp)

Hutter M, Knoblauch H, Rammert W, Windeler A, 2011, "Innovationsgesellschaft heute: Die reflexive Herstellung des Neuen", TU Berlin, Berlin

IIEC, 1992, "Feasibility Study ILUMEX Proyecto de Uso Racional de Iluminacion en Mexico", The International Institute for Energy Conservation, Washington, D.C.

IISD, 1998, "Summary of the Expert Group Meeting on the Clean Development Mechanism and Sustainable Industrial Development: New Partnerships for Industry in Developing Countries"

IISD, 2000, "ENB On The Side @ FCCC COP-6 pt.2: 25 July", http://www.iisd.ca/climate/cop6bis/enbots/25july.html

Imaz M, Gay C, Friedmann R, Goldberg B, 1998, "Mexico joins the venture: Joint implementation and greenhouse gas emissions reduction" *Lawrence Berkeley National Laboratory*, http://escholarship.org/uc/item/6gw9s2zq.pdf

INC 8, 1993a, "Matters Relating to Commitments. Criteria for Joint Implementation. Note by the Secretariat"

INC 8, 1993b, "Report of the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change on the Work of its Eighth Session at Geneva from 16 to 27 August 1993"

INC 9, 1993, "Matters Relating to Commitments. Criteria for Joint Implementation. Comments from member States on criteria for joint implementation. Note by the Secretariat"

INC 9, 1994a, "Matters relating to commitments. Criteria for joint implementation. Note by the interim secretariat."

INC 9, 1994b, "Report of the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change on the Work of its Ninth Session held at Geneva from 7 to 18 February 1994"

INC 10, 1994a, "Matters Relating to Commitments. Criteria for Joint Implementation. Comments from Parties or other member States. Note by the interim secretariat."

INC 10, 1994b, "Matters relating to Commitments. Criteria for Joint Implementation. Note by the interim secretariat"

INC 11, 1995, "Report of the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change on the Work of its Eleventh Session held at New York from 6 to 17 February 1995. Addendum"

IPCC, 1991 *Climate change: The IPCC response strategies* (Island Press)

IPCC, 1995, "IPCC Second Assessment Report. Climate Change 1995. A Report of the Intergovernmental Panel on Climate Change"

IUCC, 1993, "Climate Change Fact Sheet 220" *The Bergen Conference and its proposals for addressing climate change*, http://unfccc.int/resource/ccsites/senegal/fact/fs220.htm

Jackson T, 1995, "Joint implementation and cost-effectiveness under the framework convention on climate change" *Energy policy* **23**(2) 117–138

Jann W, Wegrich K, 2003, "Phasenmodelle und Politikprozesse: der policy cycle" *Lehrbuch der Politikfeldanalyse. München/Wien: Oldenbourg* 71–104

Jasanoff S, 2004a, "Ordering Knowledge, Ordering Society", in *States of Knowledge: The Co-production of Science and Social Order* Ed S Jasanoff (Psychology Press), pp 13–45

Jasanoff S, 2004b *States of Knowledge: The Co-production of Science and the Social Order* (Routledge)

Jasanoff S, 2004c, "The idiom of co-production", in *States of knowledge: the co-production of science and the social order*, pp 1–12

Jasanoff S, 2012 *Science and public reason* (Routledge)

Jepma C, 1999, "Editor's Note. Emissions trading." *Magazine on Joint Implementation* **5**(4)

Jepma C J, 1995, "Introduction", in *The feasibility of joint implementation* Ed C J Jepma (Springer)

Jones T, 1993, "Operational criteria for joint implementation", in (OECD, Paris), pp 2–21

Jordan A, Huitema D, 2014, "Innovations in climate policy: the politics of invention, diffusion, and evaluation" *Environmental Politics* **23**(5) 715–734

Jordan A J, Huitema D, Hildén M, van Asselt H, Rayner T J, Schoenefeld J J, Tosun J, Forster J, Boasson E L, 2015, "Emergence of polycentric climate governance and its future prospects" *Nature Climate Change* **advance online publication**, http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate2725.html

Kelly L, Jordan J, 2004, "The Prototype Carbon Fund: Addressing Challenges of Globalization-An Independent Evaluation of the World Bank's Approach to Global Programs", https://openknowledge.worldbank.org/handle/10986/20213

Keohane R, Victor D, 2010, "The Regime Complex for Climate Change", Harvard Project on International Climate Agreements, Cambridge, Mass.

Knorr Cetina K, 1995, "Laboratory Studies: The Cultural Approach to the Study of Science", in *Handbook of science and technology studies*

Kronsell A, Bäckstrand K, 2010, "Rationalities and forms of governance: a framework for analyzing the legitimacy of new modes of governance", in *Environmental Politics and Deliberative Democracy: Examining the Promise of New Modes of Governance.* Eds K Bäckstrand, J Khan, A Kronsell, and E Lövbrand (Edward Elgar, Cheltenham), pp 28–46

Kuik O J, Peters P, Schrijver N, 1994 *Joint implementation to curb climate change: Legal and economic aspects* (Springer)

Lane R, 2012, "The promiscuous history of market efficiency: the development of early emissions trading systems" *Environmental Politics* **21**(4) 583–603

Lane R, Stephan B, 2015, "Zombie Markets and Zombie Analyses? Revivifying the Politics of Carbon Markets", in *The Politics of Carbon Markets* Eds B Stephan and R Lane Routledge Studies in Environmental Policy (Routledge, London; New York), pp 1–24

Latour B, 1993 *We have never been modern* (Harvard University Press)

Latour B, 2004, "Which protocol for the new collective experiments?", in *Experimental Cultures* Ed H Schmindgen (Kadmos Verlag, Berlin), http://habitat.aq.upm.es/boletin/n32/ablat.en.html

Latour B, 2005 *Reassembling the social. An Introduction to Actor-Network Theory* (Oxford University Press, Oxford)

Latour B, 2007, "Turning around politics: A note on Gerard de Vries' paper" *Social Studies of Science* 811–820

Latour B, Woolgar S, 1986 *Laboratory life: the construction of scientific knowledge* (Princeton University Press., Princeton, NJ)

Lecocq F, 2003, "Pioneering transactions, catalyzing markets, and building capacity: the Prototype Carbon Fund contributions to climate policies" *American Journal of Agricultural Economics* **85**(3) 703–707

Lecocq F, Ambrosi P, 2007, "The Clean Development Mechanism: History, Status, and Prospects" *Review of Environmental Economics and Policy* **1**(1) 134–151

Lederer M, 2012a, "Market making via regulation: The role of the state in carbon markets" *Regulation & Governance* **6**(4) 524–544

Lederer M, 2012b, "The practice of carbon markets" *Environmental Politics* **21**(4) 640–656

Lederer M, 2013, "The future of carbon markets: carbon trading, the Clean Development Mechanism and beyond", in *Low Carbon Development: key issues* Eds U Frauke and J Nordensvärd (Routledge/Earthscan, London), pp 94–106

Lemke T, 1997 *Eine Kritik der politischen Vernunft: Foucaults Analyse der modernen Gouvernementalität* (Argument Verlag)

Lemke T, 2002, "Foucault, Governmentality, and Critique" *Rethinking Marxism* **14**(3) 49–64

Leonard J, Mintzer I, Michel D, 1999, "Climate change, capacity building and the AIJ experience", in *The UN Framework Convention on Climate Change Activities Implemented Jointly (AIJ) Pilot: Experiences and Lessons Learned* Ed R K Dixon (Springer), pp 209–237

Leslie J, Verdugo S, 1995, "Catalyzing a Market for Joint Implementation Projects", in *The Feasibility of Joint Implementation* Ed C J Jepma (Springer), pp 223–230, http://link.springer.com/content/pdf/10.1007/978-94-015-8559-0_18.pdf

Lile R D, Powell M, Toman M, 1998, "Implementing the Clean Development Mechanism: lessons from US private-sector participation in Activities Implemented Jointly", Resources for the Future, http://www.rff.org/RFF/Documents/RFF-DP-99-08.pdf

Littig B, 2008, "Interviews with the Elite and with Experts. Are There Any Differences?" *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research* **9**(3), http://www.qualitative-research.net/index.php/fqs/article/view/1000

Liverman D, 2009, "Conventions of climate change: constructions of danger and the dispossession of the atmosphere" *Journal of Historical Geography* **35** 279–296

Lohmann L, 2005, "Marketing and making carbon dumps: commodification, calculation and counterfactuals in climate change mitigation" *Science as culture* **14**(3) 203

Lohmann L, 2009, "Toward a different debate in environmental accounting: The cases of carbon and cost-benefit" *Accounting, Organizations and Society* **34**(3-4) 499–534

Lövbrand E, Stripple J, 2011, "Making climate change governable: accounting for carbon as sinks, credits and personal budgets" *Critical Policy Studies* **5**(2) 187–200

Lovell H, Liverman D, 2010, "Understanding carbon offset technologies" *New Political Economy* **15**(2) 255–273

Lovell H, MacKenzie D, 2011, "Accounting for carbon: the role of accounting professional organisations in governing climate change" *Antipode* **43**(3) 704–730

Luterbacher U, Sprinz D F, 2001, "Problems of Global Environmental Cooperation", in *International Relations and Global Climate Change* Eds U Luterbacher and D F Sprinz (MIT Press)

Luzuriaga L, 1995, "A High Efficiency Lighting Project", in *The Feasibility of Joint Implementation* Ed C J Jepma (Springer), pp 345–357

MacKenzie D, 2009, "Making Things the Same: Gases, Emission Rights and the Politics of Carbon Markets" *Accounting, Organizations and Society* **34**(3-4) 440–455

MacKenzie D A, Muniesa F, Siu L, 2007, "Introduction", in *Do economists make markets? On the performativity of economics* Eds D MacKenzie, F Muniesa, and L Siu (Princeton University Press, New Jersey; Oxfordshire), pp 1–19

MacKenzie D, Millo Y, 2003, "Constructing a Market, Performing Theory: The Historical Sociology of a Financial Derivatives Exchange" *American Journal of Sociology* **109**(1) 107–145

Marres N, 2007, "The Issues Deserve More Credit Pragmatist Contributions to the Study of Public Involvement in Controversy" *Social Studies of Science* **37**(5) 759–780

Matt E, Okereke C, Stephan B, Lane R, 2015, "A neo-Gramscian account of carbon markets", in *The Politics of Carbon Markets*, pp 113–132

Maya R S, 1995, "Joint Implementation", in *The Feasibility of Joint Implementation* Ed C J Jepma, pp 209–217

Methmann C P, 2011, "The sky is the limit: Global warming as global governmentality" *European Journal of International Relations* **19**(1)

Metz B, 1995, "Joint Implementation - What the Parties to the Climate Convention should do about it", in *The feasibility of joint implementation* Ed C J Jepma (Springer), pp 163–176

Meyer U, Schulz-Schaeffer I, 2006, "Three Forms of Interpretative Flexibility" *Science, Technology & Innovation Studies* **Special Issue 1**

Michaelowa A, 1998, "Joint Implementation – the baseline issue: Economic and political aspects" *Global Environmental Change* **8**(1) 81–92

Michaelowa A, 2000, "Flexible Instruments of Climate Policy", in *Climate Policy and Development: Flexible Instruments and Developing Countries* Eds A Michaelowa and M Dutschke (Edward Elgar)

Michaelowa A, Buen J, 2012, "The Clean Development Mechanism Gold Rush", in *Carbon Markets or Climate Finance?* (Routledge, Abingdon)

Michaelowa A, Dixon R, Abron L, 1999, "The AIJ project development community", in *The UN Framework Convention on Climate Change Activities Implemented Jointly (AIJ) Pilot: Experiences and Lessons Learned* Ed R K Dixon (Springer), pp 73–88

Miller C A, 2004, "Climate science and the making of a global political order", in *States of knowledge: The coproduction of science and social order*, pp 46–66

Miller C A, 2007, "Democratization, international knowledge institutions, and global governance" *Governance* **20**(2) 325–357

Mintzer I, Dixon R, 1999, "Implications of AIJ for CDM", in *The UN Framework Convention on Climate Change Activities Implemented Jointly (AIJ) Pilot: Experiences and Lessons Learned* (Springer), pp 407–418

Mintzer I M, 1993, "Implementing the Framework Convention on Climate Change. Incremental Costs and the Role of the GEF", UNDP, UNEP, World Bank

Miranda M, Dieperink C, Glasbergen P, 2002, "The social meaning of carbon dioxide emission trading. Institutional capacity building for a green market in Costa Rica" *Environment, Development and Sustainability* **4**(1) 69–86

Mol A, 1999, "Ontological politics. A word and some questions", in *Actor network theory and after* Eds J Law and J Hassard Sociological review monograph (Wiley-Blackwell, Oxford), pp 74–89

Moomaw W, 1994, "Achieving joint benefits from Joint Implementation", in *Criteria for Joint Implementation under the Framework Convention on Climate Change* Ed K Ramakrishna, Kilaparti, pp 11–14

Moura-Costa P, Stuart M D, 1998, "Forestry-based greenhouse gas mitigation: a story of market evolution" *The Commonwealth Forestry Review* 191–202

Muniesa F, Callon M, 2007, "Economic experiments and the construction of markets", in *Do economists make markets? On the performativity of economics* Eds D MacKenzie, F Muniesa, and L Siu (Princeton University Press, New Jersey; Oxfordshire), pp 163–189

Newell P, 2008, "The political economy of global environmental governance" *Review of International Studies* **34**(3) 507

Newell P, Paterson M, 2010a *Climate capitalism: global warming and the transformation of the global economy* (Cambridge University Press)

Newell P, Paterson M, 2010b, "The politics of the carbon economy", in *The politics of climate change: A survey* Ed M Boykoff (Routledge), pp 80–99, http://books.google.com/books?hl=de&lr=&id=xHesAgAAQBAJ&oi=fnd&pg=PA77&dq=The+Politics+of+the+Carbon+Economy++++Peter+Newell+and+Matthew+Paterson&ots=GFRHRzSVJ8&sig=CQjSimjHra2WyIYO5qSAC6DIdYc

Nordisk Ministerråd, Bohm P, 1994 *Efficiency Implications of FCCC Joint Implementation: With Special Reference to Carbon Emissions Reduction* (Nordic Council of Ministers), https://books.google.de/books?hl=de&lr=&id=Oa-6__vmNiQC&oi=fnd&pg=PA5&dq=bohm+nordisk+ministerrad&ots=tdWnPvkTpV&sig=g517Xkdgfbt8B-LwZFrVz0K0SiU&redir_esc=y#v=onepage&q&f=false

Oberthür S, Ott H E, 1999 *The Kyoto Protocol: International Climate Policy for the 21st Century* (Springer Science & Business Media)

Oberthür S, Ott H E, 2000 *Das Kyoto-Protokoll.: Internationale Klimapolitik für das 21. Jahrhundert.* (Springer DE)

OECD, 2000, "Emission Baselines. Estimating the Unknown"

OECD, IEA, 1998, "Moving forward and setting priorities after Kyoto. Highlights of the OECD and IEA Forum on Climate Change, held 12-13 March 1998, Paris"

Oels A, 2005, "Rendering climate change governable: from biopower to advanced liberal government?" *Journal of Environmental Policy & Planning* **7**(3) 185–207

Olsen K H, 2007, "The clean development mechanism's contribution to sustainable development: a review of the literature" *Climatic Change* **84**(1) 59–73

Ostrom E, 2006, "The value-added of laboratory experiments for the study of institutions and common-pool resources" *Journal of Economic Behavior & Organization* **61**(2) 149–163

Overdevest C, Bleicher A, Gross M, 2010 *The experimental turn in environmental sociology: pragmatism and new forms of governance* (Springer)

Overdevest C, Zeitlin J, 2014, "Assembling an experimentalist regime: Transnational governance interactions in the forest sector" *Regulation & governance* **8**(1) 22–48

Oxford Dictionaries, "experiment - definition of experiment in English from the Oxford dictionary", http://www.oxforddictionaries.com/definition/english/experiment?searchDictCode=all

Pachauri R K, 1993, "The economics of climate change: A developing country perspective.", in (OECD, Paris)

Page E C, 2001 *Governing by Numbers: Delegated Legislation and Everyday Policy-Making* (Bloomsbury Publishing)

Parson E, Fisher-Vanden K, 1997, "Joint implementation and its alternatives: Choosing systems to distribute global emissions abatement and finance", John F. Kennedy School of Government, Harvard University

Parthasarathy S, 2010, "Breaking the Expertise Barrier: Understanding Activist Strategies in Science and Technology Policy Domains" *Science and Public Policy* **37**(5) 355–367

Paterson M, 1996 *Global Warming and Global Politics* (Routledge)

Paterson M, 2011, "Selling carbon: From international climate regime to global carbon market" *The Oxford handbook of climate change and society* 611–624

Paterson M, Hoffmann M, Betsill M, Bernstein S, 2014, "The Micro Foundations of Policy Diffusion Toward Complex Global Governance An Analysis of the Transnational Carbon Emission Trading Network" *Comparative Political Studies* **47**(3) 420–449

Paulsson E, 2009, "A review of the CDM literature: from fine-tuning to critical scrutiny?" *International environmental agreements: politics, law and economics* **9**(1) 63–80

Pearce D, 1994, "Joint Implementation: A General Overview", Center for Social and Economic Research on the Global Environment

Pearce D, 1995, "Joint implementation: a general overview", in *The Feasibility of Joint Implementation* (Kluwer, Dordrecht), pp 15–32

Pearce D W, 1989 *Blueprint for a Green Economy* (Earthscan)

Ramakrishna K, 1995, "Criteria for Joint Implementation under the Framework Convention on Climate Change", The Woods Hole Research Center

Rheinberger H-J, 1992, "Experiment, difference, and writing: I. Tracing protein synthesis" *Studies in History and Philosophy of Science Part A* **23**(2) 305–331

Rosenau J N, Czempiel E O eds, 1992 *Governance Without Government: Order and Change in World Politics* (Cambridge Univ Press, Cambridge [u.a.])

Rose N, Miller P, 1992, "Political power beyond the state: problematics of government" *The British journal of sociology* **61** 271–303

Rose N, O'Malley P, Valverde M, 2006, "Governmentality" *Annu. Rev. Law Soc. Sci.* **2** 83–104

Rose N S, 1999 *Powers of freedom: Reframing political thought* (Cambridge University Press)

Royden A, 2010, "US Climate Change Policy Under President Clinton: A Look Back" *Golden Gate University Law Review* **32**(4) 3

Sabel C F, Zeitlin J, 2008, "Learning from difference: the new architecture of experimentalist governance in the EU" *European Law Journal* **14**(3) 271–327

Sabel C F, Zeitlin J, Levi-Faur D, 2012, "Experimentalist governance", in *The Oxford Handbook of Governance* (Oxford University Press, Oxford [u.a.])

Samaniego J, Figueres C, 2002, "Evolving to a sector-based Clean Development Mechanism", in *Building on the Kyoto Protocol: Options for protecting the climate* Ed K Baumert (World Resources Institute), pp 89–108, http://pdf.wri.org/opc_chapter4.pdf

Sathaye J A, Andrasko K, Makundi W, La Rovere E L, Ravindranath N H, Melli A, Rangachari A, Imaz M, Gay C, Friedmann R, Goldberg B, van Horen C, Simmonds G, Parker G, 1998, "Concerns about climate change mitigation projects: summary of findings from case studies in Brazil, India, Mexico and South Africa"

Sathaye J, Friedmann R, Meyers S, De Buen O, Gadgil A, Vargas E, Saucedo R, 1994, "Economic analysis of Ilumex a project to promote energy-efficient residential lighting in Mexico" *Energy Policy* **22**(2) 163–171

SB 8, 1998, "Mechanisms for cooperative Implementation. Note by the Secretariat"

SB 10, 1999a, "Activities Implemented Jointly Under the Pilot Phase. Views on the review process of activities implemented jointly under the pilot phase and information on experience gained and lessons learned, including on the uniform reporting format. Compilation of submissions from Parties. Note by the Secretariat"

SB 10, 1999b, "Principles, Modalities, Rules and Guidelines for the Mechanisms under Articles 6, 12 and 17 of the Kyoto Protocol. Submissions from Parties. Note by the Secretariat."

SB 13, 2000a, "Mechanisms Pursuant to Article 6, 12 and 17 of the Kyoto Protocol. Principles, modalities, rules and guidelines for the mechanisms under Articles 6, 12 and 17 of the Kyoto Protocol. Additional submissions from Parties. Note by the Secretariat. Addendum"

SB 13, 2000b, "Mechanisms Pursuant to Article 6, 12 and 17 of the Kyoto Protocol. Principles, modalities, rules and guidelines for the mechanisms under Articles 6, 12 and 17 of the Kyoto Protocol. Additional submissions from Parties. Note by the Secretariat. Addendum"

SBSTA 2, 1995, "Activities Implemented Jointly under the Pilot Phase. Views from Parties on a framework for reporting. Note by the secretariat"

SBSTA 4, 1996, "Activities Implemented Jointly under the Pilot Phase. Uniform Reporting Format. Note by the Secretariat."

SBSTA 6, 1997, "Activities Implemented Jointly under the Pilot Phase. Submission by the Group of G 77 and China. Note by the Secretariat"

SBSTA 7, 1997, "Activities Implemented Jointly under the Pilot Phase. Synthesis Report on Activities Implemented Jointly. Note by the Secretariat"

SBSTA 10, 1999, "Report of the Subsidiary Body for Scientific and Technological Advice on its Tenth Session."

Schneider L R, 2011, "Perverse incentives under the CDM: an evaluation of HFC-23 destruction projects" *Climate Policy* **11**(2) 851–864

Schubert C, 2014, "Social Innovations. Highly reflexive and multi-referential phenomena of today's innovation society?", TUTS-Working Paper–2-2014. Berlin, https://www.ts.tu-berlin.de/fileadmin/i62_tstypo3/TUTS_WP_2_2014.pdf

Selrod R, Skjelvik J M, 1993, "Report on World Bank appraisal mission to Mexico. The GEF-ILUMEX Project", CICERO, ECON Energy A/S, Oslo

Shapin S, 1988, "The house of experiment in seventeenth-century England" *Isis* 373–404

Shapin S, Schaffer S, 1986 *Leviathan and the Air-pump: Hobbes, Boyle and the Experimentale Life* (Princeton University Press)

Simons A, 2015 *Documented Authority. The Discursive Construction of Emissions Trading in the Expert Literature*, TU Berlin, Berlin

Simons A, Voß J-P, 2015, "Politics by other means. The making of the emission trading instrument as a 'pre-history' of carbon trading", in *The Politics of Carbon Markets* Routledge Studies in Environmental Policy (Routledge), p 304

Stavins R N, 1988, "Project 88: Harnessing Market Forces to Protect Our Environment. Sponsored by Senators Timothy E. Wirth and John Heinz"

Stephan B, Paterson M, 2012, "The politics of carbon markets: an introduction" *Environmental Politics* **21**(4) 545–562

Stewart R B, 2000 *The clean development mechanism: building international public-private partnerships under the Kyoto protocol: technical, financial and institutional issues* (UNCTAD)

Stilgoe J, 2015 *Experiment Earth: Responsible innovation in geoengineering* (Routledge, Oxon, New York)

Stirling A, 2007, "Risk, precaution and science: towards a more constructive policy debate. Talking point on the precautionary principle" *EMBO Reports* **8**(4) 309–315

Strauss A, Corbin J M, 1990 *Basics of qualitative research: Grounded theory procedures and techniques* (Sage Publications, Inc, Thousand Oaks, CA, US)

Streck C, 2004, "New partnerships in global environmental policy: The Clean Development Mechanism" *The Journal of Environment & Development* **13**(3) 295–322

Stripple J, 2010, "Weberian climate policy: administrative rationality organized as a market", in *Environmental Politics and Deliberative Democracy: Examining the Promise of New Modes of Governance* Eds K Bäckstrand, J Khan, A Kronsell, and E Lövbrand (Edward Elgar, Cheltenham; Northampton), pp 67–84

Stripple J, Bulkeley H, 2014a *Governing the Climate* (Cambridge University Press)

Stripple J, Bulkeley H, 2014b, "Introduction", in *Governing the Climate* Eds J Stripple and H Bulkeley (Cambridge University Press)

Strübing J, 2005 *Pragmatistische Wissenschafts-und Technikforschung: Theorie und Methode* (Campus)

Strübing J, 2010, "Grounded Theory - ein pragmatischer Forschungsstil für die Sozialwissenschaften", in *Enzyklopädie Erziehungswissenschaften Online* (Juventa Verlag, Weinheim, München)

The Climate Group, 2014, "Age of experiments: How states and regions are developing the next generation of climate and energy policies", http://www.theclimategroup.org/what-we-do/publications/age-of-experiments-how-states-and-regions-are-developing-the-next-generation-of-climate-and-energy-policies/

The Lab, 2015, "The Global Innovation Lab for Climate Finance - About" *The Lab*, http://climatefinancelab.org/about/

The World Bank, 2000, "Lessons Learned. Learning from the Implementation of the Prototype Carbon Fund" *Prototype Carbon Fund Occasional Papers Series* (1)

Torvanger A, 1993, "Prerequisites for Joint Implementation under the UN Framework Convention on Climate Change", CICERO

Torvanger A, Fuglestvedt J S, Hagem C, Ringius L, Selrod R, Aaheim H A, 1994, "Joint Implementation under the Climate Convention: phases, options and incentives" *Cicero Report*, http://brage.bibsys.no/xmlui/handle/11250/191912

Trexler M, 1995, "Carbon offset strategies", in *The feasibility of joint implementation* Ed C Jepma (Springer), pp 233–248

Trexler M, Kosloff L, 1998, "The 1997 Kyoto Protocol: What Does It Mean for Project-Based Climate Change Mitigation?" *Mitigation and Adaptation Strategies for Global Change* **3**(1) 1–58

UNEP, OECD, IEA, 2001, "UNEP/OECD/IEA Workshop on Baseline Methodologies. Possibilities for standardised baselines for JI and the CDM. Chairman's recommendation and workshop report", in

UNFCCC, 1992, "United Nations Framework Convention on Climate Change"

UNFCCC, 1995, "Report of the Conference of the Parties on its First Session, held at Berlin from 28 March to 7 April 1995, Addendum 1"

UNFCCC, 1998, "Kyoto Protocol to the United Nations Framework Convention on Climate Change"

UNFCCC, 2015, "Parties & Observers", http://unfccc.int/parties_and_observers/items/2704.php

US Dept. of State, 1997, "Climate Action Report. Chapter 4. Mitigating Climate Change. Joint Implementation.", http://1997-2001.state.gov/www/global/oes/97climate_report/part4d.html

US EPA, US Dept. of State, 1991, "U.S. Efforts to Address Global Climate Change. Report to Congress"

USIJI, "What are the benefits of the USIJI Pilot Program?", http://www.gcrio.org/usiji/about/whatben.html

Vellinga P, Heintz R, 1995, "Joint implementation: a phased approach", in *Criteria For Joint Implementation Under The Framework Convention On Climate Change* Ed K Ramakrishna, pp 5–10

Verweij J, 1995, "Forests absorbing carbon dioxide emissions (Face). One of the response strategies of the Dutch Electricity Generating Companies towards global warming", in *The feasibility of joint implementation* Ed C J Jepma (Springer)

Vine E L, Sathaye J A, 1997, "The monitoring, evaluation, reporting, and verification of climate change mitigation projects: Discussion of issues and methodologies and review of existing protocols and guidelines", Energy Analysis Program, Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory

Voß J-P, 2007, "Innovation processes in governance: the development of 'emissions trading' as a new policy instrument" *Science and Public Policy* **34**(5) 329–343

Voß J-P, Freeman R, 2016 *Knowing Governance - The Epistemic Construction of Political Order* (Palgrave Macmillan)

Voß J-P, Simons A, 2014, "Instrument constituencies and the supply side of policy innovation: the social life of emissions trading" *Environmental Politics* **23**(5) 735–754

Wagenaar H, 2007, "Interpretation and intention in policy analysis" *Handbook of public policy analysis: Theory, politics, and methods* 429–441

Wara M W, Victor D G, 2008, "A realistic policy on international carbon offsets" *Program on Energy and Sustainable Development Working Paper* **74** 1–24

Watt E, Sathaye J, 1995, "The institutional needs of joint implementation projects"

Werksman J, 1998, "The Clean Development Mechanism: Unwrapping the 'Kyoto Surprise'" *Review of European Community & International Environmental Law* **7**(2) 147–158

Windeler A, 2015, "Reflexive Innovation. Zur Innovation in der radikalisierten Moderne."

Winner L, 1993, "Upon Opening the Black Box and Finding It Empty: Social Constructivism and the Philosophy of Technology" *Science, Technology, & Human Values* **18**(3) 362–378

Wittneben B B, 2007 *Institutional change in the transfer of climate-friendly technology*, University of Cambridge

Wittneben B B, Okereke C, Banerjee S B, Levy D L, 2012, "Climate change and the emergence of new organizational landscapes" *Organization Studies* **33**(11) 1431–1450

World Bank, 2001, "Prototype Carbon Fund. Annual Report 2001", World Bank, Washington, D.C., http://documents.worldbank.org/curated/en/2001/07/1677825/prototype-carbon-fund-annual-report-2001

World Bank, 2006, "World Bank GEF Post-Implementation Impact Assessment: Mexico - Ilumex Project", The World Bank, Washington, D.C.

World Bank, GEF, 1994, "United Mexican States, Banco Nacional de Obras y Servicios Publicos. Mexico High Efficiency Lighting Pilot Project"

WRI, 1990 *World Resources 1990-91. A Guide to the Global Environment* (Oxford University Press, New York)

WRI, 1994, "World Resources 1994-1995. A Guide to the Global Environment", The World Resources Institute, New York

Yamin F, 1996, "Book Reviews" *Review of European Community & International Environmental Law* **5**(1) 80–81

Yanow D, 1996 *How does a policy mean?: interpreting policy and organizational actions* (Georgetown University Press)

Yin R K, 2005 *Case study research: Design and methods* 3rd edition (Sage Publications, Incorporated)