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Evaluating Adaptive Governance in Northeast Bangladesh:

A Case Study of the TRACKS Project

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Abstract

In the face of accelerating environmental issues, such as climate change, new modes of governance have emerged. One such approach is that of adaptive governance, which can be seen as a critical challenge to the conventional top-down regimes of environmental management. Despite having received increased attention and influence over the last two decades, the aspect of *evaluation* of adaptive governance remains largely unexplored in the literature, and there is a lack of a consistent, agreed upon framework for evaluation. This study intends to contribute to fill this gap in the scholarship by drawing on existing evaluation efforts in the adaptive governance literature and adopting a participatory evaluation approach. Specifically, it evaluates how one particular initiative, the TRACKS research project (*TRAnsforming Climate Knowledge with and for Society)*, contributed to two communities' climate adaptation in northeast Bangladesh, using adaptive governance as a theoretical and evaluative lens. This thesis describes how a novel, capital based evaluation framework for adaptive governance was constructed and tested with the TRACKS project. The method used in this study was qualitative interviews with citizen scientists, conducted in three rounds during 2016 and 2017. The evaluation of the TRACKS project revealed a significant impact on the communities' human and social capitals, and a weak to moderate impact on the resource and technology capital, the political capital, and the institutional capital. Despite room for improvement, the evaluation framework proved a useful tool for evaluation of adaptive governance, as it allows for achievements and shortcomings to be easily identified. Importantly, its participatory component allows for the framework to be tailored to different contexts, which suggests it might have potential in other settings as well.

Keywords: adaptive governance – participatory evaluation – climate change adaptation – community based adaptation – TRACKS – Bangladesh – human capital – social capital – resources and technology capital – political capital – institutional capital

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Contents

Chapter 1

Introduction and Context:
Adapting to a Changing Climate

1.1 Research question and objectives

This thesis is broadly about how we evaluate efforts to improve local communities' capacity to adapt to a changing climate, as 'adaptive governance'. Specifically, it evaluates how one particular initiative, the TRACKS research project (*TRAnsforming Climate Knowledge with and for Society*), contributed to two communities' climate adaptation in northeast Bangladesh, using adaptive governance as a theoretical and evaluative lens. The thesis describes how a novel adaptive governance evaluation framework was constructed and tested with the TRACKS project.

In this thesis, the following research question is explored: *How did the TRACKS knowledge mobilisation process impact on climate change adaptation in Northeast Bangladesh, evaluated as adaptive governance?* This question relates to the two main objectives of this thesis: (i) to develop a framework for evaluating adaptive governance, tailored to the TRACKS project; and (ii) implement this framework to evaluate the impacts of TRACKS on communities' adaptive capacity, defined as adaptive governance.

Evaluation has been given relatively little attention in the adaptive governance literature, and there is a lack of a consistent, agreed upon frameworks for evaluation (Plummer et al., 2012; Smedstad & Gosnell, 2013; Plummer et al., 2014; Trimble et al., 2015). This thesis addresses this gap in the scholarship by developing a novel evaluation framework, based on existing efforts and trends in the adaptive governance theory. The framework is the result of a 'top-down meets bottom-up' approach, where key principles from the adaptive governance theory is combined with evaluation indicators identified by citizen scientists in TRACKS. Finally, the framework is implemented in the evaluation of TRACKS. As such, this thesis contributes to the adaptive governance scholarship by offering a framework for evaluation of adaptive governance initiatives, developed through theory and empirical research.

1.2 Thesis structure

The thesis starts with an introduction of the context for this study: climate change in Bangladesh. The country's geography, demography and administrative organisation is

outlined, as well as an account for its vulnerability to climate change. It finishes by introducing the TRACKS research project and its attempt to address this vulnerability by creating high quality knowledge of climate variability in northeast Bangladesh.

Chapter 2 presents the theoretical framework of this thesis, starting with a wider appreciation of the governance scholarship before situating the adaptive governance theory in the 'governance landscape'. It then outlines the history and key principles of the theory, before turning to the aspect of evaluation. The trends and history of evaluation of governance will be discussed, before 'zooming in' on evaluation of adaptive governance specifically. Existing evaluation efforts will be discussed, before the choice of participatory evaluation as the approach of this thesis is explained and justified.

Chapter 3 outlines the process of developing a novel framework for evaluating the impact of the TRACKS project on communities' adaptive governance. A critical discussion of using the concept of capital is provided, before the framework is presented. Then follows a description of each of the five capitals constituting the framework.

Chapter 4 turns to the research design of this thesis, along with a methodological discussion of how the evaluation framework was applied to the TRACKS project. The choice of qualitative interviews as a method is discussed and explained, followed by an account of quality in qualitative research. Finally, the process of collecting the data is explained.

Chapter 5 presents the findings from the data collection, and analyses them according to the evaluation framework and its indicators.

Finally, Chapter 6 discusses the findings in light of the research question and objectives of this thesis, and draws conclusions about the evaluation of TRACKS, the framework, and its contribution to the adaptive governance scholarship.

1.3 Background: Climate change in Bangladesh

Bangladesh is one of the most densely populated countries in the world, with more than 162 million people spread over only 144 000 square kilometres of land, which is less than half the size of Norway (Globalis, 2017). Almost the entire country consists of delta areas, as the large rivers Ganges, Brahmaputra and Meghna run through it and together form the biggest delta on earth: the Bengal Delta. As much as 90 % of Bangladesh consists of vast delta plains under 10 meters above sea level (Haugan, 2016). Administratively, the country is divided into 64 'districts', which are grouped into eight divisions (Gall & Gleason, 2012). This study is situated in the Sylhet Division in the north-eastern part of Bangladesh.

Bangladesh is recognised as one of the most vulnerable countries in the world to the threats of climate change (Huq, 2001). In their fifth assessment report, the Intergovernmental Panel on Climate Change (2014a) (hereafter IPCC) stated that Bangladesh is at specific risk due to its exposure to extreme weather events and concentrated, multidimensional poverty, among others. Many communities in the country are highly dependent on agriculture, and have weak infrastructure, which make them particularly vulnerable for extreme weather events. As such, adaptation is a central part of dealing with climate change, and Bangladeshi communities must find ways of coping with a more unpredictable and unstable climate. For many of these communities, *small* variations in the weather can have serious impacts on their livelihoods, ranging from low crop yields to flooding, or spreading of infectious diseases. The IPCC (2014a) identify lack of knowledge and awareness among the constraints that limit adaptation.

Climate change is predicted to affect regions of the world very differently and with large variations. However, because the scientific climate knowledge has been abstracted from its local context, knowledge about how climate change is expected to impact communities at the local level is lacking (Rommetveit et al., 2010). The IPCC (2014b) also states that because climate change is so place- and context-specific, there is no single approach for reducing risk that is appropriate across all settings. How then can communities adapt to a changing climate if they do not know what kind of impacts to expect, or what approaches to use for reducing risk? These are some of the main questions guiding TRACKS, the case study for this thesis.

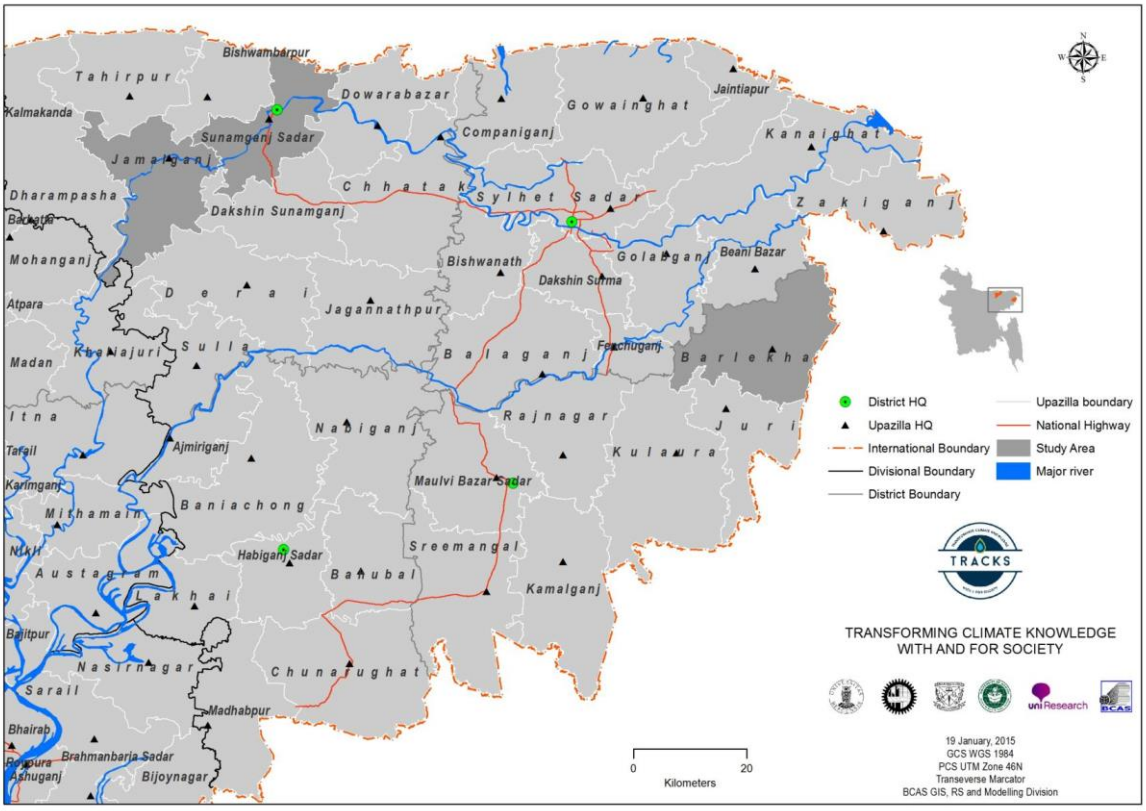
1.3.1 Sylhet Division and Sunamganj District

The TRACKS project is situated in the Sylhet Division in northeast Bangladesh, one of the few hilly regions of the country. Within this region, there are four districts: Sylhet, Moulvibazar, Habiganj and Sunamganj (Bangladesh National Portal, 2017). The two study sites in TRACKS are Barlekha/Hakaluki Haor in the Moulvibazar district, and Sunamganj Sadar/Jamalganj in the Sunamganj district (see map below). However, this thesis focuses only on the communities in the Sunamganj district, hence the sub-districts of Sunamganj Sadar and Jamalganj. Consideration for both study sites was determined to be beyond the reasonable scope of a master's thesis, and the choice to focus of Sunamganj was based on no other reason than its easier accessibility for conducting interviews.

Sunamganj, a district with over 2 million people, is one of the districts where Haor lakes are situated. A Haor is a wetland ecosystem, shaped like an enormous basin, or bowl, of low-lying floodplains. Rivers coming down the hills from India cause the Haor to flood

regularly – during the Monsoon, the summer rainy season, the Haor is flooded for months at a time (Rabby et al., 2011). Like the vast majority of Bangladeshi districts, agriculture is Sunamganj's main source of income, accounting for 67 % of the total revenue (Sunamganj District, 2015). Paddy rice is the primary crop produced in the district, but a variety of wheat, spices, fruits, vegetables, oil seeds and other foods are also being produced. After crop farming, livestock and fisheries are the main sources of household income (Bangladesh Bureau of Statistics, 2011).

People living in Haor areas are already experiencing a range of effects caused by climate change: more rain falls during the Monsoon, flash floods occur more frequently, floods damage the crops and infrastructure, the fish stocks are declining and the soil is eroding (Climate Change Cell, 2009). A study carried out by Anik and Khan (2012), where 120 households in six different villages in the Jamalganj upazila were surveyed, showed that 41.67 % of the respondents stated that, while they may be aware of climate change, they did not have a clear idea about what it meant. Only 10 % stated that they understood climate change well. The combination of this region's vulnerability to climate variability, and the lack of scientific data on the local level, was a major reason for why TRACKS chose it as one of its study areas.



Map of the Sylhet Division in northeast Bangladesh. The study areas in TRACKS are marked with dark grey. The scope of this thesis is limited to the Jamalganj and Sunamganj Sadar sub-district in northern Sylhet.

1.3.2 TRACKS as a case study and my role in the project

The TRACKS project is a collaboration between seven research institutions in Bergen, Bangladesh and Hawaii, coordinated by the Centre for the Study of the Sciences and the Humanities (SVT) at the University of Bergen. The project ran over three years, from 2014 to 2017, with the following three broad aspirations: (i) a robust, scientific understanding of climate variability in northeast Bangladesh and its impacts on communities, built on high quality climate and local knowledge; (ii) an innovative 'post-normal science approach' to mobilising climate knowledge for supporting 'community-based adaptation', and (iii) increased capacity within the communities of northeast Bangladesh to engage with different forms of knowledge.

The project is organised through five work packages: the first work package focused on climate science research, particularly to what extent existing climate models can be used in support of adaptation in northeast Bangladesh. New datasets for the climate in the region were also developed in this work package. In the second work package, over 200 people from various social, cultural and religious backgrounds in the selected Sylhet communities were interviewed and asked open questions about how the climate impacts their lives. The objective was to access their 'narratives', or stories, experiences and knowledge about the local climate. In the third work package, 60 of the interview respondents were invited to participate further in the next phases of the project, as an 'extended peer-community'. In this work package, the scientific climate data from work package 1 and the narratives from work package 2 were brought together, and negotiated in the extended peer-community. The aim was for the participants to share knowledge and agree on the most important climate indicators and their impacts on their communities. In the fourth work package, the extended peer-community became citizen scientists as they measured the different indicators that were agreed upon in work package 3 (TRACKS, 2017a). The fifth and final work package was dedicated to the on-going evaluation of the project, which this thesis contributes to. The focus of this study is specifically to evaluate the impact on the adaptive capacity of the citizen scientists in TRACKS, and to assess possible impacts on the wider communities.

To summarise, TRACKS is a research project trying to assemble high quality knowledge for adaptation and governance. It was not a self-proclaimed attempt at adaptive governance, but its steering principles were consistent with those of the adaptive governance theory. The leaders of TRACKS thus agreed that using this theory as a lens would provide interesting observations on the project and its impacts.

Chapter 2

Theoretical Framework

Introduction

The term 'governance' has gained increased popularity since the 1980s and has become a catchword for politicians as well as scientists from a variety of fields (de Alcántara, 1998; Kooiman et al., 2008; Kjær, 2004) – but what *is* governance? How can it be understood and applied, and how is adaptive governance different from other forms for governance? How can adaptive governance be evaluated? These are some of the questions to be addressed in this chapter. In the first part of the chapter, I will start with giving an overview of some of the various forms and definitions of governance, before I present the theory of adaptive governance, its origin and key principles. I will then discuss how adaptive governance can be distinguished from other governance models, and how it has been operationalised. I then turn to the second part of this chapter, where I will discuss evaluation of governance. Here I start with an introduction about evaluation traditions in political science and how evaluation relates to governance, before discussing evaluation of adaptive governance. Based on this discussion, the chapter will end with an explanation of my choice of evaluation model applied in this thesis.

2.1 Governance

2.1.1 What is governance? Definitions and examples

Traditionally, governance has been associated with governments and political leaders' exercising of power, to the extent that is has been used as a synonym for 'government'. In the 1980s, however, the concept of governance developed into new meanings, which now referred to something broader than just government – but no common definition seemed to emerge (Kjær, 2004). Over the last decades 'governance' has been applied in many different contexts, with many various connotations and understandings. It is being used by groups of very different ideologies, for a number of different and often contradictory ends (de Alcántara, 1998; Türke, 2008). According to Levi-Faur (2012), governance is referred to as everything from a buzzword or a fad, to a framing device, an empty signifier, to a theory and a perspective. So many meanings have been attributed to the concept that it has been said to

become ‘everything, and, thus nothing’ (Torfing et al., 2012). However, another way to look at it, is that governance is a concept with diverse and multiple meaning and uses.

Different definitions and understanding often vary depending on perceptions of the role of the state, both in a normative and an analytical sense (Kooiman et al., 2008). One perspective is that governance is an alternative approach to governments, which are often seen as failing to live up to the expectations of those they are set to govern. From this perspective, governance means that governing positions are moved from the state to other actors from market and civil society (Kooiman et al., 2008). Another understanding of the concept of governance is that it entails the joint action in areas where the state does not or cannot play a leading role – without necessarily implying the reduction of the activities of national governments (de Alcántara, 1998). In public administration and public policy, there are two major conceptions of governance: in a narrow sense, governance is understood as the management of networks. In a broad sense, governance refers to the management of all kinds of rules and practices affecting policy-making, no matter if they are of hierarchic, market- or network-dominated character (Kjær, 2004). Within natural resource systems, governance is increasingly used to refer to a crucial steering activity (Kooiman et al., 2008).

While the term governance is used in numerous ways, Kooiman (1999) attempted to distil some of the key traditions. Although this list is already 18 years old, and the governance literature is continually growing, it still provides a useful illustration of how diversely the concept is being applied:

(1) *Governance as the minimal state* – redefining the extent and form of public intervention
(2) *Corporate governance* – the way big organisations are directed and controlled
(3) *Governance as new public management* – making a difference between government and governance: ‘less government and more governance’
(4) *Good governance* – governance as advocated by the World Bank
(5) *Governance as socio-cybernetic governance* – as embodied by social-political or interactive governance
(6) *Governance as self-organising networks* – drawing on social network theory
(7) *Governance as ‘steuerung’ (German)* – the role of governments in steering, controlling and guiding societal actors
(8) *Governance as (international) order* – strengthening international relations through global governance
(9) *Governing the economy or economic sectors*

(10) *Governance and governmentality* – school of thought drawing on power theory, especially the legacy of Foucault

Based on the above traditions of 'governance', Kooiman (1999) goes on to identify six different ways in which authors have defined the concept:

(1) "systems of rule at all levels of human activity from the family to the international organisation in which the pursuit of goals through the exercise of control has transnational repercussions" (Rosenau, 1995)
(2) "a continuing process through which conflicting or diverse interests may be accommodated and co-operative action may be taken" (Commission on Global Governance, 1995)
(3) "self-organising, interorganisational networks characterised by interdependence, resource exchange, rules of the game and significant autonomy from the state" (Rhodes, 1997)
(4) "conscious management of regime structures with a view of enhancing the legitimacy of the public realm" (Hydén and Bratton, 1992)
(5) "mechanisms with no presumption that these are anchored primarily in the sovereign state" (Hay and Jessop, 1995)
(6) "solving problems and creating opportunities, and the structural and processual conditions aiming at doing so" (Kooiman, 1999)

Another theoretical governance approach which has been receiving increased interest over the last few decades and should thus be added to Kooiman's list, is the 'governance of the commons', primarily developed by Elinor Ostrom. In her book *Governing the Commons* (1990), she challenges three of the dominating models of understanding the range of problems associated with managing natural resource systems: Hardin's famous model 'the tragedy of the commons', 'the prisoner's dilemma', and 'the logic of collective action'. The premise underpinning these models is that individuals are primarily driven by their self-interest, and that they will therefore seek to maximise their own benefit rather than the interest of the group, which consequently leads to the over-exploitation of common resources. Privatisation on one hand, or strong, centralised control on the other, were predominantly considered the 'only' two solutions to the common resources problem (Ostrom, 1990). Ostrom set out to investigate different common-pool resources, and found that some communities were able to manage their resources sustainably, while resources managed by private actors or the state did

not always lead to sustainable management. Based by her findings, she identified a set of 'design principles' which reoccurred in the communities that managed to govern their natural resources in a sustainable way (Lopez & Moran, 2016), including clearly defined boundaries and rules, collective choice-arrangements, monitoring, graduated sanctions, conflict-resolution mechanisms and nested enterprises (Ostrom, 1990).

With so many different uses and definitions, how can the concept of governance be understood in a meaningful way? Despite the numerous uses of the concept, it is still possible to identify some features that are common to all the definitions of governance: the core of governance is that it refers to something *more* that government – representing an awareness that governments are not the only crucial actor in addressing major societal issues (Kjær, 2004; Kooiman, 1999). In all uses of the concept of governance, there is, to some extent, a focus on the inclusion and participation of non-state actors and the existence of a plurality of networks; and all the governance theories have emerged as reactions to the perceived shortfalls of existing approaches within their sub-fields (Kjær, 2004; Bellamy & Pallumbo, 2010). According to de Alcántara (1998), governance generally involves building consensus, or obtaining the consent or compliance necessary to carry out a programme, in an arena where many interests are in play. Kooiman (1999) suggests that applying the various uses and definitions to different levels of society can be one way to make sense of governance. For example, corporate governance might be most relevant at the organisational level, and 'good governance' might be more useful for national situations. Thus, Kooiman argues that each of the uses of the governance concept highlights different aspects of societal development.

In an attempt to organise the many different governance theories, Kooiman and Bavinck (2005) suggest three broad 'clusters' of governance models: hierarchical governance, self-governance and co-governance. Hierarchical governance, which is the most classic of the governance modes, comprises top-down models with a strong emphasis on steering and control, where the state is a central, regulatory governing unit. Self-governance, on the contrary, refers to bottom-up models of governance where actors govern and regulate themselves outside of the control of governments. Lastly, co-governance encompasses the broader models of governance, with a strong emphasis on the organised interactions between a range of stakeholders in society. No one actor is in control in co-governance models, instead the interaction between actors is aimed at reaching a common purpose. Both interactive governance and governance of the commons are modes of co-governance. Another useful distinction can be drawn between the *uses* of governance: it can be used both as an analytical tool, and as a normative tool.

2.1.1.1 Governance as an analytical tool

Earlier theories of political rule tended to focus primarily on the government as the main governing entity and executor of power, and therefore also the analytical starting point (Gupta et al., 2015). As such, the use of governance as an analytical tool can be understood as a response to these theories, which allows for a wider understanding of society, in recognising that multiple actors, both state and non-state, are usually involved in the process of governing. These actors can range from local groups from the civil society, to corporations and transnational social movements. Levi-Faur (2012) describes governance studies as "an interdisciplinary research agenda on order and disorder, efficiency and legitimacy all in the context of the hybridisation modes of control that allow the production of fragmented and multi-dimensional order, *within* the state, *by* the state, *without* the state, and *beyond* the state". Governance analyses also include the question of 'how', and not only 'who', signifying a more nuanced focus which include the practices and processes as well, instead of limiting the focus solely to people, organisations or nation-states (Gupta et al., 2015).

In order to clarify the meanings of governance in the literature, for analytical as well as theoretical purposes, Levi-Faur (2012) suggests four categories of governance: a structure, a process, a mechanism, or a strategy. The view of governance as a structure is dominating the literature, where governance is understood as the design of formal and informal institutions. Within this literature there is a range of different conceptualisations of governance structures, and consequently, various approaches to the study of institutions. Network governance, market governance or the governance of private institutions can be understood as approaches within the perspective of governance as a structure (Levi-Faur, 2012). The second perspective, in which governance is understood as a process, does not see governance as stable or lasting set of institutions – but rather as a neverending, dynamic process of decision-making. It includes a focus on the institutional capacity to steer or coordinate, and comprises theories of governance as a 'norm generating process' (Humrich & Zangl, 2010), 'practices of governing' (Bevir, 2011) and 'exercise of authority' (Heinrich, 2011). The third perspective sees governance as the institutional procedures of decision-making, wherein Levi-Faur (2012) distinguishes between five major mechanisms: 1) Monetised exchange: usually market exchanges, characterised by minimal or moderate transaction costs; 2) Non-monetised exchange: resources which are difficult or impossible to monetise or attribute value to. In both mechanisms, decision-making involves deciding whether to exchange, and if so, where, when and how; 3) Command: an authoritative and hierarchical mechanism of decision-making involving rule-making and the expectation of compliance; 4) Persuasion: elaboration of

interests, values and preferences, deliberation of ideas and information, and framing of options for action, and finally; 5) Solidarity: a mechanism resting on loyalty, love, faith and group identity rather than voice, interest, critical thinking and individualism. Lastly, governance can be understood as a strategy – signifying the creation, design and adaptation of governance systems beyond the formal institutions of government. This perspective also see governance as being about decentralisation of power, and the creation of informal, decentralised and collaborative systems.

2.1.1.2 Governance as a normative tool

While governance as an analytical tool can be used as a lens to gain understanding of how populations, territories and resources are governed, by whom, and at what scales, it can also be used as a normative tool (Kooiman, 2003). Gupta et al. (2015) identify two main trends of normative uses of governance: the first one is what they describe as "a neoliberal move away from state-centric models of governance towards network-based models" and the second one as "models of governance that emphasise democratic ideals such as transparency and participation".

The 'neoliberal' models generally advocate the market as the best suited and most efficient institutional design for distributing goods and services in society. Thus, they encourage deregulation, privatisation, and a decentralisation of decision-making. Multi-nodal or multi-actor governance are examples of this trend of governance as a normative tool. Both the United Kingdom and the United States of America have been dominated by neoliberal understandings of governance, especially since the 1980s under the administrations of Margaret Thatcher and Ronald Reagan (King & Wood, 1999). The other trend, which Gupta et al. (2015) refer to as 'good governance', contrarily presents the state as a key actor and the centre of governance arrangements. While neoliberal models tend to focus on participation in terms of involvement of corporations, good governance models emphasise the participation of citizens and civil society organisations. Good governance was primarily developed to guide donors in development aid, and has been used both as a condition for aid and a development goal (Doornbos, 2001; Gupta et al., 2015), often advocated by the United Nations and the World Bank, as mentioned in Kooiman's list.

2.1.1.3 Governance orientations: systems, actors and spatiality

Finally, distinctions can be drawn between the many governance approaches based on their focus of attention. Several governance models focus on system theories, including

institutional theories, organisational theories, and theories focusing on governance as a whole (Esmark, 2011; Gupta et al., 2015). Other governance theories take an actor-oriented approach, focusing on the roles of state and non-state actors and the relations between them. Three concepts of actor-oriented governance have been especially influential in theorising how the interrelations between the multiplicity of governance actors are structured: interactive governance, network governance, and hybrid governance. Interactive governance, also referred to as 'social-political governance', was suggested by Kooiman and does – as the name implies – have strong emphasis on interaction, understood as "any form of mutually influencing interaction between stakeholders" (Kooiman, 1999). Kooiman and Bavinck (2013) define interactive governance as "solving societal problems and creating opportunities through interaction between civil, public and private persons and organisations". Network governance theories are generally more concerned with the interconnections between actors in horizontal, rather than vertical, structures of decision-making. There are different perspectives of the role of networks in the various network governance theories: some theorise that governance through dispersed, collaborative networks of different actors can provide more effectivity in complex systems than centralised, vertical government systems, while others are more critical, claiming that such networks increase inequality and the erosion of public services provided by the state (Gupta et al., 2015). More recently, hybrid forms of governance have received increasing attention, focusing on how multiple state and non-state, formal and informal institutions intertwine. Such studies often take place within the context of public service provision and/or taxation, where non-state and state actors interact and begin to merge together. Hybrid governance is characterised as involving a shift from normative good governance to "pragmatic arrangements that actually work" (Gupta et al., 2015).

Other governance theories revolve around the aspect of spatiality, addressing issues related to place, space, scale and human-environment interactions. Approaches focusing on scale are often referred to as 'multi-level governance', focusing on spatial shifts taking place in governance systems. These shifts can happen upwards towards the supranational level, often seen as a consequence of globalisation; horizontally towards other actors; diagonally between interacting actors and scales; or downwards towards sub-national scales (Torfing et al., 2012). Another group of approaches emphasising spatiality is referred to as 'inter-local governance networks', which focus on governance through networks of similar actors, for example municipalities, across different locations (Gupta et al., 2015). The third group of governance models focusing on spatiality, which goes beyond scale and inter-local networks, is that of 'ecosystems approaches'. The focus of such approaches is the link between social

and ecological systems, and the need for governance to take ecosystem limits into account and integrate social, economic and ecological aspects (Gupta et al., 2015). Ostrom's beforementioned 'governance of the commons' belongs in this category. Another ecosystem approach which has gained increasing attention and influence over the last few decades, is the one constituting the main theoretical framework of this thesis: adaptive governance.

2.1.1.4 Situating adaptive governance in the governance landscape

In which part of the vast landscape of governance theories does adaptive governance belong? As discussed above, there are many uses and understandings of governance. The different governance theories can be distinguished from each other based on three broad grounds: 1) *Perception of the role of the state* – with perspectives varying from a strong, controlling state, to a minimal state, where governing positions are moved to the market and civil society, 2) *Mode of governance*, seeing governance as: a) a structure, b) a process, c) a mechanism, or d) a strategy, and finally 3) *Focus of attention* – where emphasis is usually placed on either: a) the governance system, b) the actors (state and non-state), and c) spatiality. As mentioned above, the main focus of adaptive governance is spatiality, as the link between social and ecological systems is fundamental in this theory. However, networks and interactions between a diversity of social actors is also essential in adaptive governance, so the focus is not limited to spatiality. Thus, one can argue that it is both an actor- and spatiality-oriented theory. Regarding perception of the role of the state, adaptive governance did emerge as a critical response to centralised top-down management, and sees the government alone as unfit to solve the complex environmental problems. It does not disregard the role of the state altogether, but emphasises the need for networks of diverse social actors on all levels of society. As such, the perception of the state in adaptive governance is somewhere in the middle on the scale between a strong, controlling state and a minimal state. When it comes to mode of governance, adaptive governance fits best into the category seeing governance as a strategy, with sustainable, adaptive social-ecological systems as the ultimate goal.

As we have seen, the different governance theories can also be used either as a *normative tool*, or an *analytical tool*. When applied normatively, the various governance modes can be seen as ideal models for how society, or some aspect of it, *should* be. An example of using governance as a normative tool is when politicians favour a certain type of governance which corresponds with their political ideology, and aim to shape the society according to that governance model. As such, all governance theories can be used as a

normative tool, depending on individuals' or groups' beliefs and ideologies. As discussed, the different governance theories can also be used as lenses for analysis. Because society is an incredibly complex and dynamic system, it is almost impossible to understand it without using simplified models and analyse perspectives (Knill & Tosun, 2012). Governance models can therefore be used to simplify and make sense of an empirical phenomena in society – however, because there are so many governance theories, different theories can often lead to different conclusions about the same phenomena.

As mentioned, this thesis adopts adaptive governance as its theoretical lens. With the objective being to evaluate a research object, I will be using adaptive governance as an *analytical* – rather than a normative – tool.

2.1.2 Adaptive Governance

Adaptive governance emerged as a critical response to the conventional centralised, top-down models of environmental management. It can be traced back to ecology and conservation science, organisational and governance studies (Karpouzoglou et al., 2016). Resilience and adaptive capacity constitute the very core of the adaptive governance theory, with a strong emphasis on learning how to deal with uncertainty and change through interaction between multiple stakeholders in self-organising networks (Folke et al. 2005; Olsson et al. 2006). Although the concept is not exclusively used in the governance of social-ecological systems, most adaptive governance research revolves around resilience, social-ecological systems and environmental governance (Chaffin et al., 2014). The perhaps most characterising feature of this theory is a fundamental shift away from what Folke et al. (2002) identifies as the two most fundamental errors in the past resource management policies: firstly, the assumption that ecosystems are linear, predictable and controllable, and secondly, the assumption that humans and natural systems can be treated separately. Over the last few decades, an increasing number of scholars have recognised the inherent link between social and natural systems and the need for new approaches to environmental governance. Berkes and Folke (1998) started to use the term social-ecological system to show that social systems and natural systems do not and cannot exist in isolation, and that a distinction between social and ecological systems is artificial. They argue that it is the mismanagement and depletion of the natural resources that has led us into many of the problems we are now encountering.

2.1.2.1 Origins of adaptive governance: complexity, uncertainty and resilience

Historically, environment and resource management has been focused on single issues based on a view that the ecosystems are stable and that change happens gradually (Folke et al., 2005). Different aspects of our world and society have traditionally been examined in isolation: natural scientists examine ecosystems, and social scientists examine social systems. The aim has been to increase natural system's stability and predictability by reducing the natural variation of systems' structure or function, to make them easier to control and more reliable for efficiently meeting the needs of humans (Holling & Meffe, 1996). When encountering problems, those concerned with environmental issues believed, until the 1970s and the early 1980s, that centralised control was the most efficient way to handle such problems. When unexpected and surprising events would happen in the natural systems, the response would typically be more control. This approach was based on the assumption that natural systems have one predetermined state of equilibrium, and resilience was understood as a system's ability to resist and recover from disturbance and return to the steady state (Liao, 2012).

Through his early works on complex adaptive systems in the beginning of the 1970s, the Canadian ecologist C. S. Holling was one of the first to challenge the traditional understanding of natural systems as linear, predictable and with only one state of equilibrium. He criticised the usage of a quantitative analytic approach to ecology and warned that although such an approach might be useful in the field of classical physics, it might be useless when transferred to an essentially different field – and even harmful. Holling (1973) pointed out that by approaching ecological systems as stable and able to sustain a maximum harvest of renewable resources with as little variation as possible, the determining conditions and forces on which the ecosystems rely and respond to, might change and lead to loss or reduction of resilience. A less resilient ecosystem is more vulnerable to disruptions, which can trigger sudden dramatic change and rapidly alter the whole system. Holling therefore suggested an alternative approach to natural systems – a management approach based on *ecological resilience*. As opposed to the conventional definition of resilience, which has been referred to as 'engineering resilience', Holling's new definition explained resilience as a system's capacity to absorb disturbance and still maintain its basic functions and structure, measured by the magnitude of disturbance the system can undertake without crossing thresholds and shifting into a different regime (Liao, 2012).

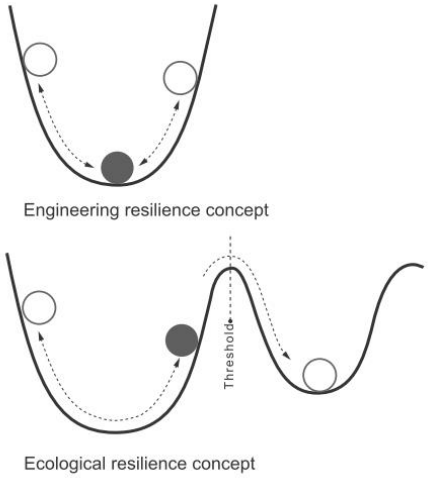


Figure 1: The 'ball-in-basin' metaphor illustrating the difference between the traditional 'engineering concept' of resilience, and the ecological concept of resilience. Illustration borrowed from Liao (2012).

The resilience approach emphasises the need to keep options open, view events in a regional rather than a local context, and the need to emphasise diversity. Instead of presuming that our knowledge is sufficient and that that future is predictable, Holling's resilience approach recognises our ignorance and accepts that the world is unpredictable, complex and dynamic. He called for a shift of perspective from focusing on predictability and maintaining the equilibrium of a natural system, to focusing on the conditions for persistence (Holling, 1973).

Holling's paper about resilience from 1973 lead to the development of the theory of *adaptive management*, defined by Holling (1978) as a "process of adaptive environmental management and policy design, which integrates environmental with economic and social understanding at the very beginning of the design process, in a sequence of steps during the design phase and after implementation". Since then, a significant body of literature on the concept has evolved, and it has now become a 'buzz word' (Hasselman, 2016; Loftin, 2014).

2.1.2.2 Adaptive governance versus adaptive co-management – what is the difference?

Adaptive management constitutes the foundation on which adaptive governance emerged from. However, a recent review by Hasselman (2016), revealed significant misinterpretations and confusion between and within definitions in the literature of adaptive management, adaptive governance and the related theory of adaptive co-management – making it challenging to distinguish between these three approaches. 'Adaptive governance' and 'adaptive co-management' seem to be used interchangeably in the literature: adaptive governance has been used to define adaptive co-management, and vice versa. According to some scholars, adaptive co-management is the operationalisation of adaptive governance,

implying that adaptive governance is the theory while adaptive co-management is the practice. On the contrary, others define adaptive governance as the implementation of adaptive co-management, thus seeing adaptive co-management as the theory and adaptive governance as the practice (Hasselman, 2016). In their review of the adaptive co-management literature, Plummer et al. (2013) similarly found that adaptive co-management is being interpreted in a range of different ways, from an approach facilitating the shift from government to governance, to a synonym for governance, to a model, strategy or tool to make governance operational.

In her review, Hasselman (2016) attempts to clarify the confusion between the adaptive theories. Firstly, she discusses how 'uncertainty' is being widely referred to and used as a justification for the theories of adaptation, but rarely with an explanation of how 'uncertainty' is understood. In her review she identifies three types of uncertainty found in the literature: 1) Imperfect knowledge, which refers to settings where knowledge is inadequate or inexact, a problem seen to be possible to solve through more research, 2) Incomplete knowledge, when multiple perspectives are required to build a complete understanding of a given system, which can be achieved through participatory processes, and 3) Unpredictability, referring to the inherent variability and constantly changing nature of complex systems, which cannot be reduced – but which rather requires the ability to cope with unforeseeable change. These three types of uncertainty are rooted in different epistemological perspectives: more positivist scholars and practitioners see uncertainty as something to remove through experimentation and discovery of new knowledge, which refers to the perception of uncertainty as 'imperfect knowledge'. More constructivist scholars and practitioners, on the other hand, view management itself as experimentation, seeking responsiveness to unpredictability. According to Hasselman (2016), the lack of acknowledgment of the epistemology underpinning research and associated views of uncertainty is a major reason for the confusion in the literature on adaptive theories. The most significant differences are found between two modes of adaptive management; active adaptive management, which is mainly dominated by a positivist epistemology, and passive adaptive management, which is underpinned by a constructivist perspective. Both adaptive co-management and adaptive governance are primarily based on constructivism, but while the adaptive governance scholarship is dominated by the perception of uncertainty as unpredictability, all of the three types of uncertainty can be found in the adaptive co-management literature. Hasselman (2016) further identify differences between the two approaches in terms of objective, participants involved, scope or scale of application, institutional context and governance aspect. These

differences are summarised in Table 1, which compares the two modes of adaptive management, adaptive co-management and adaptive governance.

Although Hasselman (2016) convincingly shows that it is possible to draw a distinction between adaptive governance and adaptive co-management, the widespread interchangeable use of the two terms in the literature still makes it challenging to separate them as they are often being used as synonyms. In their review of the adaptive governance literature, Chaffin et al. (2014) include foundational sources from the adaptive co-management literature, due to

	Adaptive management		***Adaptive co-management***	***Adaptive governance***
	Active	***Passive***		
Uncertainty	Imperfect knowledge	Incomplete knowledge and unpredictability	Imperfect knowledge, incomplete knowledge and unpredictability	Predominantly unpredictability
Epistemology	Positivism	Constructivism	Constructivism	Constructivism
Objective	Experimentation	Responsiveness	Local empowerment	Flexibility
Participants involved	Policy-makers, experts and scientists	Policy-makers, experts and scientists. The process applied may also include resource managers, resource users and community	Local resource managers, users and community are central, with support from government	Governments and organisations. The processes applied may also include policymakers, experts, scientists, lobbyists, resource managers, resource users, community and politicians
Scope or scale of application	Policy- or issue-specific	Policy- or issue-specific	Issue and location specific, but linked or supported by vertical levels of government	Across governance scales – networked governance
Institutional context	Government responsibility	Government-led responsibility	Local responsibility supported by government	Shared responsibility between government and non-government
Governance aspect	Policy	Polity	Polity	Political, policy and polity

Table 1: A comparison of active adaptive management, passive adaptive management, adaptive co-management and adaptive governance based on the table by Hasselman (2016).

how many of the early contributions to the adaptive governance literature were framed in terms of adaptive co-management. Plummer et al. (2013) refer to Ludwig (2001)'s declaration that 'the era of management is over' – due to its failure when confronted with complex problems – to explain the 'dissolving boundaries' between adaptive governance and adaptive co-management. They argue that in practice, the actual concepts shared by the two approaches are increasingly interchangeable, which can be explained by the general shift away from centralised control to alternative forms of governance. Thus, adaptive co-management can be understood as a hybrid between governance and natural resources management. Plummer et al. (2013) state that "recognition of the interchangeability of ACM [adaptive co-management] and governance perspectives is important because it creates a productive space for the interdisciplinary scholarship required to foster sustainability".

Given the widespread interchangeable use of adaptive governance and adaptive co-management, limiting my sources strictly to publications labelled as 'adaptive governance' can result in missing out on important information if the authors have used the term 'adaptive co-management' as a synonym for 'adaptive governance'. However, in order to avoid contributing to further confusion and ambiguity in the field, I will clarify my understanding of 'adaptive governance' by sticking to one definition of the approach and its key concepts and characteristics, and my sources are carefully chosen in accordance with these definitions.

2.1.2.3 Definitions of adaptive governance

As discussed above, the literature on adaptive governance is characterised by a lack of a clear and consistent definitions, with six possible definitions of adaptive governance being:

(1) "a concept from institutional theory that deals with the evolution of institutions for the management of shared assets, particularly common pool resources and other forms of natural capital"

(Hatfield-Dodds et al., 2007)

(2) "a reform strategy, one that builds on experience in a wide variety of emergent responses to failures of scientific management in our time"

(Brunner, 2010)

(3) "a range of interactions between actors, networks, organisations and institutions emerging in pursuit of a desired state for social-ecological systems"

(Chaffin et al., 2014)

(4) "a conceptual umbrella for approaches seeking to integrate knowledge of social and ecological systems into inclusive decision-making that anticipates, learns from, and responds to change"

(Wyborn & Dovers, 2014)

(5) "flexible and learning-based collaborations and decision-making processes involving both state and non-state actors, often at multiple levels, with the aim to adaptively negotiate and coordinate management of social-ecological systems and ecosystem services across landscapes and seascapes"

(Schultz et al., 2015)

(6) "an emergent, self-organised process of a social-ecological system that changes form as systems undergo periods of crisis and stability"

(Chaffin & Gunderson, 2016)

Despite the different definitions, Chaffin et al. (2014)'s literature review revealed that adaptive governance is consistently viewed as a system of environmental governance which has the potential to mediate the complexity and uncertainty inherent in social-ecological systems. Based on this observation, I choose to adopt the definition of Schultz, Folke, Österblom and Olsson (2015) above, as this definition seems to be the one corresponding the most with the shared view of adaptive governance in the literature. In order to avoid contributing to further ambiguity in the adaptive governance scholarship, the key principles of the theory as understood and applied in this thesis will be presented in the following section.

2.1.2.4 Key principles of adaptive governance

<u>Building resilience and adaptive capacity: Embracing uncertainty and change</u>

As discussed above, resilience is one of the most important concepts of the adaptive governance theory. Since Holling's first definition of ecological resilience, the concept has developed considerably. While Holling's definition can be described as incremental, referring to building resilience within an existing social-ecological system so that it can absorb disturbances and still remain the same structure and function, another dimension has been identified, called 'transformative resilience' (Nelson et al. 2007, Walker et al., 2004). Transformative resilience, or transformability, is a system's capacity to create a fundamentally new state of the social-ecological system due to untenable ecological, economic, or social structures (Walker et al., 2004; Chaffin et al., 2014). As such, resilience

also encompasses a system's ability to reorganise in the face of sudden change (Holling, 1973; Chaffin et al., 2014). The following definition of resilience from Walker, Holling, Carpenter and Kinzig (2004), is adopted in this thesis: "Resilience is the capacity of a system to absorb disturbance and reorganise while undergoing change so as to still retain essentially the same function, structure, identity and feedbacks".

Adaptability is another key principle in adaptive governance, defined as the capacity of actors in a social-ecological system to manage resilience in the face of uncertainty and surprise (Folke et al., 2005). In other words, the adaptive capacity of a human society determines whether or not they can keep the social-ecological system they are part of to shift into an undesirable regime. If the system is already in an undesirable regime, adaptability can also mean the capacity to transform it into a desirable one (Walker et al., 2004). By building resilience instead of attempting to exercise control in social-ecological systems, actors have the capacity to reorganise the system when conditions change and disturbance events happen. Acknowledging and embracing the fact that social-ecological systems are nonlinear, unpredictable and dynamic, is thus essential for adaptive governance. Resilience is often associated with diversity – of species, as well as of opportunities for humans and economic options (Folke et al., 2002). In a resilient social-ecological system, a crisis is therefore seen as an opportunity for transformation into a more desired state (Folke et al., 2005).

Social learning and social capital: Mobilising knowledge for resilience

A fundamental tool for building resilience and adaptive capacity in a social-ecological system, is learning. Folke et al. (2002) recognise 'ecological ignorance' – the perception of humanity as unconnected to and in control of nature – as an underlying cause of the vulnerability in societies. In order to govern social-ecological systems towards resilience, the ability to observe and interpret essential processes and variables in ecosystems dynamics is vital for developing social capacity to respond to environmental change (Folke et al., 2005). Building resilience therefore requires an understanding of ecosystems. However, this understanding should not only be based on conventional, scientific knowledge. In the adaptive governance theory, other knowledge systems like 'local', 'traditional' or 'craft' knowledge is recognised as equally important. According to Folke et al. (2005), scientists' role also changes as we enter times of uncertainty, rapid change and complexity: scientists can no longer act as detached deliverers of knowledge to managers, but are now becoming one of several actors in the learning and knowledge generation process. Key individuals who provide leadership,

trust, vision and meaning are also considered vital in order to create a learning environment (Folke et al. 2005; Olsson et al., 2006).

This process of combining different knowledge systems and sharing experiences is referred to as 'social learning'. More specific, social learning is a collaborative group process (Pahl-Wostl et al., 2007), targeting "a change in understanding that goes beyond the individual to become situated within wider social units or communities of practice through social interactions between actors within social networks" (Reed et al., 2010). Part of the process of social learning is a dialogue between scientists, resource users and interested publics, informed by an analysis of key information about environmental and social-ecological systems, described by Dietz et al. (2003) as 'analytic deliberation'.

Related to social learning is the concept of 'social capital', which several scholars have regarded as the 'glue' for adaptive governance and collaboration. Various definitions of this concept can be found in the literature, but a common understanding is that social capital is the features facilitating cooperation and enable people to act together, such as social interaction and networks, trust and reflexivity (Folke et al., 2005). Social capital also entails values or norms and expectations shared among members of a group (Sanginga et al., 2010).

Social learning processes are believed to result in improved knowledge, which is trusted by involved stakeholders, as essential for information to be used effectively and build social capital (Dietz et al., 2003). According to Folke et al. (2005) trust makes social life predictable and creates a sense of community, which makes it easier for people to work together. Building trust and the growth of social networks are therefore core strategies for facilitating social learning and building social capital. Furthermore, social systems are structured not only by rules, positions, and resources but also by meaning and by the entire network of communicating individuals and organisations at different levels of interaction. In order to mobilise several interest groups at various levels and start a self-organising learning process, a clear and convincing vision, common meaning and good relationships based on trust between stakeholders are essential (Folke et al., 2005).

The role of networks and institutions

Folke et al. (2005) describes self-organising social networks as "the web that tie together the adaptive governance system". The role of such networks is to connect individuals, organisations, agencies and institutions at multiple organisational levels that draw on various knowledge systems and experiences in order to develop a common understanding and policies. Further, adaptive governance relies on institutions that are polycentric, flexible,

nested in different levels of governance, and which operates at multiple scales (Olsson et al., 2006; Dietz et al., 2003; Chaffin et al., 2014). A polycentric system implies multiple private and public organisations at multiple scales, that collaboratively affect benefits and costs (Ostrom, 2012). Flexible institutions imply that they are adaptive, in other words, that they are designed to be prepared for change (Dietz et al. 2003). The institutional design must also facilitate experimentation, learning and change (Chaffin, et al. 2014). This is an important part of acknowledging social-ecological systems as dynamic and nonlinear.

Monitoring and evaluation

Summarising the key principles above, the overall goal of adaptive governance is to build adaptive capacity by enabling people and communities to live with change and uncertainty, to nurture diversity for resilience, combine different types of knowledge for learning and to create opportunity for self-organisation towards social-ecological sustainability (Folke et al., 2005). It is, however, important to keep in mind that adaptive governance cannot be reduced to a list of specific prescriptions, but that it is highly context dependent (Brunner et al. 2005). As such, each adaptive governance initiative must be operationalised and tailored to its specific surroundings. In order to do so, the aspect of learning is essential: social learning is the means of embracing uncertainty through iterative processes of adjusting governance for improvement (Rijke et al., 2012). Before turning to the aspect of evaluation, I will provide a real-world example of adaptive governance for the purpose of showing how it can be operationalised.

2.1.2.5 Operationalising adaptive governance – lessons from Kristianstads Vattenrike

With adaptive governance being so dependent on context, and the necessity of tailoring the approach to each specific case, how then it be operationalised? A first step to understand this is to look to what has been done before, and reflect on what can be learned from past experiences. I will now present one well-studied example of adaptive governance that has been considered particularly successful: Kristianstads Vattenrike.

Kristianstads Vattenrike is a wetland area in Kristianstad municipality in southeast Sweden, which covers around 1100 square kilometres of the Helgeå River catchment. It is an area of high cultural and biological importance, and includes the city of Kristianstad with around 28 000 citizens, as well as some of the most productive agricultural land in the country

– thanks to the annual flooding of the Helgeå River. Sweden's largest areas of flooded meadows are found here, as well as large beech forests, wet forests, sandy grasslands and willow bushes, all supporting a range of unique flora and fauna. The area also holds the largest reserve of groundwater in northern Europe. The importance of Kristiandstads Vattenrike was recognised internationally during the 1970s, when a 35 kilometer stretch of wetlands along the Helgeå River was declared a Ramsar Convention Site[1]. This meant that this area would be protected from further exploitation by a comprehensive conservation plan – leading people of Kristianstad to believe that their local environment would be improved and managed sustainably (Walker & Salt, 2006).

However, in the 1970s, the environmental decline in Kristianstads Vattenrike had already been evident for many years: bird populations were decreasing, and the lake was becoming clogged and eutrophicated (accumulation of excessive nutrients, causing a dense plant growth and depletion of oxygen supply). The protection the Ramsar Convention was supposed to offer, did not show any effect, and ten years after the declaration, local people observed that the area's natural values were still in decline. The degradation of Kristianstads Vattenrike has a long history as people first settled here thousands of years ago – although the pressure on the wetland environment first accelerated in 1774 with the first attempts to control water levels and flows. Since then, the area was gradually depleted due to the construction of embankments, fragmentation of the natural landscape caused by urban sprawl and road construction, fertilisers and pollution.

Consequently, when parts of Kristianstads Vattenrike was declared a Ramsar site in the 1970s, the environmental problems of declining bird populations, pollution and eutrophication were already so severe that the Ramsar protection was not enough to restore it. Another challenge to the wetlands was the abandoning of grazing and haymaking traditions. Without the traditional cultivation of the flooded meadows, they would soon be overgrown and eventually turn into forests – leading to the loss of habitat for those species dependent on the meadows. In order to preserve and restore Kristianstads Vattenrike into the desired state, the local people realised that they would have to take responsibility themselves. In the 1980s, a museum curator started educating himself about how agricultural practices had shaped the landscape and the ecosystem of Kristianstads Vattenrike over thousands of years. Through communicating this knowledge to the public and various stakeholder groups, he initiated the

[1] The Convention on Wetlands is an international treaty for the conservation and sustainable use of wetlands, which was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975 (Ramsar, 2014).

creation of a network aiming to restore the social-ecological system of Kristianstads Vattenrike. He succeeded in bringing together a forum of key individuals from a range of different groups and organisational levels: the local farmers' association, the Bird Society of Northeastern Scania, local environmental groups, as well as the Municipality of Kristianstad, the National Museum of Natural History, WWF Sweden, a national research council and the County Administrative Board (Olsson et al., 2006). Through sharing views, knowledge and discussing solutions, this stakeholder network succeeded in creating public awareness about the environmental issues of Kristianstads Vattenrike, impact the municipality, and work with farmers to ensure farming practises that preserved the area. Over the years, the network expanded and accomplished a number of achievements. The wetland, that had become an impenetrable swamp, was restored and made accessible to the public – a transformation that made it so popular that more than a hundred and fifty thousand people visit every year (Walker & Salt, 2006).

What lessons can be learned from Kristianstads Vattenrike? Firstly, it demonstrates how conventional management of natural resources with no overall plan can lead to the deterioration of an area's environment. Secondly, it shows how the empowerment of local people and the creation of collaborative networks can turn an environmental crisis around and create new opportunities. In Kristianstads Vattenrike, a museum curator took the initiative to create such a network, which shows the importance of key individuals and leadership. Creating a network of loosely connected stakeholders, serving as a forum for organisations and individuals to share views, discuss issues and build consensus, was vital in building trust and thus finding common solutions for the wetland area. The strengths of this network was its diversity, as it included a range of stakeholders from the national to the international level, in a variety of organisations – each contributing with different types of knowledge. One of the key strengths of the network was that the decisions were reached collaboratively by all the stakeholders.

Of course, the process of restoring the wetland area of Kristianstad was not defined as adaptive governance at the time. Instead, successful cases of the governance of social-ecological systems, such as Kristianstads Vattenrike, has been important contributions to the development of the adaptive governance theory and its key principles. How then, can adaptive governance initiatives be *evaluated*? As mentioned, this thesis uses the TRACKS project as a case to research this question. Thus, I will now turn to the aspect of evaluation of adaptive governance, starting with a wider introduction of the terrain on evaluation in political science.

2.2 Evaluating governance

As with the concept of 'governance', the term 'evaluation' is increasingly recognised as an important element in many aspects of society, especially in the sphere of policymaking – representing an interface where science, policies and administration meet. The primary purpose of evaluation is to systematically assess an initiative or a program's quality, utility, and accountability (Tornes, 2012; Alkin & Christie, 2004). The knowledge gained from an evaluation is intended to teach us something that can be useful for future initiatives, enable us to control if and how tasks are being carried out, or provide new insights and perspectives. Above all, evaluation should contribute to a foundation of knowledge on which one can decide whether or not an initiative should be ended or continued (Tornes, 2012). But how can the knowledge provided by evaluation be characterised? Does an evaluation report represent the 'final truth' about the initiative in question – or is it just systematised assumptions from the perspective of the evaluator? To what extent can the information provided from an evaluation be trusted? These are some of the questions to be addressed in this chapter.

One single, scientific and correct definition of evaluation is not easy – nor is it desirable, according to Tornes (2012). Along with the increased interest and focus on evaluation over the last decades, the scientific literature on evaluation has grown accordingly, resulting in a diversity of definitions and approaches. The different uses vary based on the researcher's academic background, what is being evaluated, the interests of stakeholders, institutional and political limits for the evaluation (Tornes, 2012). Different fields use the evaluation term in accordance with their own traditions, sometimes conflicting with how it is being used in related disciplines. Due to the various definitions, methods and 'recipes', there is thus no 'gold standard' for good evaluation. Therefore, evaluation should be considered an 'elastic' concept (Furubo & Sandahl, 2002). Almås (1990) provides a simple, but useful starting point for all evaluation efforts, based on the definition of evaluation as "systematised collection of data to distinguish and analyse the effect of an attempt to create change within a given area": the evaluation must be tailored to each individual case depending on the context in which the evaluation is carried out, which interests it is covering, and the focus of the evaluation. Before discussing the definition and theory of evaluation applied in this master's thesis, I will start by giving an overview of the general evaluation traditions in the field of social science.

2.2.1 Evaluation traditions in social science

Despite the array of definitions and uses of evaluation, any evaluation model is, according to Alkin and Christie (2004) based on a dual foundation of accountability and systematic social inquiry. Accountability, understood as being capable of being accounted for, is the rationale that creates the need and desire for evaluation, for governments as well as private businesses. There are several dimensions to accountability: Wagner (1989) draws a distinction between the 'reporting phase', which simply refers to a description, and the phase of 'justifying analysis', implying an explanation. Alkin and Christie (2004) add a third phase, 'answerability', which means holding the responsible actors accountable – but they stress that this is not the scope of evaluation – rather, evaluation provides the information for holding someone accountable. Accountability can also be divided into 'goal accountability', 'process accountability' and 'outcome accountability'. Goal accountability investigates if reasonable and fitting goals have been formulated, process accountability is concerned with whether the procedures for reaching these goals have been reasonable and appropriate, and outcome accountability focuses on whether or not, or to what extent, the goals have been achieved (Alkin and Christie, 2004). Outcome accountability is the main focus of most evaluation efforts. While accountability and social inquiry can be understood as the fundament for all evaluation theories, the different evaluation approaches can be distinguished based on how they emphasise three basic elements: use, method and valuing (Christie & Alkin, 2008). This has been illustrated in Alkin and Christie's 'evaluation theory tree' (2004), where accountability and social inquiry constitute the trunk, while three major branches represent the elements of use, method and valuing. Evaluation theorists whose main concern is use, focus on those who will use the information derived from the evaluation and how they will use it, for example in program evaluation and evaluation for decision making (Alkin & Christie, 2004). Others place more emphasis on the methods and study design used in evaluation, while the third group of theorists emphasise valuing above the other two. The valuing branch of the tree addresses questions such as whose values should shape the evaluation, why, and with what intent – but it also includes the work of those concerned with social justice and the philosophy of subjectivity (Christie & Alkin, 2008). Following Christie and Alkin's metaphor, the tree of evaluation studies has grown and changed over time – and the evaluation trends in social science have been shaped and reshaped by political contexts and dominating epistemologies and philosophical theories.

The origin of evaluation studies goes back to the development of social and educational programs in the 1960s and 1970s – identified as the first 'wave' of evaluation

(Karlsson, 2003). Characterising this period was the perception of the market as inadequate for providing solutions to social problems such as unemployment, urban poverty and social inequalities, and stronger state interventions were therefore considered a promising solution. Public administration was seen as well equipped to facilitate desired changes, and evaluation was seen as a 'correcting device'. The purpose of evaluation was to measure performance in order to provide governments and public administration with information about the result of an action, which in turn might help them take decisions and enforce them in an effective and efficient way (Stame, 2006). However, the evaluations that were undertaken showed that it took a long time for evaluations to be utilised, and rarely in an instrumental way, as well as frequent goal displacement, and a general tendency for public administrators to develop strategies to avoid being evaluated (Stame, 2006). These results contributed both to the emergence of alternative approaches to management and to the rise of the second wave of evaluation, which started in the 1980s. This was a time of a shifting political context, dominated by a declining confidence in the efficiency of the public sector and a re-established confidence in market regulations (Karlsson, 2003; Stame, 2006). 'New Public Management', a new approach for public administration, originated in this period, inspired by ideas and techniques from the private sector. The aim of New Public Management was to improve effectiveness and efficiency of government performance and cut costs through privatisation, deregulation, competition and outsourcing of governmental services (Klijn, 2012; Stame, 2006). This resulted in changes in the role of evaluation, and in the 1990s the evaluation discourse was dominated by a top-down perspective based on control, effectiveness and the measurement of quality (Karlsson, 2003). New Public Management marked a shift away from input controls and 'bureaucratic procedures' to the quantitative measurement of outputs in terms of performance indicators (Hood, 1991). However, the sinking faith in public administration also led to a call for different models of democracy built on principles of participation and deliberation (Hanberger, 2006). Many of the approaches to evaluation addressed the need of these alternative models, from those aiming at establishing principle of 'good governance', to those more focused on stakeholders through evaluation approaches such as 'empowerment evaluation' and 'responsive evaluation' (Stame, 2006). As such, the evaluation of contemporary management regimes has led to the development of new management approaches, as well as new models of evaluation. One response to the perceived shortcomings of the classic evaluation analysis in the 1960s and 1970s, was implementation theory, which has become an established part of public policy research.

2.2.1.1 Implementation Theory

Implementation theory grew out of evaluation research, in the wake of the first wave of evaluation studies. As mentioned above, most of these studies showed no or little effect, which led the evaluation analysts to conclude that the program in question did not work (Albæk, 1988), and that it was based on the wrong causal theory. While this conclusion led to the emergence of alternative management approaches, the first implementation researchers set out to challenge this assumption. Could it be that it was not the causal theory behind the program that was the problem, but rather the implementation of the intervention? Inspired by this question, researchers started to study the relationship between planned policy programs, and how these programs were actually carried out. Thus, goal achievement became the dominating standard for implementation research (Winter, 2012a).

Since its origin in the 1970s, implementation theory has developed through three 'generations': the first generation focused on the 'complexity of joint action' as the key obstacle for implementation. Pressman and Wildavsky (1973) concluded that even slightly different perspectives, priorities and time horizons among many stakeholders – along with bad policy instruments – could cause delay, distortion and failure in the implementation of the program.

In the early 1980s, along with the 'second wave of evaluation' and the increasing focus on 'governance', the 'second-generation' implementation research emerged: now, the focus shifted from generating theory to building theoretical framework for analysis that could guide empirical work (Winter, 2012b). The construction of theoretical frameworks and research strategies led to one of the major controversies among implementation analysts: should implementation be studied from the top-down or the bottom-up perspective? The advocates of the top-down perspective would typically take a control point of view on implementation, trying to advise on how the implementation process should be structured in order to achieve the goals of the intervention. The bottom-up researchers, on the other hand, challenged the dominating standard of goal achievement, arguing that the focus should rather be on problem solving (Winter, 2012b).

The third generation emerged in 1986 and was based on criticism towards single case studies with too many variables as the dominating approach. Again, there was a shift in focus, this time towards comparative case studies and research designs, that borrowed from both top-down and bottom-up research. There was also a call for the development of an overarching theory of implementation that focussed on process rather than outputs and outcomes (Winter, 2012b). However, even though implementation theory has received increasing attention and

focus over the last 40 years, a general implementation theory has yet to emerge – despite many scholars having this as their ultimate goal. Rather, implementation theory has been, and still is, characterised by many different approaches, research strategies, evaluation standards, methodologies, concepts and study areas.

Despite various perceptions and approaches, the implementation research field is still dominated by a top-down perspective which considers the implementation in terms of steering and control (Winter & Nielsen, 2008). When evaluating an initiative, most implementation research uses the official goals which have been formulated for the initiative or program in question, as their point of departure. In terms of method, implementation research applies a wide range of methods, from text analysis, qualitative interviews and observations of implementers to quantitative data collection on the program coverage, target group participation, outputs in terms of delivery behaviours, and outcomes (Yin, 1982). Because implementation research focuses on the relationship between goals, outputs and outcomes in specific cases, the indicators for successful implementation are highly context dependent and are defined by the goals of each individual program or initiative. Implementation research can therefore be considered an example of evaluation in *practice*, aiming to explain why policies succeed or fail by focusing on how they are "transformed during the execution process until the point of delivery – and even after in changing the behaviours of citizens and firms" (Winter, 2012b). The findings from implementation theory, negative or positive, in turn provide a basis for the development of evaluation theories in general, and contribute to the legitimation for alternative systems of governing. A distinction can thus be drawn between evaluation as *practice or policy*, and evaluation as a *science*.

It was precisely the evaluation of the current, top-down management regime that brought about the emergence of governance theories. If then, the science of governance is built upon evaluation, how is governance evaluated, and based on which indicators and theories? If governance is a response to the problems of legitimacy and implementation in traditional government regimes, how are these issues dealt with in governance systems? These are the main questions to be addressed in the following section.

2.2.1.2 Trends in governance evaluation: three broad orientations

Evaluation has been referred to as an 'indispensable tool of good governance' (Picciotto, 2015). When new governance models are introduced, the need for evaluation grows – however, because governance settings differ, the evaluation must differ as well. Governance is intertwined with democracy, thus the perception of democracy underpinning the specific

governance approach, is essential. Hanberger (2006) identify three broad democratic evaluation orientations which are based on three main democracy theories and evaluation theory. The first one is the 'elitist democratic evaluation' which is based on elitist democratic theory. This approach generally investigates if the goals formulated by the political-administrative elite have been achieved, and the evaluator is an expert at researching whether or not a method or intervention works. Citizens are not included, and dialogue and deliberation are not considered vital. Legitimacy is perceived as to which extent decisions or goals have been reached through the prescribed implementation chain.

The second democratic evaluation orientation is 'participatory evaluation', which is based on participatory democracy theory. The objectives of this approach are empowerment, self-organisation and self-learning. It takes people's opinions seriously through facilitating for stakeholders to design the evaluation themselves, in accordance with their own needs and goals – as such, the evaluator's role is to be a facilitator and a coach. Forms of direct democracy are promoted, and the process is considered legitimate if participating or affected citizens are included and empowered both by the initiative, and the evaluation of it.

The third orientation is discursive democratic evaluation, and is based on deliberative or discursive democracy theory. This approach is primarily focused on supporting collective learning, meeting the main stakeholders' need for practical knowledge, facilitate for public deliberation and justify collective action. The evaluator's role is to be a counsellor and mediator by providing analysis and introducing arguments to support the process of collective learning. It is based on the assumption that institutions and private or civil actors share the responsibility of developing and implementing a program or initiative. All legitimate stakeholders are included in the program as well as in the evaluation process, and they are the ones to decide on relevant criteria for evaluation. Hanberger (2006) provides a useful summary of these three democratic evaluations in table 2. The participatory democracy evaluation and the discursive democracy evaluation can be seen as a result of the call for more democratic evaluation approaches focusing on participation and the inclusion of stakeholders. The elitist democracy-oriented evaluation, on the other hand, seems to belong under what Bovens et al. (2008) refers to as 'rationalistic policy evaluation'. Such evaluation approaches place a strong emphasis on value neutrality and objective assessments.

I have now presented some broad evaluation trends in political science in general, and more specifically, the evaluation of governance. With this as a backdrop, I will now return to adaptive governance, presenting the prevailing evaluation trends within this theory.

Democratic orientation	*Intended use/function*	*Evaluation focus*	*Inclusion*	*Dialogue*	*Deliber-ation*	*Evaluator's roles*
EDE: *for* the people (Schumpeter)	- elite learning - rational feedback - accountability	- intended outputs and outcomes - goal achievement	policy and programme makers	not important	not important	expert
PDE: *by* the people (Pateman)	- self-learning - self-determination - empowerment	- people's own needs - goal development - steps forward	- programme implementers - self-governed citizens/clients	very important	important	- advocate - facilitator - coach
DDE: *with* the people (Dryzek, Habermas, Gutmann and Thompson)	- collective learning - justification - public debate	- stakeholder's criteria - authentic discourse - intended and unintended outcomes	all legitimate stakeholders	very important	important	- mediator - counsellor
EDE = Elitist Democracy-oriented Evaluation; PDE = Participatory Democracy-oriented Evaluation; DDE = Discursive Democracy-oriented Evaluation.						

Table 2: Characteristics of the Three Democratic Evaluation Orientations (Hanberger, 2006)

2.2.2 Evaluation of adaptive governance

Bellamy et al. (2001) state that "evaluation is fundamental to identifying change, supporting an adaptive approach that is flexible enough to meet the challenge of change, and enabling progressive learning at individual, community, institutional, and policy levels. However, evaluation in natural resource management policy has been neglected and a substantial gap is emerging between theory and practice". Although it has been sixteen years since Bellamy and his colleagues' observation, the focus on evaluation of natural resource management policies still seems to be limited: even though adaptive governance is a growing research field, which is receiving increasing attention and influence, there has been little focus on the aspect of evaluation (Plummer et al., 2012; Smedstad & Gosnell, 2013; Plummer et al., 2014; Trimble et al., 2015). There is particularly a lack of evaluation efforts focusing on evaluating the *process* of adaptive governance initiatives, and the relationship between goals and outcomes

(Trimble et al., 2015). In this section I will present some of the existing evaluation efforts and current discussions in the literature about the evaluation of adaptive governance and related theories.

2.2.2.1 Existing evaluation frameworks for adaptive governance and related theories

Where to start from, when attempting to evaluate a relatively new governance approach? A common strategy has been to look to other, related theories which have come further down the road of evaluation, a strategy that has been adopted in the evaluation of adaptive governance as well. One theory that has much in common with adaptive governance, is that of 'collaborative planning'. Innes and Booher (1999) describe collaborative planning as "part of the societal response to changing conditions in increasingly networked societies, where power and information are widely distributed, where difference in knowledge and values among individuals and communities are growing, and where accomplishing anything significant or innovative requires creating flexible linkages among many players". Guided by the theory of complexity science and Habermas' concept of communicative rationality[2], they propose a framework for evaluating the process of consensus building, divided into 'process criteria' and 'outcome criteria' (see table 3). As complexity and consensus building is also central to the adaptive governance theory, Innes and Booher's (1999) framework has informed the development of evaluation framework for adaptive governance.

Based on insights from Innes and Booher's (1999) framework, complexity and social-ecological resilience thinking, Plummer and Armitage (2007) proposed a resilience-based framework for evaluating adaptive governance. In their framework, they identify key parameters in the adaptive governance literature which are useful for analysis of performance and outcomes. The focus of concern is typically a well-defined resource, for example fishery, wildlife or forest, and how such a resource can be governed sustainably. The framework consists of three broad components: (1) ecosystem conditions; (2) livelihood outcomes; and (3) process and institutional conditions. The ecosystem component relates to the focus on sustainable governance of a defined resource, as it aims to identify ecological outcomes of an adaptive governance initiative. Examples of ecological outcomes include air quality, groundwater and species diversity. The livelihood component is inspired by the sustainable livelihoods framework that emerged in the 1990s as a response to failures of development

[2] Habermas' concept of communicative rationality is grounded in dialogue and joint learning among those with interests in an issue (Habermas, 1984).

Process Criteria	Outcome Criteria
Includes representatives of all relevant and significantly different interests.	Produces high-quality agreement.
Is driven by a purpose and task that are real, practical, and shared by the group.	Ends stalemate.
Is self-organising, allowing participants to decide on ground rules, objectives, tasks, working groups, and discussion topics.	Compares favourably with other planning methods in terms of costs and benefits.
Engages participants, keeping them at the table, interested, and learning through in-depth discussion, drama, humour, and informal interaction.	Produces creative ideas.
Encourages challenges to the status quo and fosters creative thinking.	Results in learning and change in and beyond the group.
Incorporates high-quality information of many types and assures agreement on its meaning.	Creates social and political capital.
Seeks consensus only after discussions have fully explored the issues and interests and significant efforts have been made to find creative responses to differences.	Produces information that stakeholders understand and accept.
	Sets in motion a cascade of changes in attitudes, behaviours and actions, spinoff partnerships, and new practices and institutions.
	Results in institutions and practices that are flexible and networked, permitting the community to be more creatively responsive to change and conflicts.

Table 3: Criteria for evaluation of consensus building, based on Innes and Booher (1999)

interventions. Plummer and Armitage (2007) define a livelihood as a "set of strategies employed by individuals and households to make or gain a living, as determined by capabilities, tangible (e.g., natural resource, human, physical) and intangible (e.g., claims and access relationships) assets". The livelihoods framework is increasingly being linked to ideas of complexity and resilience, and has been recognised as a useful analytical structure for evaluating adaptive governance, with resilient livelihoods being defined as those capable of: (i) coping with and recover from shocks and stresses; (ii) maintaining or enhancing existing capabilities and assets despite uncertainty, and (iii) ensuring the provision of sustainable livelihood opportunities for future generations (Plummer and Armitage, 2007). Table 4 outline the key parameters of the livelihood component of Plummer and Armitage's evaluation framework.

Livelihood (economic, social) parameters for evaluation					
Overarching parameters:					
Increased well-being	Decreased poverty	Increased income	Decreased vulnerability	Increased food security	Sustainable resource use
Example secondary parameters:					
Livelihood assets or capital stocks • Human capital (skills, knowledge, health, etc.) • Social capital (networks, groups, rules, norms, sanctions; relationships of trust, reciprocity, exchange) • Natural capital (stocks (fish) and key ecological services (nutrient cycling) • Physical capital (infrastructure and producer goods) • Financial capital (financial resources – cash, bank deposits, livestock, jewels and regular inflows of money)					
Vulnerability context • Trends (e.g. market change) • Shocks (economic, biophysical) • Seasonality					
Policies, institutions and processes (linked to "Process Component" • Institutions, organisations, policies (formal, informal) • Decision-making context (social processes, culture, gender, age, class, caste, etc.)					

Table 4: Livelihood parameters for evaluation (Plummer & Armitage, 2007)

The third component, focusing on process and institutional conditions, emphasises the importance of the adaptive governance process itself. The key principles of collaboration and social learning in adaptive governance requires that all stakeholders are treated equally, and that they are informed, listened to and respected. As such, while conventional evaluation approaches measure success in terms of outcomes such as goal achievement, the formation of agreement and implementation of projects, adaptive governance evaluation must also consider the process, as it is the backbone of the theory. Table 5 lists the characteristics of adaptive governance and process parameters for the evaluation in Plummer and Armitage's framework. A more recent evaluation effort is carried out by Trimble et al. (2015), who propose a formative evaluation framework which focuses on the operation of adaptive governance, and the link between process and outcomes. Their framework is informed by previous evaluation efforts, including Plummer and Armitage's (2007) resilience based framework presented above, and consists of four components: (i) setting, (ii) process, (iii) outcomes, and (iv) effects. The setting component encompasses the ecological or biophysical setting, the social

Characteristics of adaptive governance and generic process parameters for evaluation			
Characteristics			
Collaboration			Social learning
Pluralism and linkages	Communication and negotiation	Transactive decision-making	
Example parameters of concern			
• Multiple types of stakeholder (government, resource users, industry) • Diversity of interests represented • Multiple perspectives on the problem domain • Connections across multiple scale (local, regional, watershed, etc.)	• Shared understanding develops • Dialogue builds consideration and appreciation • Perspectives exchanged and modified via discursive communication	• Decisions are reached through dialogue (tend towards consensus and/or consent) • Diverse inputs present in decision-making • Equity and efficiency promoted • Multiple types of information accepted via multiple systems of knowledge (e.g., traditional ecological knowledge)	• Shared actions (experiments) are undertaken • Modifications are made from ongoing process of reflection (reflexivity) • Responses are made to routine errors (single loop learning) • Responses are made to values and policies from which routines stem (double loop learning) • Active questioning of the governing norms and protocol in which values and policies are embedded (triple loop learning)

Table 5: Characteristics of adaptive governance and generic process parameters for evaluation (Plummer & Armitage, 2007)

and social-ecological setting, the institutional setting, and external drivers. The process component include participation, relationship building and social learning. The outcomes component refers to social capital, social learning and adaptation, and decision making. Finally, the effects component, which is related to outcomes, encompasses ecological, social, and social-ecological effects. The framework is intended to be implemented during an adaptive governance initiative, allowing for adjustments throughout the process. Because settings will differ from each adaptive governance initiative, and in turn affect the process, outcomes and effects, specific indicators under each component have not been proposed. However, the authors do provide examples of what is meant with some of the categories under each component: the institutional setting refers to for instance the scale of the adaptive

governance initiative, its goals and its history, and existing enabling legislation. The participatory process comprises the type of ongoing activities, as well as representativeness, involvement of stakeholders, communication and deliberation. Social learning is a category both under the process component, and the outcomes component, but the focus of attention shifts between these two stages. In the process, principles of interaction, different types of knowledge, reflection, negotiation and problem definition are emphasised, while outcomes refer to indicators such as enhanced adaptability, problem solving and management plans.

Trimble et al. (2015) propose two methodological evaluation approaches for their framework: conventional-constructivist, and participatory, intended to fulfil each other. 'Conventional' refers to the external, non-participatory evaluation lead by 'experts' or 'externals', through assessing the variables in the framework by methods such as observation, focus groups, document analysis, and questionnaires among others. 'Constructivist' is referred to as contemplating the claims, concerns and perceptions of those involved in the case. The participatory approach is an internal evaluation where the stakeholders themselves are the evaluators. This approach is encouraged by the diversity of stakeholders, which may lead to different perspectives of what a positive impact is. As such, different actors decide for themselves which indicators are important for evaluation. Trimble et al. (2015) argue that because participation and the involvement of multiple stakeholders are core principles in adaptive governance, its evaluation also needs to be participatory and inclusive. This evaluation framework has been developed based on theory reviews, but will be refined as it is being tested in two ongoing case studies: one located in Uruguay, focusing on adaptive governance of small-scale fisheries, the other one takes place in Brazil, investigating a marine protected area in Parana.

Many studies have explored the viability of an adaptive governance framework in resource management, when facing complex and uncertain problems which involve many stakeholders. The existing evaluation efforts, as those presented above, also seem to be intended for settings concerning the management of a resource. Very few studies have evaluated the applicability of adaptive governance in settings of climate change adaptation planning on the community level (Aytur et al., 2015). A recent effort to fill this gap, has been carried out by Aytur et al. (2015), who are exploring an ongoing process of stakeholder involvement in support for climate change adaptation in Exeter, New Hampshire. Their main objective is to study how the process aligned with the principles of adaptive governance. They propose using the concept of 'boundary objects' and 'boundary experiences' as indicators for evaluation. They define 'boundary objects' as physical products that stakeholder groups can

use to share knowledge, such as maps, models, images, field notes, and other types of information. Such objects are intended to help facilitate conversations between stakeholders and scientists, and to cross disciplinary or cultural barriers, by developing a shared language and a new vocabulary for stakeholders (Aytur et al., 2015). 'Boundary experiences' is a term developed by the research team, referring to the dynamic process of interaction between stakeholders, in which they share knowledge and develop boundary objects. By applying these two concepts as components for evaluation, the researchers found that the project they were evaluating aligned with several important principles of adaptive governance, including: clarifying common goals with stakeholders, building on local communication and governance structures, and integrating complementary knowledge systems. This evaluation covered the first phase of the project, so their attention was limited to the process, and did as such not include an assessment of outcomes as it was too early to conclude on this aspect.

A fourth evaluation framework relevant to adaptive governance has recently been put forward by Ensor et al. (2016). Their theoretical starting point is community-based adaptation, which is closely related to adaptive governance, as a central claim about community-based adaptation is that it increases resilience through participatory learning and action on the grass-root level. The evaluation Ensor et al. (2016) propose aims at investigating if, and to what extent, community-based adaptation actually does lead to increased resilience. In order to do so, they start from the concept of social-ecological resilience, defined as "the capacity of social-ecological systems to continue to provide the goods and services that support a desirable quality of life in face of external disturbances" (Ensor et al., 2016). The evaluation indicators applied in their framework is Bahadur et al.'s (2013) list of 10 characteristics of resilience, which is based on a systematic review of literature related to society, ecology and social- ecological systems, rendered in table 6. The framework was applied to three different cases, which proved it to be "a practical means of translating key aspects of resilience theory into the design, implementation and evaluation of CBA [community-based adaptation] activities".

2.2.3 Evaluating TRACKS as adaptive governance

The main objective of the TRACKS project, is to mobilise knowledge about current climate variability in communities in northeast Bangladesh, how it affects the local people, and how this knowledge can make them better prepared for future changes. As such, this project is not about sustainable management of a specific resource or ecosystem, like many adaptive governance initiatives are. Rather, TRACKS is situated in communities where the social-

Characteristics	Summary description
High diversity	Diversity in ecosystems and economy Variety of stakeholders engaged in processes Diversity of planning response and recovery activities
Effective governance and institutions	Legitimate formal and informal structures Flexible and responsive institutions Enabling learning and experimentations
Acceptance of uncertainty and change	Systems that engage with and accept change Flexibility rather than assumed linearity
Non-equilibrium system dynamics	Dynamism and change Coping with, adapting to and shaping change Empowered individuals and institutions to deal with disturbance
Community involvement and inclusion of local knowledge	Shared rights and responsibilities for resource management Community engagement ownership, participation Combined scientific and indigenous/local knowledge
Preparedness and planning	Timely information, plans embedded in institutions Redundancy and planning for failure Investment in agency and adaptive capacity
High degree of equity	Account for equity and justice Equitable economy and distribution of assets and wealth "Hard" or technical adaptations may fail to address equity
Social capital, values and structures	Trust, norms and values Address multiple values and interests
Learning	Essential to cooperate, learn and apply lessons Iterative programme processes or organisational learning
Adoption of cross-scalar perspective	Transcend the local scale Engage with short and long time horisons Networks across regions, links to community structures

Table 6: Ten characteristics of social-ecological resilience (Ensor et al., 2016, adapted from Bahadur et al., 2013)

ecological system is already changing as a consequence of global warming, and the people must build adaptive capacity to cope with the changes. Consequently, parts of the evaluation frameworks proposed for adaptive governance that typically focus on the management of a well-defined resource, has little relevance for the TRACKS project. Other parts, however, provide valuable tools useful for evaluation of a climate change adaptation process. In this section, I will discuss how the evaluation frameworks presented above can be applied in this thesis.

2.2.3.1 Drawing on existing frameworks

Adapting to climate change is all about building resilience in a complex world. Adaptive governance offers a set of principles and guidelines on how to achieve this, and most of the proposed frameworks for evaluation use these principles as a starting point. However, as noted by Conley & Moote (2003), "the criteria relevant to a given evaluation will always vary with the reasons for evaluation, the values and perspective of the evaluator, and the context and characteristics of the collaborative effort being evaluated". In the same vein, Plummer and Armitage (2007) emphasise that mapping out a suite of specific criteria and indicators for evaluation is problematic, because any adaptive governance initiative is highly context-dependent. Connick and Innes (2003) also point out that many evaluation efforts of collaborative processes miss the mark because they assume that policies can be designed to produce predictable outcomes, even in highly complex settings. This supports an approach that tailors the evaluation criteria to its context. Consequently, instead of solely relying on existing evaluation indicators for adaptive governance, this thesis follows Trimble et al. (2015)'s initiative to adopt a participatory approach that will allow a tailoring of the evaluation to its specific context. In addition, it draws on existing evaluation efforts and key principles of adaptive governance, which will be outlined and discussed in Chapter 3.

2.2.3.2 Adopting a participatory evaluation approach

Participatory evaluation goes under many names, some of them being 'empowerment evaluation', 'fourth generation evaluation', 'democratic evaluation', and 'pluralist evaluation' (Pollitt, 1999). Although these approaches may differ from each other, they share some essential, common principles: they agree that it is fundamental to good evaluation practice that major stakeholders participate actively; and they all seek to break with the management-based tradition of evaluation, which sees itself as neutral, and where the evaluator is seen as an independent expert who uses unbiased methods (Plottu & Plottu, 2011). While the goal of traditional management-based evaluation approaches is to produce a value-free evaluation, participatory evaluation approaches are based on the assumption that any human intervention in a process is inherently biased – and that it is impossible for an evaluation process to be neutral and non-politicised. Participatory evaluation aims at bringing together diverse stakeholders in the evaluation process, based on principles of inclusion, dialogue and deliberation (Plottu & Plottu, 2011). According to Cousins and Whitmore (1998), the core premise of participatory evaluation is that the stakeholders' involvement will improve its relevance, ownership, and hence, utilisation. The conceptualisation of utilisation in this

regard, has traditionally been in terms of: (i) support for concrete decisions, (ii) an educative or learning function, or (iii) the political or persuasive use of evaluation to further a particular agenda, or to reaffirm decisions that have already been made. Participatory evaluation is supposed to increase the external validity of evaluation because multiple stakeholders are allowed to express a diversity of perspectives and points of view. Getting to be involved in the evaluation also makes it more relevant for the stakeholders, because it addresses their particular concerns (Plottu & Plottu, 2011).

Trimble et al. (2015) chose a participatory evaluation approach in their study of fisheries governance in Uruguay, and the governance of a marine protected area in Brazil because it fosters social learning, reflexivity and feedback. Agreeing that this is an approach that corresponds well with the principles of adaptive governance, and therefore is worth exploring, participatory evaluation is implemented in this study. How this was done in practice will be outlined in the following chapter.

Chapter 3

Developing a Framework for Evaluation

Introduction

As discussed in Chapter 2, the aspect of evaluation has been given relatively little attention in the adaptive governance theory. Building on existing evaluation efforts and through adopting a participatory evaluation approach, this thesis aims at contributing to the adaptive governance theory by developing a novel framework for evaluation. This chapter presents how the framework was developed through assembling key principles from the adaptive governance literature and evaluation indicators identified as important by citizen scientists in the TRACKS project. Upholding that context is crucial for any evaluation effort, the chapter starts with a presentation of the TRACKS project, the 'post-normal science' theory it is based on, my role in the project and a discussion about neutrality. Then I turn to how the framework was developed, along with an account for the choice of capitals as categories, before each capital is presented at the end of this chapter.

3.1 Background: The TRACKS project

As mentioned in Chapter 1, TRACKS was started in 2014 at the Centre for the Study of the Sciences and the Humanities (SVT) at the University of Bergen, in collaboration with seven other research institutions in Bergen, Bangladesh and Hawaii. The overall objective of the project was to co-produce high-quality knowledge about current climate variability and impacts with communities in northeast Bangladesh, in support of climate change adaptation. From 2014 to 2017, the researchers gathered scientific data and facilitated the mobilisation of knowledge about climate variability in three communities in northeast Bangladesh, aiming to find out how the current climate is affecting people in these regions (TRACKS, 2014). As outlined in the first chapter, the project was organised through five work packages, with this thesis contributing to the evaluation aspect of TRACKS. It particularly evaluates the project's impact on the citizen scientists' adaptive capacity, and possible impacts on the wider communities.

3.1.1 Post-normal science

TRACKS is steered by perspectives of 'post-normal science'. Post-normal science emerged from the philosophy of science in the 1990s, and is one of a family of alternative 'extended'

approaches to science (sometimes grouped under the heading sustainability science), for supporting urgent decisions on societal issues characterised by significant uncertainty and high stakes, like climate change (Funtowicz & Ravetz 1993). The epistemological point of view underpinning this theory is that under conditions of high uncertainty, everyone – scientists and non-scientists alike – can have a legitimate knowledge to contribute to an issue. At the same time, whether aware of it or not, post-normal scholars argue that all knowledge-holders are in part steered by their values, motivations and experiences, and that this biases their knowledge claims (Funtowicz & Ravetz, 1991; 1992). Advocates for post-normal science thus argue that, under these conditions, rather than having objective truth as a goal in science, that science should be judged relative to its 'quality'. That is, quality appraised according to how knowledge can be used in addressing the issue at hand; its fitness for function.

Towards this aim, post-normal science looks to new scientific practices, norms and criteria that break the traditional boundaries between academic disciplines, as a critical challenge to 'normal' science for issues like climate change. Its advocates argue that problems cannot be solved with the same methods that were used to create them. A central claim in TRACKS is that the IPCC's climate models are too abstract and general to be useful for regions and local communities, considering that climate change is expected to impact different regions very differently, with significant local variations. In post-normal science approaches, researchers from different disciplines work together in interdisciplinary teams, where they share experiences and collaboratively develop common methods. Going further, post-normal science seeks to extend the 'peer community' to other actors in other knowledge systems; from local knowledge, to traditional knowledge, craft knowledge or institutional knowledge for example. It explores approaches for initiating peer review across these knowledge systems; allowing the peer community to collectively weigh the quality of each claim for decision-making.

Consequently, the goal of TRACKS is to mobilise both local and scientific knowledge about the weather in northeast Bangladesh in order to contribute to an increased understanding of the current climate variation, which can in turn lay the foundation for adaptation strategies for current and future climate change (TRACKS, 2017b): they argue that the local people's knowledge and experiences can be of equal importance and value as the information provided by scientists. The TRACKS researchers operate from the hypothesis that facilitating a dialogue between climate science and local knowledge systems, will lead to high quality knowledge about climate variability, which can be a fundament for more

legitimate and reliable climate adaptation strategies. They attempt to achieve this through creating an 'extended peer-community', entailing an open dialogue between everyone who is affected by a problem, involving all interested stakeholders, both in the decision-making process and the implementation of measures. The aim is to make the solutions more democratic and legitimate and to make asymmetrical power relations more transparent in order to avoid abuse of power and knowledge (TRACKS, 2014).

3.1.2 My role in TRACKS

The choice of TRACKS as the case for my master's thesis was not a mere coincidence. I was first introduced to the project in 2014, when I undertook an elective course called "Research Project in Theory of Science" at SVT as part of my bachelor's degree. Through this course, I was invited to participate in one of SVT's ongoing research projects as an inside observer, and the TRACKS project's topic and approach caught my interest. Project manager Dr. Scott Bremer invited me on board, and so I participated in TRACKS as an inside observer, and was encouraged by the researchers to do so with a critical eye. During this semester, I wrote five blogposts about my impressions that were published on TRACKS' webpage, and I also turned in a final assignment. As I learned about the project, I became interested in finding out if its goals could be achieved – and if so, how. As the semester came to an end, I discussed with Dr. Bremer the possibility of conducting an evaluation of TRACKS in my master's thesis. He suggested my research could contribute to the project's evaluation work package – led by Dr. Anne Blanchard and Dr. Mathew Stiller-Reeve.

The TRACKS evaluation work is in two parts: (i) an internal evaluation of interdisciplinary dynamics within the consortium; and (ii) an external evaluation of how the TRACKS project impacts on communities in Sylhet Division, in Bangladesh. In discussion with Dr. Bremer and Dr. Blanchard, we agreed that my master's thesis research would be part of the development and application of a framework of indicators for the 'external' evaluation component. In this way, my research is not a solitary exercise run by myself alone, but a collaborative exercise, working closely with other TRACKS partners.

There were two important decisions made at the beginning. The first was about which theoretical framework would structure this evaluation. I put forward that I wanted to use adaptive governance as my theoretical framework, because I found that its core principles correspond well with the goals of TRACKS. As discussed in Chapter 2, the key principles of adaptive governance include learning to live with change and uncertainty, combining different types of knowledge for learning, creating opportunity for self-organisation, and nurturing

sources of resilience for renewal and organisation (Folke et al., 2005). Similarly, the main goals of TRACKS were to (i) mobilise high-quality knowledge in support of local climate change adaptation, which relates to the learning aspect; (ii) reconnect climate science with its local context and build a robust understanding of climate variability by combining scientific and local knowledge, which corresponds with the adaptive governance principle of using of using different types of knowledge, (iii) identify an 'extended peer-community' of diverse people, facilitate for citizen science, and increase the capacity within the communities to engage with different types of knowledge, which relates to the adaptive governance aspects of self-organisation and nurturing sources of resilience in terms of increasing knowledge.

The TRACKS partners agreed that although not an explicit exercise in adaptive governance, TRACKS does share a number of characteristics of this approach, and therefore that this theory provides a useful lens to evaluate TRACKS. The second important decision was about how this evaluation framework would be constructed. It was agreed that in keeping with the open 'post-normal' approach of the TRACKS project, working closely with an extended peer-community of local people, the evaluation framework would be in part constructed according to areas where they felt they saw, or could foresee, potential impact in their own lives and in their community. This was according to a qualitative bottom-up, participatory approach to co-designing an evaluation framework.

The decision to work together with TRACKS partners and the citizen scientists to develop an evaluation framework lead to some critique from peers and teachers in the PGI (Politics, Governance and Innovation) research group that my master's research is part of. They raised important questions about neutrality: how to ensure an unbiased evaluation of the project when collaborating with TRACKS researchers and citizen scientists? How could I be a neutral evaluator if I was involved in the project myself? Upholding that the answer to these questions is a matter of perspectives and approaches, I will in the following section attempt to answer them.

3.1.3 How to ensure neutrality in a collaborative evaluation approach?

As discussed in Chapter 2, and which is to be further discussed in Chapter 4, the notion of objectivity in social science is related to epistemological and methodological perspectives, and the purpose of the research. If the aim of a study is to come up with universal evaluation criteria, it can of course be argued that it is important that the researcher is not involved in the study object. This also relates to which *methods* are best suited to answer research questions that aim at generate universal knowledge: as will be discussed in more detail in the next

chapter, quantitative, standardised methods are usually considered best suited for such studies. Quantitative research methods are often linked to a positivist tradition, where expectations of neutrality and distance between the researcher and the research object are considered central to the reliability and validity of the research. However, as outlined in the first two chapters, this thesis starts from the assumption that evaluation cannot be separated from its context, but that it must instead be tailored to each specific case. When choosing a participatory evaluation approach, using qualitative interviews as a method, other concepts of quality apply – which are often linked to the constructivist perspective (this will also be discussed in Chapter 4). Importantly though, the specificity of this research - relating specifically to one initiative in one place - does not preclude that the lessons learned cannot be transferable to other contexts. Indeed, as will be seen in the discussion, the TRACKS consortium and I consider that the fundamental building blocks of the evaluation framework can make a strong contribution to the adaptive governance literature.

Another central question in this discussion is that of whether *any* evaluation can be neutral. Even when the aim of a research project is to come up with universal evaluation criteria, can the study be completely free from bias? Social scientists have different opinions regarding this question. Tornes (2012) upholds that evaluation is more than a description – rather, it is an assessment and a conclusion about the positives and negatives about the initiative under scrutiny. Vestman (2011) states that because humans have different perceptions of what is most important about an initiative, evaluation cannot be a neutral activity. On the contrary, evaluation involve the exercise of power at several points, such as deciding the objective of the evaluation, when it is to be carried out, and which criteria and methods it is to be based on. Even when using standardised methods, many choices are made by the researcher, such as which indicators are more important than others, what information is included and what is left out, and how the results are interpreted. As discussed in Chapter 2, the emphasis on value neutrality and objective assessments are typical for elitist democratic-oriented and 'rationalistic policy' evaluation approaches, while other criteria play a stronger role in participatory evaluation. Consequently, this thesis upholds that all evaluation efforts has some degree of bias, and that for this kind of study, other quality concepts are more important for the validity and reliability. As will be explained in more depth in Chapter 4, this thesis understands validity as transparency – instead of aspiring to distance and independency, emphasis is placed on making the whole research process transparent, and on clarifying and give reasons for all the choices that have been made along the way. Rather than seeing bias as something that can be eliminated, this thesis upholds that the researcher should be aware and

reflexive of her bias, and focus on being balanced and critical. Furthermore, a critical evaluation was always a central aspect of TRACKS, as the fifth work package was devoted to this purpose. Based on the fact that the TRACKS partners and I agreed on the evaluation approach and criteria of quality, I do not consider it an obstacle for the reliability and validity of the research that the evaluation was carried out in a collaboration with TRACKS researchers.

3.2 Developing a framework for evaluating impacts of the TRACKS project on the community of citizen scientists

Having clarified a common understanding and agreement for the evaluation approach, I started working with Dr. Bremer and Dr. Blanchard to develop a framework for evaluation. This process started in the beginning of 2016. I reviewed the adaptive governance literature in search of the theory's core principles and criteria for success, and found that the following three themes were reoccurring the most: (i) social learning, about social-ecological systems, resilience, change and uncertainty, (ii) combining different types of knowledge, both local and scientific, (iii) collaboration between a diversity of actors, building trust and sharing knowledge (Folke et al., 2002; Armitage & Plummer, 2010; Ison et al., 2013; Schultz et al., 2015). These criteria guided the first round of evaluation interviews.

3.2.1 First round of evaluation interviews – March 2016

Dr. Bremer and Dr. Blanchard were traveling to Bangladesh in March 2016 to hold TRACKS workshops in Sunamganj Sadar and Barlekha, and we agreed that they would conduct interviews with the citizen scientists in there, to elicit 'bottom-up' indicators for the evaluation framework. We designed short interviews with three open questions, which were conducted with 16 citizen scientists, eight from each study area. Twelve men and eight women were interviewed, some in smaller groups of two and three. In advance, Dr. Bremer, Dr. Blanchard and myself had agreed on the following three questions, based on core principles of adaptive governance:

1) *What do you expect to learn from the workshops? What type of knowledge do your friends and family need to cope with the changes in the weather?*
2) *What can we do to keep with community working and learning together, like a group of friends, over the next year?*
3) *How can you use this new knowledge from the workshops and the citizen science in your work/your own life?*

The questions were worded in a simple manner to ensure that all the respondents could easily understand them. Dr. Bremer and Dr. Blanchard conducted the interviews, most of them with a translator, but a few of them were done in English. Dr. Bremer asked the questions while Dr. Blanchard prompted and wrote down the answers. The first question relates to one of the most essential principles in the adaptive governance theory: learning. This is also one of the main objectives of the TRACKS project. As previously discussed, adaptation must be context specific – consequently, the first question aimed at finding out what kind of knowledge the citizen scientists need to cope with the changes in the weather, and what they expect to learn from the TRACKS workshops. The second question relates to three other core principles in the adaptive governance theory: networks, collaboration, and learning together. With this question, we sought to uncover what the citizen scientists considered as important factors to keep the network, or extended peer community, working together. The third question refers to the adaptation and resilience aspects, and aims at finding out how the citizen scientists can use the knowledge they build through TRACKS in their everyday lives.

The next step was to organise the indicators taken from the interview answers into sub-categories or themes under the larger three headings that guided the interview. This constituted a first level of analysis. All the answers from the interviews have been included in table 7 below.

Main category	**Sub-categories or themes (grouping indicators into sets)**	**Indicators (from the interviews)**
Learning	*Learning to predict the weather*	Early warnings – natural signs of weather and floods
		Weather forecasts using natural science
	Learning about how the weather changes daily and seasonally, now and in the future	Temperature
		Rain
		Storms: cyclones, Kalboishaki, lightning
		Wind
	Learning about the impacts of the weather	Floods and flash floods
		River levels
		Erosion
		Droughts
		Impacts on food production

		Impacts of storms
	Learning about practical adaptation action	Deforestation and tree-planting
		Agriculture measures
		Adapt to Kalboishaki/cope with storms
		Stop flash floods
		Early-harvest rice
		Helping destitute women
Keeping the community working together	*Practical organisation*	Early notice about meetings
		Regular and frequent meetings as a group
		Setting up communication online and through mobile phones
		Providing the right equipment
	Nurturing interaction	Informal meetings as 'sub-groups'
		Social mixing and building relationships
		Building trust
		Common topics
		Measuring indicators together
	Interpersonal attitudes	Respect and openness
		Generosity
		Sincerity and honesty
	Motivators	Improved understanding/new knowledge
		New networks, locally and internationally
		Encouragement of TRACKS partners
		An opportunity to share experiences/knowledge
		Political action
	Sharing with the community	Politicians
		Religious leaders
		Newspapers
		Songs/poems
		Schools

Making knowledge usable		Neighbours, friends, family and colleagues
		Doctors
		Farmer co-ops
	Practical use	Prepare farms and food production/processing
		Transport routes/equipment
		Harvesting herbs
		Daily life

Table 7: Themes for measuring TRACKS' impact on communities, raised by the extended peer-community

The citizen scientists' answers to the first interviews gave us a good idea of what they expect and need from TRACKS, and confirmed that adaptive governance is a suitable lens for evaluation, as the respondents themselves identified several principles of adaptive governance as quality criteria for the project.

3.2.2 Choosing a capital-based evaluation framework

In order to design a framework, Dr. Bremer, Dr. Blanchard and I compared the indicators from the citizen scientist interviews and key principles from the adaptive governance theory and combined them into a first draft list of common indicators. That is, a set of indicators that emerge where the 'top-down' principles of adaptive governance theory meet the 'bottom-up' aspirations (embodied in indicators) of the extended peer communities. However, while these indicators constituted a rich and varied list of impact factors, we were concerned that they were 'hanging loosely', and that they should be organised into a tight, internally consistent framework. This led us to look at a capital based framework.

Turning to a capital based framework is based on two reasons. First, the capital concept can be seen to 'bubble up' at different points in the adaptive governance literature. This noted, as far as I can see, there are no examples of a completely capital-based evaluation approach in the adaptive governance scholarship; that is, a framework tied together by the common concept of capital. Most frameworks draw on capital as part of a multi-faceted evaluation toolbox that includes process and learning, but not consistently in terms of capital. For example, as seen in Chapter 2 (Table 4), Plummer and Armitage (2007) used five different capitals in their evaluation framework, however, these were limited to the livelihood component of the framework. As 'capital' is a much-used concept in the adaptive governance, and other principles of the theory lack a similar, clear categorisation, it seemed like a natural 'next step' to use the capital concept to organise the indicators.

Second, in his PhD, Dr. Bremer used the concept of capitals to evaluate interactional quality in Integrated Coastal Management, through developing a novel evaluation framework. In discussion, Dr. Bremer, Dr. Blanchard and I agreed that an adapted capital framework may provide the conceptual glue that would tie together these disparate indicators. Dr. Bremer used 'financial capital', 'social capital' and 'human capital' in his framework, which was guided by the theory of interactive governance. In order for my framework to correspond to both the indicators in the adaptive governance theory, and the indicators from the interviews with the extended peer community, I worked with Dr. Bremer and Dr. Blanchard to choose the following five capitals: 'human capital', 'social capital', 'resources and technology capital', 'political capital' and 'institutional capital'. The framework we developed is thus a combination of the indicators derived from using a participatory evaluation approach, and the core principles from the adaptive governance theory.

3.2.3 The steps to develop the framework

The indicators identified by the citizen scientists, as outlined in table 7 above, were compared with a more extensive list of principles identified from the adaptive governance literature, as discussed in Chapter 2. We agreed that it gave meaning to categorise them into the following

	From the adaptive governance literature	**From citizen scientists**
Human capital	*Learning*	*Learning* - *Predict weather* - *How weather changes daily and seasonally today and in the future* - *Impacts of the weather* - *Practical adaptation action*
		Pragmatic hands-on learning experiences
	Deal with uncertainty	*Improved understanding and new knowledge*
		Translating learning into practice in different vocations
	Key individuals providing leadership and meaning	*Organisational roles* - *Early notice of meetings*

		- *Organise regular and frequent group meetings* - *Setting up communication* - *Organise for people to measure indicators together* - *Motivating the citizen scientists*
Social capital	*Interaction/network building*	*New networks, locally and internationally*
	Self-organising as social networks	
	Deliberation/dialogue	*Regular and frequent group meetings, and informal meetings as sub-groups*
	Participation	*Measuring indicators together*
		Inclusiveness/openness
	Diversity - *Different scientific disciplines* - *Different knowledge systems*	*Social mixing*
		Opportunity to gain and share knowledge
	Trust	*Building trust*
		Interpersonal attitudes - *Respect and openness* - *Generosity* - *Sincerity and honesty*
	Consensus	*Common topics of interest*
Resources and technology capital	*Scientific models*	*Weather measuring technology*
	Finance	*Resources*
	Technology	*Online and mobile phone communication*
	Meeting places	
Political capital	*Power sharing*	*Political action*
	Leadership	*Leadership*
Institutional capital	*Flexibility*	*Sharing knowledge with communities and other institutions*
	Nested/integrated institutions across scales	
	Accountability	
	Deliberation	

Table 8: Indicators of quality according to the adaptive governance theory and interviews with the citizen scientists, categorised into five capitals

five capitals: ‘human capital’, ‘social capital’, ‘resources and technology capital’, ‘political capital’, and ‘institutional capital’. Table 8 above shows how the indicators from the citizen scientists and the adaptive governance literature respectively fits into the five capitals. As mentioned, we found that the indicators suggested by the citizen scientists corresponded well with most of the adaptive governance principles. Dr. Bremer, Dr. Blanchard and I therefore agreed that the indicators from both the theory and the interviews with the citizen scientists could be merged into common indicators in the capital framework. Before presenting the capital framework, I will address some important critiques towards the concept of capital.

3.2.4 The concept of capital – the commodification of social life?

Over the past decades, the concept of ‘capital’, originally from the field of economics, has become a means of evaluation across social, political and management sciences. In this way, the concept has come to move away from a strict classical economic use, and be appropriated in a more generic sense. For instance, scholars from ecological economics Costanza and Daly (1992) define capital as “a stock that yields a flow of useful goods and services into the future”. It is this definition that this thesis starts from. Experiences from different fields have shown that the concept of capital is a powerful tool for evaluating social interaction (Bremer, 2011). However, the adoption of a concept with such deep roots in classical economics into the domain of social science has not gone by without being widely criticised.

Fischer (2005) claims that implementing the term ‘capital’ has “allowed economists to colonise sociologists’ topics”. Concerning social capital, Haynes (2009) upholds that rather than being an *expansion*, social capital is a *reduction* to economic thinking and the simplification of complex, social phenomena. Fischer (2005) states that the term ‘capital’ itself is problematic because it demands redefining and explanation to become meaningful in the sphere of social sciences. He states that “it is a metaphor that misleads: Where can I borrow social capital? What is the going interest rate? Can I move some of my social capital off-shore?”. Bowles (1999) similarly notes that ‘capital’ refers to something being possessed by individuals, while the attributes of social capital, such as social norms, commitment to others and trust, describe relationships *among* people. He argues that the term ‘social capital’ and the way it is being conceptualised in the literature, is so different from other forms of capital that it weakens its explanatory power and should therefore be abandoned. In the same vein, Tittenbrun (2014) states that the concept of ‘capital’ has been extended from its original meaning to the extent that new concepts often have nothing left in common with the initial ‘capital’ concept. He refers to the adoption of capital concepts in social sciences as “the

commodification of social life". These critiques manifest the importance of a critical reflection on the concepts applied in research. Recognising the widespread criticism of using the concept of capital in social science, I will now address them.

The essence in the criticism, as I perceive it, relates to the capital concept's connotations and background. Critics see it as problematic to use a term that originated in the field of economics, initially to describe something that can be possessed and traded, about complex human relationships, interactions and qualities. As discussed above, a central objection is that the conceptualisation of capital in the social sciences expands it so far from its original meaning that it makes little sense to use the term at all. In defending the use of the concept of 'social capital', Sobel (2002) argues that although the term itself admittedly is not easily justified, the topics under the social capital umbrella are worth studying, and applying principles from the field of economics can provide important insights. He upholds that "a vague keyword is not sufficient reason to condemn a promising line of research". Following Sobel's argument, I acknowledge that adopting a term from an essentially different field should not be done without critical reflection and redefining – however, given that a clear definition and conceptualisation of 'capital' is provided, I uphold that it can still be a useful concept in the social sciences, and particularly in evaluation approaches.

The purpose of using the concept of capitals in this thesis is not to reduce social and human relations and properties to commodities, or to something that can be bought or sold in a market. Rather, the concept is understood as a way of making sense of a social process, and to categorise the impacts of such a process in a meaningful way. Furthermore, the term 'capital' has already gained prominence in the adaptive governance literature: social and human capital are key features of the adaptive governance theory, thus, understanding other steering principles in the theory in terms of capitals seems like a natural extension when developing a framework for evaluation. As such, this thesis is taking the concept of capitals to its full realisation in the adaptive governance theory. Moreover, it begins from a clear definition from ecological economics (see above), which is careful to distinguish itself from definitions from classical economics. As a field, ecological economics presents a critical challenge to classical economics, towards a clearer recognition of limits to growth in natural capital, and a more equitable distribution of capital as embodied in the work of Marx for instance. Here capital is freed from a purely instrumental value, to have value in and of itself, and to emancipate marginalised groups; human and non-human. Clarifying how each capital is defined and understood, is essential in this regard, and will be outlined in the end of this chapter, after the framework is presented.

3.3 Presenting the capital framework for evaluation and its five capitals

The final framework for evaluation adopted in this thesis is presented in table 9 below. Then follows a presentation of each of the five capitals. The indicators are chosen with consideration to encompass the indicators provided by the citizen scientists, and the key principles identified in the adaptive governance literature.

Human capital	**Social capital**	**Resources and technology capital**	**Political capital**	**Institutional capital**
Learning about the weather, its impacts and its uncertainties	Networks and interaction (formal and informal)	Scientific models	Impact on local policies and politics	Cooperation across institutions
Translating learning into practice in different vocations	Participation and sharing experiences	Weather measuring technology		Remaining flexible to changing conditions
Leadership and clear organisation	Trust and openness	Communication infrastructure for the extended peer-community		

Table 9: Conceptualising impact indicators relative to capital stocks

3.3.1 Human capital

In our framework, human capital is defined as "the stock of education, skills, culture and knowledge stored in human beings themselves" (Costanza & Daly, 1992). The Resilience Alliance (2007a; 2007b), a key group in the adaptive governance field, upholds that human capital is strong where there is an abundance of the knowledge provided by highly educated and trained individuals, as well as knowledge diversity from people with different kinds of educations and experiences. The first two indicators under 'human capital' in the evaluation framework relate to the aspects of *learning* and *knowledge* in particular. As discussed in Chapter 2, social learning is a key principle in the adaptive governance theory, understood as a collaborative process taking place in a setting where different knowledge systems are combined, and a group of people share experiences. In our framework, the first indicator is related to what possible impact TRACKS can have on the individuals' stock of knowledge,

and the second refers to how this knowledge can be used practically. The third indicator relates to another aspect of human capital that is considered crucial in adaptive governance: leadership. Folke et al. (2005) and Olsson et al. (2006) state that leaders who provide trust, vision and meaning are vital in order to create a learning environment. The citizen scientists also emphasised the importance of a clear organisation of the meetings and workshops.

3.3.2 Social capital

Strongly related to human capital, is the social capital. In the framework, we have adopted Putnam (2000)'s well-known definition of social capital as "connections among individuals – social networks, and the norms of reciprocity and trustworthiness that arise from them". Despite the criticism that this form of capital in particular has been subject to, it has still gained increased attention and importance in assessing the quality of social relationships. In the adaptive governance literature, social capital has been claimed to be the glue that holds collaboration together, as noted in Chapter 2. While an increase in human capital can be understood as the *outcome* of social learning, social capital can be understood as the process itself, and the prerequisites that *enable* it. The first indicator refers to the importance of networks with different actors and the interaction between them, as identified by both the citizen scientists and in the adaptive governance literature. The second indicator embodies the aspect of social learning – the participation of diverse stakeholders, and the sharing of knowledge and experiences. The final indicator under the social capital refers to a prerequisite which has also been deemed important by the adaptive governance literature as well as the TRACKS citizen scientists: trust and openness between the participants.

3.3.3 Resources and technology capital

The 'resources and technology capital' is the one most closely related to capital in its original form, as it relates to the manufactured, physical artefacts and resources. In the framework, we have defined this capital as the "physical, man-made stock, produced and reproduced by society" (Weisz et al., 2015). As the name suggests, this capital entails the resources and technology required for a high-quality project in terms of adaptive governance. In our framework, the three indicators are mainly based on the tools that the citizen scientists themselves said was important for them to carry out the work in TRACKS.

3.3.4 Political capital

In our framework, political capital is defined as "the knowledge, skill, education and advantage someone has to give them status in society" (Bourdieu, 1986). In their review of the adaptive governance literature, Chaffin et al. (2014) identified several research areas to improve the theory, one of them being the roles of power and politics in the emergence of adaptive governance. The citizen scientists also put 'political action' forward as an important indicator through the interviews. The indicator we have chosen in the framework thus entails the possible impact TRACKS can have on local political processes and decisions.

3.3.5 Institutional capital

Ostrom introduced the concept of 'institutional capital' in 1990, defined as "the supply of organisational ability and structures, literally the 'capital' of institutions that society has at its disposal". As institutions is a central topic in the adaptive governance, it seemed like a logical extension to include it in this framework. The citizen scientists also decided that sharing knowledge with communities and other institutions is an important indicator. In the adaptive governance literature, institutions that are nested, flexible and deliberative, are crucial in order to adapt to changing conditions. However, because there are different conceptions of what an *institution* means, this requires clarification. According to some perspectives, institutions are limited to the formal and legal institutions in a society, such as for example political organisations, laws, educational institutions and government units. This thesis adopts a wider understanding of institutions, according to the sociological institutionalism perspective, where institutions are also understood as for example norms, cognitive concepts, and morals, in addition to the formal and legal institutions (Hall & Taylor, 1996; Knill & Tosun, 2012). As such, the institutional capital refers to the possible impact TRACKS can have on a range of institutions, particularly in terms of flexibility and cooperation, as emphasised by the chosen indicators.

Having presented the framework for evaluation, how it was developed and on what basis, I now turn to the method chapter, where it will be explained how the framework was implemented in TRACKS.

Chapter 4

Method and Research Design

Introduction

As discussed in Chapter 3, we developed a framework for evaluation by combining key principles from the adaptive governance theory with indicators identified by citizen scientists in TRACKS through interviews. The interview questions were developed in collaboration with Dr. Bremer and Dr. Anne, while they carried out the interviews in March 2016. The answers were refined into indicators that were then merged with the adaptive governance principles into the capital framework presented in the previous chapter. This chapter outlines how the evaluation was *implemented* in TRACKS. That means, how we evaluated the impacts of the TRACKS project on the extended peer-community of citizen scientists and beyond, using the evaluation framework. It presents the research design of this thesis, how the components relate to each other, and the choice of qualitative interviews as a method. Arguing that methodological perspective also plays an important role in choice of approach and method, this chapter starts with a methodological discussion.

4.1 Does a single truth about the social world exist? A methodological discussion

Most people can agree that the natural world is steered by laws and predictable patterns, which can be observed objectively: The Earth orbits around the sun, ice melts when the temperature rises above a certain level and gravity makes objects fall to the ground. It is not controversial to state that these are objective facts that we can obtain knowledge about. Of course, many of the natural laws also apply to humans: we are born, we grow up, we age and we die, and we have certain needs. Like all species, we inhabit a physical natural world, but we also inhabit a social world. To what extent is human behaviour explained by natural processes, or by social processes? Can the social world be studied in the same manner as the physical, natural world? There are different perceptions about this in the social sciences, and researchers often have different opinions about what the goals of research are, and how these goals should be achieved (Rubin & Rubin, 2012). A distinction is typically drawn between two major perspectives: positivism and constructivism. The positivist perspective is inspired by the natural sciences and the conception that a universal truth about the social world exists, and that we can uncover information about this world through our senses. Constructivists, on the other hand, are harder to categorise. According to Moses and Knutsen (2012), the

constructivist perspective includes those who believe that a real world exists, but that there are many different perceptions of it, to those who believe that there is no single, true social world, but rather many – because everyone has their own perception of reality, and thus construct their own social worlds.

According to Rathbun (2008), it is humans' deliberate attempt to change the world around us through cognition, reflection and learning that distinguishes the social world from the natural. Humans have developed ideas, thoughts and perspectives. We are all born into a context, a knowledge system, a perception of reality, a set of dominating values, thoughts and norms that shape us as individuals, and which shape our understanding of the world and society. Because knowledge is always filtered through people, it is always subjective, according to the constructivist perspective (Rubin & Rubin, 2012): every individual is steered by different ideas, concepts and perspectives, and so the truth about the social world is in the eye of the beholder, according to constructivism. The positivist perspective, on the other hand, upholds that a single truth about the social world does exists, with specific laws and patterns, which we can obtain unbiased knowledge about, by using carefully chosen methods (Moses & Knutsen, 2012).

Methodological perspectives guide researchers in their work. Those who identify with the positivist perspective, are usually interested in testing theories and uncovering truths that can be broadly applied to populations or societies. Objectivity and distance between the researcher and research objects is therefore considered essential in order to avoid bias (Lincoln et al., 2011). Consequently, positivists usually have a preference for standardised research instruments such as experimental and quantitative research methods. The findings are considered to be true as long as they fulfil certain conditions, and high quality research is assessed in terms of validity, reliability and generalisability (Rubin & Rubin, 2012).

Because the world is incredibly complex and constantly changing, constructivists uphold that social phenomena cannot be separated from its context. For this reason, and also because they see social research as inherently biased, researchers identifying with the constructivist perspective are typically more concerned with trying to understand and explain the *meaning* of social action (Moses & Knutsen, 2012; Rubin & Rubin, 2012). According to Moses and Knutsen (2012), constructivist researchers therefore have a 'weak spot' for narrative approaches, but are still open for a diversity of other methods, from comparative methods and statistics to experiments. As such, the various research methods can be said to have roots in different theoretical positions: quantitative and experimental methods tend to be preferred by researchers relating more to the positivist perspective, and narrative and

qualitative methods tend to be preferred by researchers who relate more to the constructivist perspective. Some philosophers have stated that because of their roots in fundamentally different theoretical perspectives, quantitative and qualitative methods are incompatible (Becker, 1996). A perhaps more fruitful way to perceive it, is to see different methods as *complementary* rather than incompatible, suited to answer different types of research questions. For example, when researching which political candidate is likely to win an election, a quantitative survey among voters might be the most logical approach (Rubin & Rubin, 2012). As such, methodological perspectives might be more useful in understanding a researcher's topics of *interest*, and interpretation of the results of a study. Researchers who believe in a single, true social world may be more interested in studies that can generate general understandings or assumptions about society – and if the research fulfil certain quality measures, the researcher will possibly consider them as unbiased facts. On the other hand, researchers who are more sceptical to the notion of a one, social reality, are perhaps more interested in going deeper into other people's understandings and interpretations of the world. Regardless of choice of method, they are likely to consider the research results as *one* way to understand a social phenomenon, coloured by researchers' choices and interpretations, rather than a general truth. For this reason, I uphold that it is important to be reflexive of one's methodological perspective, as it may be an influencing factor for the choices and interpretations made in a research process. In the following sections I will now present the research design and the method chosen for this study, and how my methodological perspective has informed my choices.

4.2 Research design

A research design is an overall plan or strategy for how and why the research is to be carried out – however, the design of a qualitative study rarely begins from a predetermined starting point, with fixed steps to steer the process. Instead, a qualitative research design is constructed and reconstructed throughout the research process (Maxwell, 2013). The central components in a research design are goals, theories, research questions, methods, and validity, and the connection between these are continuously reconsidered during the study. The purpose of the research design is to show the link between these components. As presented in the introduction chapter, the research question guiding this thesis is: *How did the TRACKS knowledge mobilisation process impact on climate change adaptation in northeast Bangladesh, evaluated as governance?* The theoretical framework of this study has been

presented in Chapter 2 and 3. In this section, the choice of method will be explained with reference to the research question, goals and theories.

4.2.1 Method: Qualitative interviews

Before designing a research project, it is essential to ask "what do I want to learn?". The answer to this question guides the choice of method. According to Aberbach and Rockman (2002), qualitative interviews are a suitable method when attempting to understand how people think or how they interpret an event. Rathbun (2008) argues that qualitative interviews are best fitted to gather information about the characteristics about the social world that are different from those of the natural world, and when wanting to include factors such as culture, norms, ethics, perceptions, learning and cognition.

Qualitative interviews were considered a useful method for this thesis for a number of reasons. As mentioned in the methodological discussion above, quantitative methods are usually chosen when breadth is considered more relevant than depth, and when the goal is to be able to make general statements that can be applied to society or people. The case being studied in this thesis, is highly context specific: because climate change affects regions of the world very differently, with large, local variations, adaptation must be tailored to each community – there is no 'one fits all' adaptation strategy. As such, the aim is not to apply the results to the wider society, but rather to understand climate change adaptation relative to the local context in which it is embedded. A second reason for choosing qualitative interviews is the approach: applying a participatory evaluation approach made qualitative interviews a natural choice of method, as it allows the respondents to answer according to their own knowledge systems. This is a crucial criterion when the evaluation criteria are based on the respondents' opinions and points of view. In settings like this, when the aim is to investigate people's conceptions of a specific topic or social phenomena, Stenbacka (2001) and Aberbach and Rockman (2002) state that open questions are important in order for the informants to be able to organise their answers in accordance with their own references and knowledge structures. The choice is also influenced by my methodological perspective as a researcher: in identifying mostly with the constructivist perspective, the focus of this thesis is not to uncover a single truth, but rather to understand what is true for the respondents in this study. This also relates to the necessity of tailoring evaluation to its specific context, as discussed in Chapter 2 and 3. Rather than evaluating the impacts of TRACKS based on predetermined criteria derived from theory, qualitative interviews that allow the respondents to answer relative to their own perceptions, was considered the best suited method in this respect.

4.2.2 How to ensure quality in qualitative interviews

Because qualitative and quantitative methods are essentially different research approaches, the quality of the research must also be assessed relative to different concepts of quality. According to Golafshani (2003), many of the most common concepts of quality, such as reliability, validity and generalisability, were originally developed for the assessment of quantitative methods. As such, they need clarifying and redefining before they can be applied to qualitative research. Stenbacka (2001) states that the most common definitions of reliability, validity and generalisability are not appropriate for qualitative research because they aim to *explain*, while the aim of qualitative research is to generate *understanding*. Without redefining them for use in qualitative research, these quality concepts can lead to unnecessary restrictions and erroneous conclusions, according to Stenbacka (2001). With this criticism as a backdrop, I will now discuss how concepts of quality can be understood in terms of qualitative research.

4.2.2.1 Validity

A common understanding of validity is that it is a quality concept for the researcher to make sure that he is measuring what he wants to measure (Ringdal, 2013). However, because the aim of qualitative research is not to *measure*, this understanding is not well suited to assess the validity of qualitative methods, according to Eneroth (1984). Stenbacka (2001) states that it is the purpose of the research, that primarily decides if the data is valid. Based on this, she upholds that it easy to answer how validity can be ensured in qualitative research. When the aim is to generate an understanding of a social phenomenon, one is interested in understanding the respondent's conception of reality about a specific topic. This means that the understanding of the phenomenon is valid if the respondent is involved in the topic and gets the opportunity to speak freely according to her own knowledge structures (Stenbacka, 2001).

4.2.2.2 Reliability and replicability

Ringdal (2013) defines reliability as to what extent repeated measurements with the same tools will lead to the same results, in other words, if the results can be replicated. According to Stenbacka (2001), this understanding of reliability is irrelevant for qualitative research – again, because the aim of qualitative methods is not to measure. If qualitative interviews were to be repeated with the same people, a few years later, would the answers be the same? Quite certainly not, as people and contexts change over time. Stenbacka (2001) therefore suggests

alternative concepts to ensure reliability in qualitative research: if the researcher makes the whole research process transparent, from planning to collection of data and analysis, the study will be reliable.

4.2.2.3 Generalisability

Statistical generalisability is a common quality concept in quantitative research – meaning that it can generate general claims about a population or society. Yin (1989) distinguishes between *analytical* and *statistical* generalisation, and upholds that only analytical generalisation is relevant for qualitative research. This means that general, theoretical conclusions can be drawn from the empirical material. In other words, the aim of qualitative research is not to make universal claims about a population, but rather about a theory (Yin, 1989).

4.2.2.4 Ensuring quality in this thesis

Based on the discussion above, and in recognising that qualitative research requires different quality concepts than quantitative research, this thesis aims at ensuring validity, reliability and analytical generalisability as defined by Stenbacka (2001) and Yin (1989): validity is understood in terms of to what extent the study fulfils its goals, reliability as transparency, and analytical generalisability as the possibility of drawing general, theoretical conclusions based on the findings. In the following section I will now present how the data collection was carried out, before I discuss strengths and weaknesses with the approach.

4.3 The data collection

As explained in Chapter 1, this thesis focuses on *one* of the two citizen scientist groups in TRACKS, the one that situated in the Sunamganj district. This was due to the necessity of limiting the scope of the thesis. Instead of doing some interviews in both study sites, I considered it a better option to focus on one, as it allows for higher representativeness and more thoroughness.

Originally, I was planning on travelling to Bangladesh and conduct interviews during the second half of 2016. These plans were put on hold as a series of terrorist attacks struck the country, the most fatal one directed towards foreigners, where 24 victims were killed. Through consulting my advisors, we decided that travelling to Bangladesh would be unsafe, and I postponed my trip. By the end of 2016 the situation had still not improved. Therefore, we asked a Bangladeshi TRACKS colleague, Professor Mohammad Mahfujul Haque, to

conduct 12 interviews with the citizen scientists on my behalf. In May 2017, the situation had improved, and I was able to accompany TRACKS researchers from Norway to the study sites in northeast Bangladesh for a week, from the 11th to the 19th, to complete my fieldwork. In the following sections, after an account for the research ethics in this study, I will present how the two rounds of data collection were carried out.

4.3.1 Research ethics

At the beginning of the project, TRACKS applied to the Norwegian Social Science Data Services (NSD) for permission to conduct 220 personal interviews and group interviews with people in the study sites Barlekha/Hakaluki Haor, Sunamganj Sadar and Jamalganj. The permission was granted for throughout the project period, and included permission to collect personal information such as name, gender, age, occupation and contact information about the interview respondents – given that this information was anonymised in publications and deleted within two years after the end of the project. Because the evaluation interviews were conducted with the same respondents that were interviewed in the beginning of the project, and seeing as this data collection was part of the evaluation work package, the consortium agreed that the permission from NSD extended to these interviews as well. The interview topics in this study are the same as in the initial interviews in TRACKS, and all the respondents were citizen scientists who had chosen to be part of the extended peer-community. As such, they are partners in the TRACKS project. All the respondents in this study gave verbal consent to be interviewed, and had the opportunity to stop the interviews at any time and for any reason, and to withdraw their answers. The information about the respondents has been anonymised in this thesis, and the data is stored and will be handled in accordance with NSDs requirements[3].

4.3.2 Qualitative interviews conducted in November 2016

The interview questions were developed based on the indicators in the evaluation framework outlined in Chapter 3, and guided by valuable feedback from Dr. Bremer, Dr. Blanchard, Professor Roger Strand and Professor Haque. The aim of the interview questions was to cover all the twelve indicators in the evaluation framework while still keeping them as open as possible. The questions were categorised according to the five capitals, however, a few of the questions related to more than one capital. This is explained in further detail below. In case

[3] The application to NSD and the granted permit can be found attached at the end of the thesis.

Capital:	Indicators:	Interview questions:	Prompts:
Human capital	*Learning about the weather, its impacts and its uncertainties*	What have you learned from working with the TRACKS project so far?	*- About the weather?* *- About long-term changes in the weather?* *- About the impacts of the weather?* *- About the uncertainties of predicting the weather?* *- Is there anything you would like to learn more about?*
	Translating learning into practice in different vocations	Have you used what you are learning in TRACKS in your daily life? If yes, in what ways?	*- In your employment?* *- In your daily occupations (with your family/friends, transport, market place…)*
	Leadership and clear organisation	What do you think about how the meetings, workshops and the citizen science have been led and organised?	
Social capital	*Networks and interaction (formal and informal)*	What has kept you motivated as a citizen scientist?	*Is anyone missing that were there in the beginning? Do you know why?*
	Participation and sharing experiences	How and with whom are you sharing your experiences from TRACKS?	*- Citizen scientists* *- Other people in your village* *- Are there people you talk with that you didn't talk with before TRACKS?*
	Trust and openness	Do you feel like you and others can speak openly in the citizen science group?	*Why/why not?*

Resources and technology capital	*Scientific models* *Weather measuring technology* *Communication infrastructure for the extended peer-community*	What do you think about the scientific climate information presented to you in the workshops?	*- Do you trust it?* *- Is it useful?* *- Is it interesting?*
		What do you think about the weather measuring equipment for learning about the weather and impacts?	*- Have you learned how to use it well?* *- Do you trust it?* *- Does it help you learn about the local weather?* ***- Have you faced any unexpected challenges that made it difficult for you to measure the citizen science indicators? If yes, what happened, and how did you deal with it?***[4]
		To what extent have you stayed in contact with other citizen scientists? Did technology such as phones or internet (website, Facebook) play a role?	
Political capital	*Impact on local policies and politics*	Do you think that TRACKS has had an impact on local politicians' discussions and decisions? If yes, to what extent, and on which issues?	

[4] This question relates to the institutional capital as well, under the indicator 'remaining flexible to changing conditions'. It is marked in bold to indicate that this is a prompt that should always be asked since it is the only question relating to this indicator.

Institutional capital	*Cooperation across institutions* *Remaining flexible to changing conditions* *Remaining flexible to changing conditions*	How has the TRACKS project and citizen science worked with different groups of people in your community?	*- Has TRACKS been useful for these groups of people?* *- Have these groups changed the way they work as a result of working with TRACKS? How?*
Additional Questions		What do you expect from TRACKS over the last months of the project?	
		Has the TRACKS project been negative or disappointing to you or others in any way?	
		Is there anything more you would like to add?	

Table 10: Interview questions built into the evaluation framework

some of the respondents would provide less thorough answers, I added prompts under most of the questions. The questions are presented in table 10 above, built into the evaluation framework to show how they relate to each capital and indicator.

Professor Haque conducted 12 interviews with citizen scientists on my behalf the 25th and 26th of November 2016. I asked him to ensure diversity in age, gender, backgrounds and professions among the respondents, and to keep the questions open and only use the in case of very short answers. The interviews were audio taped, and then transcribed and translated into English by a professional translator. The details of these 12 citizen scientists are listed in the next chapter, presenting the findings of this research.

4.3.3 Qualitative interviews conducted in May 2017

In order to experience the context of the interviews, and meet the respondents in person, I accompanied TRACKS researchers when they travelled to Bangladesh the 11th of May to visit

citizen scientists and arrange the final workshops for the project. To allow for comparison with the interviews conducted in November, we arranged meetings with five of the same respondents that Professor Haque had interviewed. While the first interviews were semi-structured, these follow-up interviews were carried out more like conversations than interviews. In order to allow the respondents to speak freely about what was most important to them, I opened the conversations with asking them to tell about their experiences since they were last interviewed in November 2016, and then asked follow-up questions based on their answers. In addition to these five follow-up conversations, I conducted three interviews with citizen scientists who had not been interviewed before. For these interviews, I used the same questions as Professor Haque did in November, however with a modification of the first additional question (see table 10): because TRACKS was coming to an end, I asked if the project had met their expectations, instead of asking what their expectations for the final months of the project. The interviews and follow-up conversations were conducted by me asking questions in English, while either Mr. Saifullah Rony, Professor Haque or Mrs. Salma Juthi translated. Instead of recording and transcribing the interviews, I continuously took notes as the translator translated the respondents' answers.

4.3.4 Advantages and disadvantages

As discussed above, one of the main advantages of qualitative interviews as a method is that it allows for a deeper insight into how people understand, experience and interpret an event or social phenomenon. Especially through keeping the interview questions as open as possible, the respondents are allowed to answer according to their own knowledge systems and understandings. On the other hand, particularly in settings where there are cultural differences, and a language barrier, qualitative interviews also have some disadvantages.

In the first round of data collection, one obvious disadvantage was that I was not able to conduct the interviews myself, and not even be present. As such, I missed out on important factors such as context, situations, how the questions were asked, and body language. In addition, as only one of the respondents could speak English, the interviews were carried out in Bangladeshi, which made me dependent on a translator. Although the interviews were recorded, there is still a possibility for misunderstandings during the transcriptions and translations – especially considering they were carried out by an independent professional translator who was not present during the interviews. Another possible implication is that Mr. Haque is a Professor, and as such has a high status in the Bangladeshi hierarchy, while many of the respondents were poor, and sometimes illiterate people. There is a possibility that this

perceived difference in status may have led to restrictions on some of the respondents' feeling of being able to answer freely and honestly.

In the second round of data collection, I conducted the interviews and follow-up conversations myself – however, I was still dependent on a translator. As such, how the questions were translated and interpreted by the translators was out of my control. In several cases, a conversation also seemed to take place between the translator and the respondent before the answer was translated to me, and sometimes the translated answer seemed much shorter than the answer the respondent had given. There is therefore a possibility that some of the information was lost during the translation; that it was summarised back to me, according to what the interviewer-translator considered important, or could simply remember from a long answer. Having the interviews recorded, transcribed and translated would have been a safer way to ensure that no information was lost. Due to the delayed fieldwork, this was unfortunately not possible within the time available. In the following chapter, the findings of the two rounds of data collection are presented and analysed.

Chapter 5
Findings and Analysis

Introduction

The evaluation interviews were conducted with in total 15 of the 21 citizen scientists in the two study areas in the Sunamganj District, the Upazilas Sunamganj Sadar and Jamalganj. Twelve interviews were carried out by Professor Haque on my behalf in the end of November 2016. When I travelled to Bangladesh in May 2017, I conducted another eight interviews – three of them with citizen scientists that had not been interviewed before, and follow-up interviews with five of the same people Professor Haque interviewed in November, to allow for comparison. Because these two rounds of interviews were conducted differently, they are treated separately in this chapter. First, findings from the twelve first interviews are presented and categorised under the five capitals of the evaluation framework. Then I present my experiences from the study trip in May, along with the findings from the interviews I conducted myself. Finally, an overall analysis is carried out in the last section of the chapter.

5.1 First round of interviews: November 2016

Semi-structured interviews were conducted with twelve citizen scientists from Sunamganj and Jamalganj 25th and 26th of November 2016. Five of the respondents are from Jamalganj, and seven are from Sunamganj Sadar. Eight of the respondents are men, and four are women. Four of the respondents from Jamalganj are men, and one is a woman. From Sunamganj Sadar, four of the respondents are men, and three are women. The youngest respondent is 24 years old, and the oldest is 68, with the average age of all the respondents being 42. Two of the respondents are journalists, three work in different kinds of businesses, two are teachers, two are day labourers, one is a community leader, one is a counsellor and one is a traditional doctor. The personal information about the twelve respondents, and what indicators they have responsibility for measuring as citizen scientists, is listed in table 11 below.

5.1.1 Human capital

5.1.1.1 Learning about the weather, its impacts and its uncertainties

On the question about what the respondents had learned from working with the TRACKS project so far, all twelve respondents answered that they have learned a lot about the weather, and eight of twelve emphasised that they did not understand the weather and climate well

	Gender:	Age:	Area of residence:	Occupation:	Indicator/s:
Respondent 1	Male	68	Jamalganj	Business on medicine	Rainfall, Kalboishakhi[5]
Respondent 2	Male	50	Jamalganj	Journalist	Rainfall, river level, temperature and Kalboishakhi
Respondent 3	Female	30	Jamalganj	Community leader	Lightning
Respondent 4	Male	56	Jamalganj	Teacher	Rainfall and temperature
Respondent 5	Male	24	Jamalganj	Poultry business	Wind speed and temperature
Respondent 6	Female	30	Sunamganj Sadar	Day labourer	Insects, rainfall, frogs' croaking and grasshopper flying
Respondent 7	Female	30	Sunamganj Sadar	Day labourer	Animal behaviour and mango bud
Respondent 8	Female	40	Sunamganj Sadar	Counsellor	Changes in the sky, clouds and rainfall
Respondent 9	Male	46	Sunamganj Sadar	Journalist	Rainfall, river level and wind speed
Respondent 10	Male	45	Sunamganj Sadar	Business (sand and others)	Kalboishaki
Respondent 11	Male	49	Sunamganj Sadar	Kabiraj (traditional, rural doctor based on herbal medicine)	Temperature and air
Respondent 12	Male	39	Sunamganj Sadar	Teacher	Wind speed

Table 11: Overview with information about the twelve respondents.

before joining the project. Ten out of twelve stated that learning and gaining knowledge through project meetings and citizen science has been the main motivation, or one of two main motivators, for their participation in TRACKS. One of the respondents expressed it as follows:

[5] Kalboishaki (Nor'wester in English) is the Bengali name for strong, destructive storms that usually start with strong gusts from the northwestern direction along with rain and sometimes hailstorm at the end of a hot day.

"I have always known that people become scientists after graduating from universities, going abroad and taking degrees and certificates and spending lots of money. But the concept that a common citizen can also be a scientist has attracted me the most."

- Respondent 2

Which weather issues the respondents have learned the most about, relates to which indicators they have been given responsibility for as citizen scientists. For example, respondent 2, who is measuring rainfall, river level, temperature and Kalboishaki, said that in the past they could only guess how the rainfall would be, but that they are now able to predict it with specificity. He has also learned to measure the river level accurately. He said that before he joined TRACKS, his measurements did not match with the government record, but that now they do. For example, he kept a record of the rainfall level in August 2016 and wrote it down in the notebook he was given. He later saw on TV that his readings were the same as the weather office's. He said that the measurements and readings have been very helpful for him to understand the local weather. Further, he said that from the first TRACKS meeting, a clear understanding was built up for the common people with a lot of information from the grass root – for example that when the frogs croak, it may rain the next day.

Another revealing example is provided by respondent 7, who has been given responsibility for measuring animal behaviour and mango bud. The respondent said that she never used to keep track on weather issues, and that she never used to know what is happening to the weather in the country. She said that the best thing about joining TRACKS is that she never knew any of the things that she has learned from this project, and that she used to not believe them. "I didn't know them, didn't understand them and didn't even try to understand them", she stated. She said that the most important thing she has learned is the croaking of frogs: she has learned that frogs croak a lot just before rain and storm, and that she used to have no idea about it – but that now she sees that this is true.

"I never knew that when it rains or storms, many insects come out of the ground like snakes and worms. (…) I neither believed nor knew but now that I have seen it with my own eyes, I do believe."

- Respondent 7

A third example comes from respondent 9, who's indicators are rainfall, river level and wind speed. He noted that before joining TRACKS, he did not have much knowledge about

weather and climate. He never noticed the clouds in the sky, and he did not understand wind speed. Now that he is a citizen scientists in TRACKS, he has learned to measure and understand the speed of the wind. He has also learned how temperature affects rainfall, and how he can get information from the clouds. Because of the rainfall level readings, he also realised that it rained a lot in Sunamganj in 2016. He said that one day the water level in Sunamganj was about 1800 mm., and that all the roads went under water that day. He said that the experience he got in 2016 will help him a lot in the coming years, because he will be able to do many things on his own. With the experience he has gained, he hopes that he will be able to forecast the weather.

"The most motivating thing is that I have learnt a new thing and now I have sufficient knowledge on weather. I feel good when I tell them [people] the forecast and it comes out to be true."

- Respondent 9

One last example is given by respondent 12, who is measuring wind speed. The respondent said that he has learned about temperature and wind speed, and how it connects to rainfall. Further, he said that TRACKS have helped them understand how the climate is changing, and stated that the more they learn about the weather, the more they can adjust with the changing weather.

"It [TRACKS] has given us an idea on how the climate is changing and how we can balance it for the world, maybe we will not be able to control it but TRACKS has given us an idea on how we can survive in the changing situation."

- Respondent 12

5.1.1.2 Translating learning into practice in different vocations

Ten of the respondents gave concrete examples of how they have made use of their learning from TRACKS in their occupations, either by sharing knowledge with their colleagues, or taking more practical measures. For example, respondent 5, who is responsible for administering the medical component of a poultry business, explained how he has put the knowledge he has gained on temperature to use in his job. He said that he has learned that if the temperature is 23-24°C in the morning, it can reach 28-31°C at noon, which is bad for the chickens. Based on this knowledge, he can predict when it is going to be a hot day, and instructs his colleagues to shower the chickens, give them water to drink and to change it at

noon. He also asks them to open the curtains in the poultry dens so that more air can come in so that the chickens will not overheat. He said that normally two or three chickens die in hot weather, which can cost him 1000 BDT[6], but because he now understands the temperature and can take precautions on hot days, he can save this money.

Another example is given by respondent 10, who works in the sand business. He said that the knowledge he has gained about the weather has been fruitful in his life as it helps him in his sand business:

"When the sand comes in boats for my business, if I know it is going to rain or storm, I place them in a higher place, otherwise they get washed away with [the] water."

- Respondent 10

Respondent 9, who is a journalist, explained that he uses the knowledge he has gained when he has to go to places far away to gather news. He said that he will first check the sky to see if there are any signs of rain or thunder, and that he keeps this in mind. He gave an example of how he used his knowledge about the weather in June last year: he was going to Bishwamvarpur Upazila (a neighbouring sub-district north of Sunamganj Sadar), with a colleague from The Daily Prothom Alo newspaper. It was raining the night before their departure, and it rained all night until 10 am the next morning. His colleague asked him what they should do, and he answered that it would not rain anymore because the clouds were scattering away in the south sky. It turned out that he was right, and it did not rain the whole day, and his colleague was amazed. The respondent also explained how he writes about the weather in the newspaper as well, and that he always highlights weather-related issues.

A last revealing example of how the citizen scientists use their knowledge in their occupational life, is given by respondent 11, who is a Kabiraj – a traditional, rural doctor practicing herbal medicine. He said that the knowledge he has gained on temperature helps him decide where to store his medicines. Because some of them require cold and dry temperature, he moves them to a cooler place when the thermometer tells him that it is getting hot – something he never used to do before.

5.1.1.3 Leadership and clear organisation

[6] 1000 BDT (Bangladesh Taka) is about 12.50 USD.

Seven of the respondents stated that the way the workshops and meetings have been organised, have been central to build relations between the citizen scientists, and to keep them united. Five of the respondents emphasised that it is the way the meetings and workshops has been facilitated that has enabled them to speak freely in the meetings. One of the respondents would have liked to have more organised meetings.

Two of the respondents complemented Mr. Saifullah Rony for his leadership and attitude. Respondent 2 said that it is inspiring how Mr. Rony greets them before a meeting: when they meet, Mr. Rony always asks about the wellbeing of all his family members. He said that this attitude has a huge effect on them. Respondent 8 said that when there is something in the meetings is unclear to them, Mr. Rony helps them to understand.

Four of the respondents had suggestions to what could have been organised by TRACKS. Respondent 3 would have liked TRACKS to organise a meeting where they could come with suggestions to the project. She said that it would also be helpful if TRACKS took the initiative for each village to have a volunteer who could measure the weather and inform about the weather forecast. Respondent 5 suggested that a meeting should be organised at the Union level, to show the chairman and the other members of the Union Council the work that has been done through TRACKS for the betterment of the society. Respondent 8 similarly suggested that TRACKS should spread the information through seminars and trainings in the villages and towns. Respondent 10 also suggested that TRACKS should organise a meeting for everyone who has been involved to show them what has been done so far.

One of the respondents said that more people should have been included in the citizen science group, and that 25 people are not enough, and that if the citizen science could have been facilitated a little bit more, it would have been better. The respondent also said that if other resource people would have been included in workshops with the citizen scientists, they would have been able to think more practically.

5.1.2 Social capital

5.1.2.1 Networks and interaction (formal and informal)

All twelve respondents said that a bond or a connection has been built between the members of TRACKS, and three referred to the network that has been created as a family. One of the respondents described it like this:

"A bond is building among us. We all who work in TRACKS, we have become a family with a very friendly bond."

- Respondent 1

Respondent 5 said that he knew several of the other members by face before getting involved in TRACKS, but that he never talked to them. Through the project they have gotten to know each other, and a bond has been built between them, which means that they will help each other when facing problems, the respondent said. Respondent 7 similarly said that she did not know the other members of TRACKS before getting involved in the project, but that now a connection between them has been built.

All of the respondents also said that they interact with other citizen scientists between the organised meetings, and that they often discuss their citizen science tasks and TRACKS when they talk. The frequency and regularity of these informal meetings varied between the respondents. Seven of the respondents did not specify how often they interact with other citizen scientists between the bimonthly meetings, but two of them said that they sometimes meet with others, and five of the respondents said that they have contact with other citizen scientists on a regular basis. Four of the respondents said that they meet other citizen scientists one to several times per week, and one of the respondents said that he sometimes meets other citizen scientists every day. One of the female respondents said that she mostly stays in touch with other female citizen scientists, and one of the male respondents said that he does not have contact with the female citizen scientists between the organised meetings.

Three of the respondents emphasised that the network that they are now part of has been one of the main motivators for them to participate in the project. For example, respondent 3 said that through working for the TRACKS project, she has gotten the will and interest to mix with people. She expressed it at follows:

"We can't do anything alone, but when we are together, much valuable information comes out and that helps us to be united."

- Respondent 3

5.1.2.2 Participation and sharing experiences

All twelve respondents emphasised that a lot of valuable information has come out through sharing experiences and knowledge with each other in the TRACKS meetings, and that they have learned a lot from this. Respondent 1 expressed it like this:

"We didn't know about many things before joining TRACKS, but being with this project and being with you have given us a chance to gain and share knowledge."

- Respondent 1

Three of the respondents emphasised that they had heard about several of the weather indicators discussed in TRACKS from their elders. One of them, respondent 9, said that their elders have said that when egrets fly and the sky is covered with black clouds, it will rain – and that this is absolutely right. He said that he believes that the information from their elders is also scientific, and that it is important to preserve their knowledge. One of the respondents expressed surprise and gratitude over finding out that the local knowledge was taken seriously by TRACKS:

"In the fourth meeting in Zarin hotel, [they] showed us some pictures of the indicators, frogs, fishes, how famine affects people. I was amazed that the information they took from us, they took it very seriously and presented the exact things that we said. I was very grateful."

- Respondent 2

One of the questions was not formulated clearly enough, and was therefore misunderstood by the interviewer. The intension was to ask the respondents if they shared knowledge with other groups of people within their communities, such as neighbours, farmers or students. However, as the wording of the question was not specific enough, the question asked was instead if any of the respondents had any communication with the citizen scientists in the other Upazila. Although this question was misunderstood, it revealed that two of the respondents had some contact with the citizen scientists in the other Upazila. One of the respondents from Jamalganj said that he sometimes talks over the phone with two of the citizen scientists from Sunamganj Sadar, and that they tell each other about their work. Another respondent, from Sunamganj Sadar, said that he used to stay in touch with one of the citizen scientists in Jamalganj until he lost his phone, and thus this citizen scientist's number.

All the twelve respondents gave examples of how they share the knowledge they have gained through TRACKS with people outside of the project. For example, respondent 1 explained how he has learned that Kalboishaki occurs more in Boishakh, and that he can use this knowledge in several ways. For example, he can use his experience to make people aware of the increased risk of Kalboishaki occurring in Boishakh, and advise them not to go to the Hoar more often. He would also warn cattle owners about letting their cows come out, since

thunder and lightning can occur during Kalboishaki. The respondent has cattle himself, and explained that the weather is therefore a crucial issue for him. He explained that if he knows when lightning occurs, he can be aware.

Two of the respondents said that they use their knowledge about the weather to aware their children who go to school. Three said that they share with their relatives and family, and one of the respondents said that by learning about temperature and how to measure it, him and his wife can now dress their children accordingly. Now they know when it is going to be cold and their kids need warm clothes. Respondent similarly explained how his knowledge about temperature has helped him understand how to dress his sick mother. He said that his mother sweats a lot because of her illness, and that now that he knows the temperature, he dresses accordingly: one day he saw that the temperature was high, and therefore he dressed her with a saree [traditional female garment]. If he did not have this knowledge, he would have covered her with a light blanket, and other clothes, he explained. Another respondent said that his children are also interested in keeping records, and that when it rains of floods, his little daughter reminds him to check the measuring equipment.

Eight of the respondents said that they share knowledge with their neighbours and people in their communities, and two said that they share information with their friends. Respondent 2 said that some people told him that the TRACKS project could not possibly be fruitful because it is coordinated from Norway, but when he showed them the work he did every day on temperature and rainfall level, they understood and realised the importance of the project. Respondent 4 said that he shares information with people who come into his office, and people he meets in the mosque. He said that they notice the machine he uses to measure temperature, and ask what it is, and he explains how it works and how it can help them to take precautions. Respondent 5 similarly said that he shares information about temperature with his customers who buy chicken from him.

Three of the respondents could tell about occasions when people who are not part of TRACKS have showed interest and wanted to participate in the project. For example, respondent 2 said that when TRACKS organised a meeting in the Zarin hotel, some people had seen this in the citizen science magazine, and asked him why he had not invited them to the meeting. Nine of the twelve respondents emphasised that they want the knowledge mobilised in TRACKS to be spread to more people. One of the respondents wish that more people would have been included in the citizen scientist groups, for example primary level teachers, medical science doctors and lawyers, so that they also could have gotten these people's opinions and insights. The respondent said that citizen science is about experience,

and the more experience, the better the data. Respondent 2 said that he would like to write a blog about TRACKS.

5.1.2.3 Trust and openness

All the twelve respondents answered that they can speak freely in the TRACKS meetings. Seven of the respondents said that they can express themselves freely because of the relation that has been built between them, and they respect each other. One respondent expressed it as follows:

"In the meetings earlier, I did not know anyone, so I just went and came out as soon as my work was done. But now, we go there earlier and sit for some time and talk because now we know each other and can share our opinion freely."

- Respondent 11

Respondent 12 said that both because of how the meetings are organised, and because a bond has been built among them, no one dominates each other, and everyone listens carefully to one another. One of the respondents said that she feels that she can speak freely without hesitation, but that she never says anything before thinking about what she wants to say, and whether what she wants to say has value. Another respondent said that when people who do not know each other meet, one cannot expect them to immediately share their feelings and thoughts – but that over time, when people get to know each other and relations are built, they feel comfortable with sharing their thoughts openly.

Respondent 8 stated that part of the reason why everyone can speak freely is that they are all in the project for a common purpose. Respondent 9 said that it is because everyone is dedicated to their work, and because the knowledge they get through TRACKS will help them in their lives. As mentioned, five of the respondents said that the reason why they can speak freely is the way the meetings are lead and organised.

One of the respondents asserted that the female participants are less eager than the men towards their citizen science work. He stated that they are a little weaker and that they have not perceived the information properly. Another respondent stated that there are some greedy people participating in the project who are expecting benefits in return for their work.

5.1.3 Resources and technology capital

5.1.3.1 Scientific models

All of the twelve respondents stated that they have strong confidence in the scientific information that was presented to them in TRACKS meetings and workshops. Nine emphasised that they found the information interesting and useful, and five said that one reason for why they find the scientific information reliable, is that they have seen it happen themselves – in other words, the scientific models match their personal experiences.

5.1.3.2 Weather measuring technology

Ten of the respondents said that they have had no problem operating the weather measuring machines and equipment they have been given. Two of the respondents had faced difficulties. One of the respondents said that he does not know how to use the machine watch that he was given, because he does not know the method. Another one said that he has no problem using the wind measuring device, but that he does not fully understand how the weather station functions. Two respondents said that they had a little trouble operating the weather measuring machines at first. One of them got it right after using it for 4-5 days, and the other respondent received help to fix the problems he was facing: the thermometer showed a temperature that was very different from the day before, so he understood that something must be wrong – but Rony told him to keep the thermometer in the fridge for five minutes, which solved the problem. Another one of the respondents lets her daughter use the watch that shows temperature and humidity, so she does not use it herself, but her daughter can use it without problems. Two of the respondents said that they had faced minor problems, such as flat batteries.

Nine of the respondents said that the weather measuring equipment helps them understand the local weather. Respondent 9 said that he has also learned how to convert millilitres into millimetres. Five respondents had suggestions regarding the weather measuring technology: the respondent who has problems with the weather stations would like it to become easier to operate. He suggested that TRACKS should organise trainings in using the machines. Respondent 2 said that it would be helpful if the citizen scientists also had a laboratory where they could analyse all their data. He said that this could be helpful for the community as well as other scientists who could analyse their work. Respondent 4 said that if there are any other weather measuring machines, they would like to use them as well, and respondent 5 said suggested that a tower showing temperature and wind speed should be established so that people in the fields and Haor can be aware. Respondent 8 said that they want to know more about the weather, and that they would like to know if there is any machine that can tell when it is going to flood or storm.

5.1.3.3 Communication structure for the extended peer-community

The majority of the respondents meet the other members of the extended peer-community in person, but many also communicate over the phone, and some through social media and the internet. Eight of the respondents regularly communicate with other citizen scientists via phone, and two also use Facebook as a communication channel, where they are members of the TRACKS Facebook group. However, one of them said that he had faced trouble using Facebook, as his account was hacked – so after that he said he only uses it once a week. He also uses e-mail to send pictures of his rainfall and wind speed measurements to Rony.

5.1.4 Political capital

5.1.4.1 Impact on local policies and politics

Two of the respondents are politicians themselves. Both of them said that they have shared the knowledge they have gained through TRACKS with colleagues and people they have political meetings with. One of them, respondent 3, who is a community leader, said that she is responsible for delivering messages to three different Wards[7] – and that she uses this opportunity to spread knowledge about the weather, what different weather signs mean, and about TRACKS. She said that she has talked to the women in the Ward meetings and given them a basic understanding of lightning, which is the indicator she is measuring. She said that everyone gives her their full attention when she tells them about TRACKS. Respondent 8, who is a counsellor, has also shared information about TRACKS in meetings she has attended. She has told them that it may storm or rain if the temperature gets high, and she has told them about TRACKS and the citizen science. One of her colleagues has also learned to use the thermometer, and measures temperature with it. Further, she said that her colleagues are positive to the citizen science and what they are learning through TRACKS, and that they want weather information in Unions, Upazilas and villages. Although people get news about the weather on TV, she said that often it comes late at night and many people cannot watch it – but that if weather information is spread in villages, they can understand it directly and be aware. As such, she has told her colleagues that if weather measuring equipment could be distributed in villages and fringed areas, people could learn to use it and thus become aware and understand the weather directly. Her colleagues were positive to her suggestion.

[7] A Ward is a rural administrative unit in Bangladesh. Usually one village is designated as a Ward, and nine Wards form a Union, which is the smallest local government unit in the country. A Union Council ('Parishad' in Bengal) consists of a chairman and twelve members, including three members exclusively reserved for women. A Union Council is the unit primarily responsible for agricultural, industrial and community development within the local limits of the Union.

Five of the respondents also attend meetings with politicians through their positions, and four of them said that they use these opportunities to share information about TRACKS and what they are learning through the project. Respondent 2, who is a journalist, said that because he is participating in TRACKS, many community leaders that he knows have called him to ask for information about the water level, sky and flood risk. They want to have the weather signs confirmed so that they can aware people. Another one of the respondents, who is also a journalist, said that when he attends meetings and seminars about climate change and disasters with local government representatives, he tells them about TRACKS and what they are learning through the project. He said that what he has learned has helped him understand disasters, and that he shares this knowledge in the meetings he attends.

Three of the respondents said that as far as they are concerned, no local government politicians know about the citizen science they are doing. When asked if any Union Parishad members had gotten to know about any of the knowledge mobilised in TRACKS, one respondent answered: "No, no. They are busy stealing ration." Another respondent said that there is no arena where they can impact the local politics. However, several of the respondents had suggestions about how to attempt to influence the politicians. Three of them suggested to initiate a meeting in the Upazila Parishad and invite the chairman and other council members, and tell them about the TRACKS project and how it is working. Respondent 1 also suggested that all the NGOs and the District Commissioners from both Jamalganj and Sunamganj Sadar should be invited to a meeting where they would get to learn about the project.

5.1.5 Institutional capital

5.1.5.1 Cooperation across institutions

As discussed in Chapter 3, this thesis adopts a broad understanding of the concept of institutions as both formal and social institutions, including families, groups of farmers or fishermen, the bazar, and similar. This indicator therefore partly overlaps with the three indicators *5.1.1.2 Translating learning into practice in different vocations, 5.1.2.2 Participation and sharing experiences,* and *5.1.4.1 Impact on local policies and politics.* In order to differentiate between the indicators, 'cooperation across institutions' is here defined as settings in which cooperation actually takes place, either in terms of citizen scientists collaborating with other institutions, or in terms of institutions outside of TRACKS making active use of the knowledge the citizen scientists provide them with.

As revealed in section *5.1.4.1,* the respondents could provide some examples of cooperation with local government institutions. While most of the respondents' examples

entailed sharing knowledge and experiences with politicians on their own initiative, respondent 2 explained how community leaders contacted him to get information about the weather. Because these politicians were actively seeking information from a citizen scientist, and because they were going to use it to aware people about bad weather, this is an example of cooperation with local government institutions. The same respondent said that he has also shared his weather measurements with the 'gauge office' of Bangladesh, to compare his data with theirs. He found out that his measurements matched their readings, and one time his readings were even more accurate than theirs, and the office said so themselves. This provides another example of cooperation with a formal institution, as they were actively using the respondent's data and comparing them with their own measurements.

The two respondents who are teachers, have both utilised the knowledge from TRACKS in their schools. One of them, respondent 4, who is a Madrasa[8] teacher, explained how he is training 8-10 of his students to measure temperature. He said that he goes to their homes and train 3-4 students at a time, and that when these students have understood the method, they teach another two students what they have learned – and so the knowledge spreads. He said that he already has 15-20 students who are interested to learn. He also said that he wants to start including his citizen science measurements in the weather lectures he teaches. The other teacher, respondent 12, has incorporated what he has learned about the weather in the lectures he gives. He also teaches the students who are interested to use the anemometer, and encourages them to discuss weather issues with their elders. He said that sometimes he also learns from his students. Because the teachers are central part of the school institution, and they are enable to include the knowledge from TRACKS in their teaching and pass it on to students, this can be understood as an example of cooperation with the formal institution of the school.

Although all the respondents have explained how and with whom they share knowledge, it is in many cases challenging to conclude whether this can be understood as *cooperation* with social institutions. As mentioned above, a distinction is therefore drawn between the one-way sharing of knowledge from citizen scientists to others, and settings in which exchange of knowledge has taken place, or where the information from TRACKS is actively used by social institutions.

The family can be understood as a social institution with a certain structure and social rules. As mention in section *5.1.2.2 Participation and sharing experiences,* seven of the

[8] A Madrasa is a Muslim religious school.

citizen scientists share the knowledge they have gained with their families and relatives in different ways. For example, two of the respondents said that they use the knowledge to aware their children who go to school, and another one said that him and his wife use the knowledge about temperature to decide how to dress their children.

A store or business can also be understood as a social institution. Several of the citizen scientists gave some revealing examples of how their knowledge about the weather has impacted their businesses. For example, the respondent who is responsible for the medicine component of a poultry business, has changed the way he treats the chickens because of his improved understanding of temperature. He instructs his colleagues to give the chickens water and open the covers to their cages when he predicts that the temperature will rise – and as such, the knowledge he has gained from TRACKS has changed a central aspect of the poultry business he works in.

Another social institution where the citizen science has had a clear impact, is the local media. Both the respondents who are journalists, explained how they actively used their weather knowledge in their journalism. For example, respondent 2, who is also the chairman of the press club, explained that when he is together with other journalists, he tells them about TRACKS and his citizen science. He said that he also tells them about river level and rainfall and how these indicators relate to floods, and his colleagues also use this information in their work.

5.1.5.2 Remaining flexible to changing conditions

In terms of weather-related issues, the interviews did reveal some examples of how increased knowledge and understanding of the weather has made the respondents more flexible, or adaptive, to changing conditions. Four of the respondents gave concrete examples of how the knowledge they have gained has enabled them to take precautions and adjust to different weather conditions. As mentioned in section 1.2, one respondent who works on a poultry farm, is actively using the knowledge he has gained on temperature, in caring for his chickens. While he used to lose 2-3 chickens in hot weather, he can now avoid this because he can predict when the temperature will get high, and gives the chickens water and shade accordingly. Another example from the same section, is the sand-businessman who uses his knowledge on rainfall to adjust where he places his sand deliveries. Because he can now predict when flood occurs, he places his sand higher up above the water when boats come to pick it up, so that it does not get carried away by the flood. A third example is the traditional doctor who uses what he has learned about temperature to decide where to store his herbal

medicines that require cooler temperatures. Five respondents also explained how the increased understanding of the weather has made them aware and enabled them to take better informed decisions about for example about their movements or how to dress.

Apart from the examples of specific weather-related adaptation, two respondents did demonstrate flexibility in terms of ensuring that their measurements are taken even when they do not have a chance to do so themselves: one of the respondents explained that as she does not know how to use the weather measuring watch, she lets her daughter use it instead. Another respondent similarly thought his son and daughter to measure rainfall for him when he is away.

5.1.6 Other aspects

5.1.6.1 Reputation, loyalty and power

Three of the respondents mentioned some factors that did not explicitly fit into the evaluation framework indicators. For example, respondent 1 expressed that it is important that Jamalganj makes a good impression, and therefore everyone has to be conscious when they represent Jamalganj in an organisation, to maintain their good name. Because of this, he said that he always tries to motivate the female citizen scientists, because in his opinion they are not as eager towards their work as the men. He said that even though he is a businessman, he makes time to do his measurements because he feels responsible now that he is involved in an organisation.

Respondent 4 said that one of the main motivator for him to be involved in TRACKS, is that all of the project leaders are respected people and therefore he wants to participate and help. He also said that because they have been given a responsibility from TRACKS, they will look very bad if they do not fulfil their duties.

Respondent 11 explained that part of the reason why he wanted to become part of TRACKS, is that all the project leaders are educated people. He also said that he wants to do the work with full dedication so that he can make an impression – because if he does his work properly, people will remember his name.

5.1.6.2 General feedback about TRACKS

All twelve respondents said that they have no complaints about TRACKS, and six of the respondents emphasised that they enjoy participating in the project. Two of the respondents said that they feel grateful, three used words like ‘inspiring’, ‘meaningful’ and ‘hope’ when

they described their experience with participating in TRACKS, and one expressed that he is proud because he is part of something that has importance for the wider society:

"When I work with TRACKS, I feel proud because I am not doing it for myself, I am doing it for the society and I appreciate that over individual benefit."

- Respondent 5

5.1.6.3 Thoughts about continued learning

Although all the respondents stated that they have learned a lot, five of them emphasised that they would like to learn more. Four of the respondents specified that they expect the TRACKS project to facilitate for continued learning. Three of the respondents stated that they would like to contribute to the continuation of the project, and six of the respondents said that the knowledge and experience they have already gained will help them for many years, and that they will continue their measurements after the TRACKS project has ended:

"The experience we have gained, we can do it even if you are not here. In [the] future, when you will be gone, we will do it for our own interest."

- Respondent 1

Respondent 1 stated that if they continue with the readings and measurements, both the citizen scientists and the TRACKS project can get a clear view about climate change. Respondent 3 said that if TRACKS can train them more through meetings and discussions, they will learn and know more and will be able to spread the knowledge. Two of the respondents brought up the issue of earthquake, and said that they would like to learn more about it, and which precautions that can be taken. Both of them perceived earthquake as related to climate change. One of them stated that earthquake may occur when it gets very hot, and that is had occurred more frequently over the last two years. Respondent 7 said that she would also like to learn about the indicators that other citizen scientists have been assigned to do. Respondent 8 said that she would like to learn more things about the weather, such as why it rains heavy, and why it sometimes gets very cold.

5.2 Second round of interviews: A week in the field, May 2017

My trip to Bangladesh was essential for this study, not only to complete my fieldwork, but also to experience and better understand the context of this thesis. Knowing that Bangladesh

is very different from Norway in countless ways cannot make up for experiencing it first-hand. The first thing that struck me when I arrived in Bangladesh was indeed how fundamentally different everything seemed to be. One of the strongest evidences of this was the complete chaos in the traffic, which seemed to be absent of system and rules regarding everything from vehicles and road standards, to safety and speed limits. In most of the places we saw, men were overrepresented in the public areas, and many of the women wore hijabs, and some niqabs or burkas. The cities, towns and rural areas we went to and drove by seemed randomly constructed with no overall plan. In rural Sylhet, almost all of the building were made of brick, many lacking doors and glasses in the windows. Several families often lived together in small houses. Many of the roads were extremely narrow and in poor condition – often we drove on mud roads. Being a northern European in rural Bangladesh was also quite an experience: most people there have rarely, or maybe never, seen a light-skinned person before. We were therefore often followed around by big groups of curious locals. At the most, we had at least 30 people witnessing the interviews with the citizen scientists.

Despite the profound challenges the Bangladeshis are living with, and the lack of infrastructure and material goods we might often take for granted in our part of the world, there seemed to be a harmonious atmosphere over the places we visited and drove by. Compared to northern European societies, people seem to socialise a lot more in Bangladesh: wherever we went in Sylhet, there were children playing football in the fields, playing in ponds, and playing hoop rolling. Everywhere, people were outside together, either working along the roads, gathering hay, cutting trees that had fallen down, herding animals, fishing, or doing grocery shopping or selling in the lively markets. Many people were also just sitting around talking, while overlooking the rice fields, or walking together in smaller or bigger groups. Everyone we talked to were nothing but friendly and welcoming.

These images are in stark contrast to some of the stories the respondents shared through the interviews. Important for the context of the interviews conducted in May, is the spring flood event that struck the Sylhet Division in early April. The annual floods that fills up the Haor usually starts in late April, after the rice crops have been harvested. The consequences of it starting almost a month early this year, were severe: an estimated total of 114 000 hectares (km^2) of rice crops were damaged in the region, affecting over 341 000 farmers (Islam, 2017). According to the Bangladeshi Department of Agriculture, the Sunamganj District was hit the hardest, where the flood affected 171 870 farmers. The rotting rice crops in turn lead to the death of 50 tons of fish in the Haor areas of Sunamganj,

according to The Financial Express (2017). These events were reoccurring themes in all eight interviews.

5.2.1 New interviews with citizen scientists

I conducted three new, full semi-structured interviews with citizen scientists who had not been interviewed before: two women from Jamalganj, and one man from Sunamganj Sadar. The two women from Jamalganj are both previous members of the Union Parishad, but did not get re-elected this year. The man from Sunamganj Sadar works in a governmental livestock office and has recently moved to Sunamganj Sadar from the city of Sylhet. The interviews with the two women from Jamalganj, hereby referred to as respondents 13 and 14, were conducted simultaneously in the market place in Jamalganj the 14th of May, as they both came to respondent 5's store together to be interviewed. However, the respondents were still asked the questions separately, and answered them separately. In some of the questions they had very similar experiences, and therefore answered together. The interview with the man living in Sunamganj Sadar, hereby referred to as respondent 15, was conducted after a workshop TRACKS arranged with the citizen scientists of Sunamganj on the 15th of May. An overview of the information about the respondents is provided in table 12. The questions were the same as the ones asked in November, only with an update of question number 12: instead of asking about their expectations for the last months of the project, I asked them if their expectations of the project had been met. I asked the questions in English, and Mr. Saifullah

	Gender:	**Age:**	**Area of residence:**	**Occupation:**	**Indicator/s:**
Respondent 13	Female	43	Jamalganj	Housewife (previous member of Union Parishad)	Lightning
Respondent 14	Female	38	Jamalganj	Housewife (previous member of Union Parishad)	Kalboishakhi
Respondent 15	Male	27	Sunamganj Sadar	Works in government livestock office	Rainfall

Table 12: Overview with information about the three respondents interviewed in May.

Rony translated. Instead of recording and transcribing the interviews, I continuously took notes as the translator translated the respondents' answers.

5.2.1.1 Learning and sharing knowledge

The three respondents said that they have learned a lot from participating in TRACKS. As with the interviews conducted in November, these respondents had also learned most about the indicators they are responsible for as citizen scientists. All the three respondents also gave examples of how and with whom they share the knowledge they have gained. Respondent 13 explained that her responsibility is to record causalities in terms of human lives, cattle, trees and other forms of damage caused by lightning, and that she has learned this through TRACKS. She said that before she joined the project, she never used to keep record of these things. The Union Parishad, which she used to be part of, is responsible for keeping record of damage and causalities from lightning. When she was a member there, she was responsible for reporting to the Parishad about the recordings she did as a citizen scientist. In addition to reporting to the Parishad, she also shares the knowledge she has gained from TRACKS with her friends and family. She gave an example of one time her kids brought some friends over to their house, and she told them what she has learned about the weather. Respondent 14 said that she has learned a lot of things that she never used to think about before joining TRACKS. Her responsibility is to keep track of damage caused by Kalboishaki, such as how many houses have been damaged, how many trees have fallen and so on. She said that she has also learned a lot about local knowledge, for example she has learned that the mango buds can indicate heavy rainfall. Last year this was a helpful indicator, she said, but that it was not accurate this year. She hares the knowledge she has gained with members of her family. She has also built relations and network through her position in the Union Parishad, and thus she also shares information with them. Respondent 15 said that he has learned a lot of things through TRACKS, like measuring rainfall, predicting rain and responsibility. He said that he shares the knowledge he has gained with his colleagues, friends, family and people in his village. He advises them to take precautions, and when to harvest rice, for example.

5.2.1.2 Organisation of meetings and interaction

On the question about what they thought of the TRACKS meetings they have been organised, respondent 13 said that she thinks that it works well with how the citizen scientists meet every two months. She said that she is happy with the frequency, and that she has learned a lot from these meetings. Respondent 14 said that the workshops and meetings is a good way to get to express themselves, share experiences, and get ideas. Respondent 15 said that he would have liked more citizen scientist meetings to be organised by TRACKS. All three respondents noted that they can speak openly in the meetings, with no restrictions or barriers. Respondents 13 and 14 stated that the reason for this openness is that the citizen scientists have become a

family where everyone feels free to talk. Between the organised meetings, respondents 13 and 14 said that they regularly meet and talk to the other citizen scientists in their area, and respondent 15 said that he sometimes has contact with other citizen scientists – but that he has just recently moved to Sunamganj Sadar and therefore he does not know them that well.

5.2.1.3 Motivators

On the question about what has motivated them to be a citizen scientist in TRACKS, respondent 13 said that mental satisfaction, in terms of getting to learn and contributing with something to the country, is what motivates her the most. Respondent 15 similarly said that he is doing the citizen science for the country. Respondent 14 said that they live in an area that is very vulnerable to climate change, and that knowledge therefore is essential – and they need more of it. Therefore, she wanted to join TRACKS so that she could get knowledge, she explained.

5.2.1.4 Scientific information and weather measuring equipment

Respondent 15 said that in his opinion, the scientific information they were presented in workshops and meetings was reliable. The two other respondents, however, said that one weather indicator they had learned about through TRACKS was accurate: as mentioned, respondent 14 said that the mango bud indicator was a good indicator last year, but not this year. In TRACKS, they were thought that the mango buds flowering was a sign of heavy rainfall. While they observed this one year ago, the opposite happened this year, they explained. As for the weather measuring equipment, respondent 15 said that he had only faced a small problem with his rainfall gauge, when the funnel was broken during a Kalboishaki and had to be replaced. Otherwise he has had no problems with the weather measuring equipment. Respondent 13 said that she was given the little machine that showed time, temperature and humidity, but that she has not understood how to use it. Respondent 14 said that she can understand the machine and how it measures temperature and humidity, and that she can get information from it. She explained that when the temperature and humidity is high, she knows that it might rain, and she is aware. If the temperature is very high, she tries to avoid the sunlight or she brings an umbrella when she goes out.

5.2.1.5 Political impact

All three respondents said that there has been no impact on local politics. Respondent 15 said that this is because there is no relationship between them and the local government.

Respondents 13 and 14 noted that maybe the local politicians could be influenced if a meeting was arranged with them. Otherwise it is very hard to influence them, they stated, because they are very busy people.

5.2.1.6 Impact on other groups in society

The female respondent told us that they are part of a project called 'The Hunger Project', which the largest volunteer-based organisation in Bangladesh, working to empower people in rural areas to become the drivers of their own development and progress to overcome hunger and poverty. They explained that this project has made use of the knowledge that has been mobilised through TRACKS. Respondent 15 stated that he did not think that TRACKS has impacted on other groups of society.

5.2.1.7 Expectations

All the three respondents emphasised that TRACKS has not in any way been negative to them. Respondent 14 said that the research being done in this project is unique and good. On the question about if TRACKS has met their expectations, respondent 13 said that she had expected TRACKS to be a big project that collaborated with a lot of people, but that it has turned out to be a very small project which few people involved. Respondent 14 said that she is satisfied with what they have learned about daily weather prediction and weather phenomena. However, because they live in an area that is very vulnerable to climate change, something needs to be done to protect the people from extreme weather so that they can survive, she stated. She said that this is the main question – how they can control and protect themselves against disaster. Respondent 15 stated that people at the grass root level need to get more benefits in order to be able to climate change. He said that both the knowledge and technology need to be updated. As for the future, the respondent said that there should be more projects TRACKS, with more collaboration, and which lasts for a longer period of time. Respondent 14 suggested that a meeting at the Upazila-level should be organised so that weather information can be spread.

5.2.2 Follow-up interviews

To allow for comparison, follow-up interviews were conducted with five of the same citizen scientists who were interviewed in November. These were respondents 1, 2, 5, 7 and 12 (see table 11) – three from Jamalganj and two from Sunamganj Sadar, four men and one woman. These were not structured interviews, but more a conversation about the respondents'

experiences from the time that had passed since the first evaluation interviews in November. I asked the questions in English, and Mr. Saifullah Rony was the translator for the interviews with respondents 1, 2 and 5. Mrs. Salma Juthi, who was employed by TRACKS for one of the workshops in Sylhet, was the translator during the interview with respondent 7. Respondent 12 was fluent in English, so the interview with him did not require a translator.

The first follow-up conversation took place in the NGO guesthouse in Sunamganj Sadar, Saturday 13th of May, with respondent 2 – the journalist from Jamalganj. Mr. Saifullah Rony functioned as translator during the interview, while I lead the conversation and took notes. I started with asking the respondent to tell about his experiences over the last months since he was interviewed in November. The early flash flood was the first topic that came up. The respondent said that the flash flood came the 3rd of April, and that it was the first time in history it had come that early. He explained that he had seen the rainclouds above the Indian boarder the 2nd of April, and that he had observed many weather indicators three days before the flash flood had started. He said that by combining his own experience with the knowledge he has gained through TRACKS, he is now able to predict the weather. He has also identified a danger level in the river, so that when the water rises above this mark, he warns people. Before the water reaches this level, he said it is hard to predict a flood, because the water level increases gradually. By the 7th of April, however, the respondent had come to realise that the flood was coming. He had also measured the wind speed, and it was 28 km/h. At this day, he attended a conference with local politicians, where he used the opportunity to warn people that a flood was coming. Because of his warning, a reinforcement of the embankment that protects the crops was attempted. This proved unsuccessful as the flood caused the embankment to collapse two days later, the 9th of April, and the rice was destroyed. The respondent explained that he owns 36 hectares of rice crops, and that the flood damaged everything – he did not get a single rice corn. He further said that they live in a very vulnerable area, and that they depend on more learning, equipment and financing in order to get out of the vulnerable situation. He stated that they need better long-term forecasts, because even though they have now learned short-term prediction of the weather, they do not have enough time to prepare for extreme weather events. As for TRACKS, the respondent had a simple, specific suggestion: because it is difficult to measure the wind when it rains, he suggested that TRACKS provides umbrellas for the citizen scientists. In terms of sharing knowledge, the respondent explained that he writes about weather issues in the newspaper, and he also shares weather information with the journalist association where he is a member. In addition, he shares knowledge with his colleagues – like he said in the first, his colleagues

also use the information he provides in their work. He also explained that each Upazila has a disaster community, and that he is a member of the one they have in Jamalganj. Finally, he said that he has also thought his son to do the measurements.

The second follow-up conversation took place on Sunday the 14th of May, with respondent 1: the medicine store owner from Jamalganj. We went to his store in the market place in Jamalganj, and the conversation was conducted in the same manner as the first follow-up interview, with Mr. Saifullah Rony as a translator while I was taking notes. The early flash flood was the first topic that came up in this conversation as well: the respondent said that over the time that had passed since the first interview, the flash flood had caused heavy destruction. He said that during his 67 years he has lived, he has never experienced that a flash flood came this early. He explained that the flash flood damages the crops, and especially the rice, and as a consequence the rivers and Haor areas get polluted. In addition, they have to cope with Kalboishaki. Because of these struggles, lots of people move to Dhaka in order to survive, the respondent said. According to him, 40 % of people in his area has migrated to Dhaka. He claimed that it is the middle class that suffers the most because they own a lot of crops, while poor people own very little land – and so they are not impacted as badly from extreme weather. Because the rice fields are so vulnerable to floods, they are also hard for the owners to sell, and when they lose all their crops they are also unable to move, the respondent stated. In terms of learning, he said that through TRACKS, he has gotten scientific knowledge for the first time – and that he now can measure and predict the weather accurately. He called the project a milestone, and that is has opened his eyes. He said that before the flash flood in April he noticed that black clouds were covering the sky in a very little amount of time, and that this lead him to think that something might would happen. When it comes to sharing knowledge, the respondent explained that a lot of people comes to his store to get advice and medicine, and that he tells them about the weather. He said that he is also a member of religious associations, and an ambassador in the business community, and that he shares the knowledge he has gained in TRACKS in these organisations. He also said that he meets the other citizen scientists in Jamalganj once a week. The respondent also said that he had one demand: that because he has worked hard for TRACKS, he would like the people working in the project to help his son get a scholarship in Bergen. Finally, he said that he feels very lucky to be part of TRACKS and that he is very satisfied. He said that the project is a good opportunity to share and gain knowledge, and that it has helped him to know when and how to plant rice, and how to store his medicines.

The third follow-up conversation also took place in the market in Jamalganj the same day, this time in the poultry store where respondent 5 works. Like the others, respondent 5 also started with telling about the early flash flood. He said that in March it had rained like it does in rain season, and that the embankments and all the crops were damaged in the flood, and that it gave off a bad smell. He explained that diseases and health problems had increased as a consequence, and that a lot of fish died in the Haor. He told us that many people can only eat once a day now. In other years, the month of Falgun[9] has been totally dry, and rice can be cultivated in this period, the respondent explained. He said that before, they used to do rituals and pray for rain – but that they do not need to do that anymore. By the help of the devices he has gotten from TRACKS, he can now understand and predict the weather – but he cannot predict floods, because the water increases gradually, he explained. He that in order for people to survive, the forecasts must be more sophisticated. To be able to cope with extreme weather events in the future, they need better infrastructure, more equipment and more knowledge. Whole communities must be included, not only individuals, the respondent stated. In terms of sharing the knowledge he has gained about the weathers, he said that he shares with his colleagues and family.

The fourth follow-up conversation took place in the NGO guesthouse in Sunamganj Sadar, Sunday 14th of May, with respondent 12, the teacher from Sunamganj Sadar. This is the respondent who is fluent in English, and thus no translator was required for this conversation. The respondent was invited to tell about his experiences over the last half year, and he started with saying that being a citizen scientist in TRACKS has given him a sense of dignity and responsibility, and that he has learned a lot of new things. He said that after getting involved in the project, he has started noticing weather indicators such as mango buds, birds' movements and the clouds. With the little machine he was given, he also understands temperature and humidity, which makes him able to predict when it is going to rain. If the humidity is above 80%, he brings an umbrella or a raincoat when he goes somewhere. He said that that morning, he saw that the humidity was 81% and the temperature 31°C, and he told the headmaster of the school where he works that it would rain that day – and his forecast came true. He also measures wind direction and speed. He stated that because of TRACKS, he has now become aware of the climate. However, he said that he has experienced some

[9] The traditional seasons in Bangladesh are summer (April-June, consisting of the months Boishakh and Jyoishtho), Monsoon season (June-August, consisting of the months Asharh and Shrabon), autumn (August-October, consisting of the months Bhadro and Ashshin), dry season (October-December, consisting of the months Kartik and Ogrohayon), winter (December-February, consisting of the months Poush and Magh), and spring (February-April, consisting of the months Falgun and Choitro).

contradiction between some of the things he has learned through TRACKS, and reality: they have learned that the mango buds indicate heavy rainfall, but this year there were few mango buds and still so much rain that the crops were taken by the flash flood. He explained that there have been early floods in previous years too, but never as early as this year. He also mentioned that tons of fish died this year and that there are different theories about what killed them. Further, the respondent said that they have also learned that when birds fly around it is an indicator for storm – but this year there has been few birds, yet many storms. He suggested that maybe it is because of climate change or pollution that some of the indicators are inaccurate. In terms of sharing knowledge, the respondent said that he shares with his colleagues and students. There are 1500 students in the school where he works, so there is a great potential for spreading information, he noted. He said that he is already sharing information, observations and thoughts with his students. He also shares with other people. For example, he is active on Facebook, where he spreads his forecasts. When it comes to the other citizen scientists, the respondent said that between the organised bimonthly meetings, he meets other citizen scientists in the market place. He also said that some of the other citizen scientists are seeking to get benefits in return for doing citizen science. When the respondent was asked if the knowledge he has gained has made him better prepared for extreme weather events, he said no – and that we can do little against nature. However, he thinks that learning about weather indicators can make them responsible and aware. He stated that more interaction is needed, between conscious people, the government and the media. He also called for more action, and said that emissions must be limited – and suggested that planting trees can protect against flooding. As for the respondent's expectations of TRACKS, he said that the project has partly met them, but that he does not feel confident using the data from the weather station that has been installed at their school. He wants to learn to interpret the data so that he can use it. He stated that more experience and confidence is needed, in order for them to give forecasts.

The last follow-up conversation was with respondent 7, and was conducted during the break in the workshop in Sunamganj Sadar on Monday the 15th of May. Mrs. Salma Juthi translated. The respondent said that before she joined TRACKS she did not use to think about the weather, but that she can now understand it easily. She said that she has learned that the insects start making noises about 25 minutes before the rain starts, and that she warns her colleagues when the weather is going to get bad. She said that the knowledge she has gained has made her aware that any kind of weather can come – and provided an example of how this awareness has helped her in her life: recently, they experienced a Kalboishaki. There was no

rain or wind, but she noticed a roaring sound. She grabbed her daughter and went out of the house, and realised that the kitchen roof had blown off. Worried that the whole house would collapse, she stayed outside together with her mother and daughter. She said that now she aware her neighbours about dangerous weather, and tells them to prepare to take their children and evacuate to a safer place. She emphasised that being involved in TRACKS has been a very positive experience for her, and that she wants to continue being a citizen scientist. The expectations she had for the project has been fulfilled, as she has gained a lot of knowledge about many things after she got involved. Finally, she said that she wants the citizen science to be organised in a permanent way, and that if they can get support and access to new technology, the knowledge will evolve.

5.3 Analysis

The findings have revealed that TRACKS has led to a significant increase in human and social capital in the citizen scientist communities in Jamalganj and Sunamganj Sadar. Under the human capital, there has particularly been a strong impact on the learning indicator: all 15 respondents stated that they have learned a lot through participating in TRACKS, and each of them could provide examples of what they have learned and how they are using it. The impact was not as also significant under the indicator 'translating learning into practice in different vocations': ten of the respondents could give examples of how they actively use the knowledge they have gained in TRACKS in their occupational lives. For the indicator 'leadership and clear organisation' there has also been a clear impact – with seven respondents stating that the organisation has been important for creating a network, and five saying that it is because of the organising they can speak openly in the meetings. Two of the respondents also specifically complemented Mr. Saifullah Rony for his leadership. Seven respondents gave suggestions to other kinds of meetings that TRACKS could organise, indicating that there was a wish for more organised activities among about half of the respondents.

Under social capital, there has been a significant increase in all three indicators: a network has been created, as all of the respondents report that they are interacting with other citizen scientists on their own initiatives, between the organised meetings. Five of the respondents referred to the network that has been created as a family. In terms of participation and sharing experiences, all respondents said that they have learned a lot from sharing knowledge with each other, and all respondents provided examples of how, and with whom, they share the knowledge they have gained through TRACKS. As for the indicator 'trust and

openness', all respondents stated that they could speak freely in the meetings. However, during the interviews, two of the respondents accused other citizen scientists for wanting some benefit in return for being a citizen scientists, and one respondent claimed that the female citizen scientists were less eager and capable than the men. This indicates that there is some distrust present between some of the citizen scientists.

On the last three capitals, there have been moderate to weak increase. The resources and technology capital has had a moderate increase, mainly due to the second indicator, 'weather measuring technology'. 12 of the 15 respondents had no problem using their weather measuring technology, and many of them emphasise that the weather measuring equipment has given them a better understanding of the local weather. Regarding the scientific models, 13 out of 15 said that they trust the scientific information they have been presented. The last indicator, 'communication infrastructure for the extended peer-community', had low to no increase. While eight of the respondents use phone as one communication channel with the other citizen scientists, most of them meet in person and only two uses Facebook.

On the political capital, there has also been a low increase. Some respondents could provide examples of when they have shared weather information with politicians, however, none could give examples of any specific political decisions that TRACKS has clearly had an impact on. Thus, the influence on local policies and politics seems to be limited to creating awareness and spreading knowledge.

The increase in institutional capital has also been relatively low. Under the indicator 'cooperation across institutions' the interview question was, as mentioned, misunderstood. As such, some data is lacking about this indicator. However, although limited, there has been some impact on institutions in terms of schools, businesses and the media, where the citizen scientists in these institutions have actively implemented the knowledge they have gained in TRACKS. One central feedback from 11 out of the 15 respondents, is that the knowledge about the weather should be spread to more people.

As for the indicator 'remaining flexible to changing conditions' there has been a low impact, with some notable exceptions. Some of the respondents explained how they have used the knowledge to become more flexible, for example the sand businessman who moves his sand delivery up higher in order to save it from getting washed away and the lady who can now aware her neighbours when the storm is coming. However, as was revealed in the follow-up conversations, it is difficult to be flexible and adaptive when only short-term forecasts are available and there is not enough time to prepare. This will be discussed more in depth in the next chapter.

Chapter 6
Discussion and Conclusions

The aim of this thesis is to study what possible impacts the TRACKS project has had on climate adaptation in two communities in northeast Bangladesh, by implementing a novel framework for evaluation based on principles from adaptive governance and participatory evaluation. In this way, the thesis hopes to say something about both (i) TRACKS' impact on local adaptive governance capacity in the two Sunamganj communities, and (ii) a wider appraisal of the strengths and weaknesses of the evaluation framework itself, and how it might be used for evaluating adaptive governance in other contexts, and contribute to adaptive governance scholarship at large. Drawing on the analysis in Chapter 5, this chapter starts with an assessment of the impacts of TRACKS, what was achieved, and what was not achieved. It then turns to a discussion about the evaluation framework, its strengths and weaknesses, what lessons can be learned from it, and how they might contribute to the adaptive governance theory. Finally, the thesis ends with a summary of the discussion and conclusions, and raises some questions that might be relevant to address in future research.

6.1 What were the impacts of TRACKS?

As the analysis in Chapter 5 revealed, the TRACKS project has had a significant positive impact on the study areas in terms of human and social capital. In particular, the knowledge about weather issues, both theoretical and practical, has significantly increased among the citizen scientists. All respondents said that they have learned a lot about weather issues through TRACKS and could provide examples of how they have translated this knowledge into practice, in their daily lives, or their occupational lives.

However, not all of the climate indicators that were agreed upon in the workshops, proved reliable during the citizen science. For example, two of the respondents reported that one of the indicators they had learned about through TRACKS, the mango bud flowering, had not been accurate this year. Allegedly, heavy clusters of mango buds in spring is supposed to indicate heavy rainfall in summer, but while this was accurate in 2016, it was not in 2017. This year, there were few mango buds, but significant rain and flooding. It is of course too soon to discard the mango bud as an unreliable indicator after only two years of regular measurements, especially as only two respondents claimed that it was inaccurate, but their observations do open up some reflections. For instance, not all traditional or local knowledge

is necessarily true – some of it can be superstition. As such, there is a possibility that the mango buds have never had any connection with rainfall. Another possibility is that the is a relationship between mango buds and rainfall, but it is poorly understood as a mechanism. Perhaps the relationship between mango buds flowering and the weather is a complex one, that is not useful for predicting rainfall, but possibly something else. A third possible explanation is that this used to be a useful indicator for rainfall when the climate was more stable. Now that the climate is rapidly changing and becoming more unpredictable, it is possible that some of the indicators that used to be accurate, such as the mango buds flowering, have become less precise. Of course, the data from this study is not sufficient to support any of these theories – but it raises a central question that future research about local climate knowledge could start from.

The third indicator under human capital, 'leadership and clear organisation', can be understood in two ways: (i) the leadership provided by the TRACKS researchers and how the workshops and meetings have been organised, and (ii) the leadership and organisation provided by the citizen scientists themselves, both in the extended peer-community, and in their wider communities outside of TRACKS. Regarding the organising lead by TRACKS, the majority of the respondents seemed to be satisfied with the way the meetings and workshops have been organised has helped create a network and keep them united. Regarding leadership and organisation within the citizen scientist group, all the respondents said that they meet outside of the organised meetings, indicating self-organisation, as an important element in the adaptive governance theory. Three of the respondents also emphasised that they would like to contribute to the continuation of the citizen science. Looking wider, all of the respondents have been sharing knowledge with other people, from family members, friends and neighbours, to colleagues and customers. Several of the respondents said that people trust the information they provide because they have been involved in TRACKS. Some have also convinced other people to measure indicators. Thus, the citizen scientists seem to provide leadership by sharing knowledge in their communities, and by organising informal meetings among themselves. The role of power and influence is however an aspect that was less explored in our framework, which will be discussed more in the discussion about the framework and what lessons can be drawn from it.

Under social capital, the 'network and interaction' indicator particularly stands out, as all of the respondents reported that they interact with other citizen scientists regularly on their own initiative, and many of them noted that they now meet people they did not know before getting involved in TRACKS. Regarding the indicator of 'participation and sharing

experiences', all of the respondents also said that they have learned a lot from the knowledge sharing in the workshop and meetings, as noted in Chapter 5. As discussed in Chapter 2, social learning is a central part of adaptive governance, believed to result in improved knowledge which is trusted by the stakeholders involved (Dietz et al., 2003). As we have seen, this notion was confirmed in TRACKS, as all of the respondents have learned a lot through the collaborative processes of knowledge sharing. However, eleven of the fifteen respondents noted that the knowledge needs to be spread to more people, which might indicate that more people should have been involved in the project. Concerning the indicator 'trust and openness', the third indicator under the social capital, the analysis also revealed some degree of distrust among the citizen scientists – as several respondents accused some of the other citizen scientists of having a different motivation in terms of personal benefit for participating in the project. This goes to show, that even though all respondents stated that they felt that they could speak freely and openly in the meetings and workshops, trust among all of the citizen scientists was not completely achieved. A question to be addressed in this regard, is to what extent it is realistic to assume that everyone in such a diverse group have complete trust in each other? Is this a matter of trustworthiness, or different motives for participation? This is another aspect that was not explored in this thesis, and which will be addressed under the discussion about the framework.

As discussed in Chapter 5, the evaluation framework revealed a lower impact on resources and technology capital, institutional capital, and political capital. The evaluation did register a moderate impact on resources and technology capital. While 13 of the 15 respondents said that they trusted the 'scientific models' discussed in the workshops, during the follow-up conversations in May, several respondents called for better long-term forecasts, as they had been unable to predict the flash flooding in April 2017 early enough to take preventive action. Otherwise, most respondents (12 of 15) did appear comfortable using 'weather measuring technology', though much less used the 'communication infrastructure', with only two of the respondents using Facebook for instance. The impact on political capital was lower, as none of the respondents could show examples of political impact. Nevertheless, those of the respondents who were involved in local politics, said that they shared information about TRACKS and what they have learned from the project in political discussions. As such, it might have contributed to increase awareness among the local politicians.

Regarding institutional capital, respondents discussed some degree of cooperation across institutions, or perhaps *impact* on other institutions is more accurate. For example, as discussed in Chapter 5, the citizen scientists who work as journalist, explained how they

actively use the knowledge they have gained through TRACKS in the media, both by writing about it themselves, and by sharing with their colleagues. Similarly, in schools, the two citizen scientists who are teachers actively integrate what they have learned in TRACKS in their teaching. In terms of the other indicator under this capital, 'remaining flexible to changing conditions', there was some degree of impact. The interviews revealed several examples of how the improved understanding of the weather has made the citizen scientists more adaptive. For example, the poultry farm worker can now measure, understand and predict temperature, and uses this knowledge to keep his chickens from dehydrating on hot days. Several respondents also gave examples of smaller adaptations, such as knowing how to dress their children and sick family members according to the weather, when to bring an umbrella, and many also decided their movements based on their own weather forecasts. How then, does these results relate to the research question of this thesis? How has TRACKS' impacted the communities' capacity to adapt to climate change?

Mobilising high-quality knowledge through bringing together an extended peer-community of diverse local people was the main goal of TRACKS, and as the evaluation shows, this goal has largely been achieved. A self-organising network has been created, citizen science is being carried out in different parts of Sunamganj Sadar and Jamalganj, and the knowledge is being shared with many people outside of TRACKS. The project has contributed to create awareness about climate change, and has improved many peoples' scientific literacy. Citizen scientists have learned to use their knowledge in their daily lives to make small adaptations to the changing climate. Indeed, as became evident in the follow-up conversations undertaken in May, some citizen scientists have learned to predict the weather and can foresee when extreme weather events, like the flooding in April 2017, may occur. However, the evaluation has shown that TRACKS goals were not necessarily always the same as the communities' goals.

The evaluation revealed a number of ways in which the TRACKS project didn't go far enough to support local adaptation. Many citizen scientists argued that the early flash flood event of April showed the knowledge produced through the project to be insufficient for building the adaptive capacity necessary to cope with the more severe consequences of climate change in their communities. Four of the five respondents emphasised that they were not able to predict the flash flood early enough to take preventive action, and called for better long-term weather forecasts. The fifth respondent explained how the knowledge she has gained enabled her to predict storms early enough to evacuate and warn her neighbours, but like the other respondents, she also stated that new technology would make their knowledge

evolve. In addition, they had additional hopes and requirements for the project, such as political action and spreading of knowledge to more people. Combined, the Upazilas of Sunamganj Sadar and Jamalganj count more than 358 000 inhabitants, and only 21 people were involved in TRACKS as citizen scientists. Although the citizen scientists actively share their knowledge with others, whole communities have not been involved in the learning process as such, and the extent of the adaptive capacity building on a larger community scale is therefore likely to be limited. There are of course limits to what can be done over the course of a three-year research project, but because the goal of TRACKS was to mobilise knowledge for climate change adaptation, then perhaps the local people in the study areas should have been involved already in the planning stage of the project. This is of course difficult in funded research – involving local people in the planning of a project that one had no guarantee would get funding, would be a big risk to take.

In terms of adaptive governance, TRACKS has met the important requirements of social learning, bringing together different types of knowledge, and creating networks between diverse stakeholders. This corresponds with the steps of building resilience and adaptive capacity as discussed in Chapter 2, where learning to deal with uncertainty and change through interaction between multiple stakeholders is identified as a key premise (Folke et al. 2005; Olsson et al. 2006). The project has succeeded in mobilising knowledge about what kind of weather related issues are most important to the local people in the study areas. As will discussed more below, other requirements, such as nested institutions and flexibility, the project was not able to achieve within its timeframe. As such, TRACKS can be seen as an important first stage of adaptive governance in the study areas, as it has led to a strong increase in social and human capital, and as it has created awareness and knowledge about a pressing issue that many of the respondents had little knowledge of before the project started. However, as discussed above, the knowledge gained through TRACKS has enabled the citizen scientists to predict the weather, but not to prepare for extreme weather events. Consequently, more research is needed on practical adaptation strategies.

6.2 The framework – lessons learned

The capital based framework we developed and implemented in TRACKS, has proved a useful tool for the evaluation of adaptive governance. By combining the principles of adaptive governance with indicators derived through participatory evaluation, the framework allows for tailoring to context, which is crucial for adaptive governance initiatives. The five capitals function as an organising concept, which are broad enough to be applied to different settings,

and perhaps some of the indicators are as well. The strength of the framework and participatory approach is precisely that the indicators can be tailored to each context, based on the feedback from stakeholders. In this way, the indicators will clarify which capitals are more important and achievable in each setting. In TRACKS, most emphasis was placed on human capital, social capital and resources and technology capital, which reflected the feedback from the first interviews with the citizen scientists. In other contexts, other capitals might be deemed more important.

The framework also confirms that adaptive governance must itself be adaptive – and that all of its principles might not be easily achievable across all settings. As mentioned in Chapter 2, principles of adaptive governance have been developed through studies of cases where social-ecological systems have been governed sustainably. However, most of the cases that have been used for the development of adaptive governance have taken place in developed countries (Karpouzoglou et al., 2016). Do the same principles apply in a climate change adaptation setting in a developing country? How can for example nested, flexible institutions be achieved in a country with weak institutions? How does corruption and poverty influence an adaptive governance process? The evaluation framework might give a more realistic picture of what actually works in different settings, and which principles are harder to achieve.

Another strength of the framework is the inclusion of political capital. The role of politics in the emergence of adaptive governance has received little attention in the literature. In their literature review, Chaffin et al. (2014) recognised this aspect as one of the main topics for future adaptive governance research. Political action was also identified as an evaluation indicator by the citizen scientists in TRACKS. Although political capital was not adequately explored in our framework, it is an important start of addressing the aspect of politics in adaptive governance. This brings us over to the weaknesses of the framework.

Firstly, as mentioned above, there were some aspects that were not addressed in the evaluation framework. These include power and influence, which could go under the political capital. How individuals exercise power over others and how they may influence people inside and outside of TRACKS has not been explored, and this constitutes a hole in our framework. In any further development of the framework, this aspect should be addressed. Another aspect that was left out, is stakeholder's motivation to participate. As the analysis in Chapter 5 revealed, some of the respondents said that one of their motivations to be part of TRACKS was reputation and respect in their communities. As already discussed, some respondents accused other citizen scientists to want some kind of benefit in return for

participating in the project. Most of the respondents seemed to be part of TRACKS for altruistic reasons, but it could be interesting to go deeper into this aspect. Different motivations seemed to have led to some degree of distrust among some citizen scientists, and although this did not come across as a major obstacle in TRACKS, this might be different in other cases. Therefore, this might be an aspect worth addressing in future research.

Another shortcoming of the framework is that it only entails one order of outcomes. That is, it does not take into account that it might take longer to achieve some indicators than others. As with TRACKS, human and social capital had already seen a strong impact, while the others had a weaker impact. This could be because it takes longer to impact the political and institutional capital, for example. Perhaps the framework could be organised into an order that reflects the stages of an adaptive governance project. This would be something to take into account in further development of the framework.

6.3 Summary and closing remarks

This thesis put forward a framework for evaluating adaptive governance, and tested it with the TRACKS project. The framework was found to be a useful tool for highlighting TRACKS' impact on adaptation in northeast Bangladesh communities. As we have seen, the project has had a significant impact on human and social capital in the study areas, as all of the respondents said that they have learned a lot about weather issues through participating in the project, which has – to some extent – increased their adaptive capacity to cope with climate change. However, the majority of respondents called for the knowledge mobilised in TRACKS to be spread to more people, and for more knowledge on long-term prediction of the weather, that can enable them to prepare for the more extreme weather events, such as flash floods. Despite these shortcomings, TRACKS can be seen as an important first step to increase the adaptive capacity and resilience of the communities involved, as it has contributed to increase knowledge and awareness about climate change and its impacts. As such, TRACKS addressed two important issues identified by the IPCC as limitations to adaptation in Bangladesh, as discussed in Chapter 1.

Adopting a capital based framework for evaluation has made the achievements and shortcomings of the case in this thesis, easily identifiable. Importantly, it allows for adaptation to different contexts, which can contribute to highlighting how adaptive governance might function differently in developing and developed countries. In turn, this can help identify research agendas for future research within adaptive governance, such as how developing countries can become robust to a changing state of their social-ecological systems. As such,

although there is room for improvement on the framework, it might have potential in other contexts as well.

Applying a participatory evaluation approach was essential in order to begin to identify what the communities in TRACKS need in order to cope with climate change. This was clearly demonstrated as the project goals of TRACKS were largely achieved, while the citizen scientists clarified that more knowledge was needed in order to cope with the more extreme weather events. This suggests that participatory approaches can be an important contribution to evaluating adaptive governance.

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