THE ANTICIPATORY GOVERNANCE OF SUSTAINABLE FUTURES

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CHAPTER 1

Introduction

1.1. Anticipating change

In road cycling, during a *demarrage,* a cyclist takes a leap forward. This escape from the peloton marks a radical turn mentally from keeping speed, heart and cadence rates steady (aligning past-present-future states) to proactively transforming this state into a more desired future (victory). Multiple interdependent factors challenge prediction and plannability, such as the cyclist's physical condition, the stamina of fellow cyclists to respond to the attack, road surface and weather conditions, and other unknowns such as accidents along the way. The *demarrage*s in this thesis are anticipatory practices in science and policy to govern the future. Anticipation has become a growing focus in response to the often more reactive and incremental tendencies of governance interventions (Nuttall, 2010). Environmental governance scholarship has advanced thinking on steering the environmental and societal impacts of climate change, by shifting a focus on the nation-state to the global (Biermann, 2007) and urban levels (Bulkeley & Betsill, 2013) and from centralized, top-down governance to modes of governance that involve stakeholders in decision-making (Driessen et al., 2012). Others have focused on steering in transnational (Andonova et al., 2009) or polycentric arrangements (Morrison et al., 2017; Ostrom, 2010). In these literatures, there is a growing awareness of the need to imagine and anticipate climate change (Boyd et al., 2015), and the need to understand the steering effects of anticipation processes proliferating in diverse contexts across the globe at all scales of governance (Vervoort & Gupta, 2018).

Many anticipation processes in the context of climate change are developed to guide decision-making towards meeting the goals set in treaties such as the Paris Agreement and mechanisms such as the Intended Nationally Determined Contributions (INDC) to reduce emissions (Jordan et al., 2018) in sectors including agriculture (FAO, 2017; Mason-D'Croz et al., 2016), water management (Quay, 2015) and urban development (von Wirth et al., 2019). The International Panel on Climate Change (IPCC) scenarios are arguably the most influential form of anticipation (IPCC, 2019), followed by global environmental assessments that help governments prepare for future environmental, social, and economic developments (Pereira et al., 2019; van Vuuren et al., 2012). Other forms of anticipation, such as more innovative and experiential methods, e.g. sustainability games, are used to experience, embody, and experiment with diverse climate futures (van Beek et al., 2022; Vervoort et al., 2022). Or they can be more traditional planning methods like cost-benefit analyses, used to calculate future benefits and prioritize present-day investments (Atkinson, 2015). Thus, anticipation processes include a wide range of methods and tools, but share a common intentionality - they guide actions in the present based on a vision of the future, with the aim to steer the future in the present (Vervoort & Gupta, 2018). With the growing role of anticipation in various domains, futures studies has become a multidisciplinary field (Andersson, 2018). Or, in the words

of Urry, 'futures are now everywhere' (2016, p. 1). With the expansion of anticipation processes, an explicit future-orientation in governance scholarship to examine the growing use of anticipation for climate action (Granjou et al., 2017; Pulver & VanDeveer, 2009; Vervoort & Gupta, 2018) is needed.

1.2. Problem statement: the future as an object of governance

If futures are everywhere, it is increasingly important to analyze *what* futures are imagined and *how* these images steer actions in the present. Images of the future can call attention to future dangers and crises (Paprocki, 2019). Examples include 'A Brave New World' which warned of the impacts of technological progress on society (Huxley, 1932). Or Toffler's 1970 book 'Future Shock' which argued that the accelerated rate of our changing society results in a crisis of adaptation (Toffler, 1970). 'Limits to Growth' (Meadows et al., 1972) drew attention to the limits of our planetary system. Contrarily, images of the future can also call attention to alternative (and more desired) futures, such as Thomas More's Utopian society (1516), or modern Utopias believing in the salvation of science and technologies (Goode & Godhe, 2017). Grand narratives such as these affect how we think and act in the present (Groves, 2017). For example, Hartman (2014) noted that Malthusian theory shaped discourses on the impact of African population growth on environmental degradation and, consequently, paved the way for strategies to reduce fertility rates since the late 1960s. Therefore, scholars argue for understanding imagination as a social practice, by examining how future images shape social meaning (in the present) and create powerful imaginaries that are collectively held, institutionally stabilized, and publicly performed (Jasanoff & Kim, 2015). Recognizing this performativity requires scrutinizing anticipation processes, i.e., the methods and tools used to imagine and govern the future, as sites of politics where future threats and promises are being made sense of and negotiated in the present (Jansen & Gupta, 2009). Futures are thus an object of governance, i.e., steering collective action – images of the future steer governance choices in the present (Polak et al., 1973). Images of the future encompass the extent to which the future can be known and managed (Vervoort & Gupta, 2018). For example, the very act of developing scenarios such as the IPCC scenarios implies that exploring diverse future outcomes makes sense and allows for some form of management of the future in the present. In contrast, experiential futurists approach the future as something that can be experienced in the present for the opening up and creation of alternative futures (Candy & Potter, 2019).

What do these insights mean for the way in which anticipatory governance processes are used to realize more sustainable futures in diverse contexts across the globe? There has been little science research of the many global, regional, and national anticipation processes that are used in sustainability governance scholarship (Burch et al., 2019). A

knowledge gap exists regarding how different conceptions of the future, as embedded in processes of anticipation, steer actions in the present to realize sustainability transformations (Vervoort & Gupta, 2018). Therefore, this thesis aims to examine how conceptions of the future steer governance actions to be taken in the present, and their implications for realizing sustainability transformations. This is done by examining anticipation processes in various sustainability domains and in diverse global contexts through the lens of anticipatory governance. I comprehensively analyze approaches to anticipatory governance in the literature and in practice and critically examine their implications for steering sustainability transformations in diverse contexts across the globe. Empirically, this thesis focuses on four regions in the Global South, since most research on anticipatory governance has focused on the Global North (Biermann & Möller, 2019; Vervoort & Gupta, 2018), although many parts of the Global South are highly vulnerable to challenges such as climate change (Adger & Vincent, 2005; Okereke, 2018). Therefore, researchers have called for a better representation of the diverse ways in which futures and pasts are imagined in the many socially, culturally, and politically diverse contexts of the world (Appadurai, 2013; Escobar, 2020). Such critique of Global Northern-focused future images complements calls for more equity and justice in global environmental governance (Kashwan et al., 2020; Okereke, 2006) and better representation in norm-setting institutions such as the SDGs (Sénit & Biermann, 2021), which are also crucial elements in light of the need for more inclusive and democratic anticipatory governance.

1.3. Research questions and structure

The central question in this thesis is '*How do conceptions of the future steer anticipatory governance actions in the present, and with what implications for realizing sustainability transformations?*'

I break this main question up into four research sub-questions.

The first question I ask is: '*How do different approaches to anticipatory governance in the literature relate to practice?*' In answering this question, I address a theoretical knowledge gap by giving insight into how different theoretical strands conceive the future in processes of anticipation and their implications for steering actions in the present, as well as an empirical knowledge gap by examining how these understandings relate to anticipatory governance in practice in diverse sustainability contexts across the globe, beyond the Global North.

The second question is: '*Which approaches to anticipatory governance dominate and why?*' This question is important to understand underlying factors that explain why certain

approaches to anticipatory governance become dominant. The analysis sheds light on what is being prioritized and marginalized.

The third question is: '*What are the implications of the prevalence of different approaches to anticipatory governance for realizing sustainability transformations?*' In answering this question, I shed light on the political implications of dominant dynamics in anticipatory governance and what they mean for global efforts toward sustainability transformations.

The fourth question is: '*How do different approaches to anticipatory governance open up or close down future possibilities?*' Building on the previous, more general question, this final question is motivated by the need to better understand specifically what the dominant approaches mean for frames of the space of future possibilities and possible forms of actions in the present to realize those futures.

Through this research, I scrutinize the first-order governance question concerning the 'what, how and why' of anticipatory governance. More specifically, **chapter 2** unpacks the notion of anticipatory governance within a wide range of dispersed literatures across the social sciences and interdisciplinary sustainability sciences on three elements: a) the conceptions of the future embedded in anticipation processes, b) their implications for actions in the present, and c) the ultimate aims intended to be realized with anticipatory governance. The literature review creates a typology of diverse approaches to anticipatory governance which are applied in theory-based case studies to examine anticipatory governance in practice in sustainability contexts across the globe.

A range of perspectives on futures, anticipation and anticipatory governance are included from various research fields and practices, most prominently futures studies and environmental governance, but also research on transformations, transitions, social-ecological systems, science and technology studies, policy and planning, and responsible research and innovation.

The resulting framework is used to examine anticipation processes in many culturally, socially, and politically diverse contexts of the world to generate context-specific and comparative insights. In several theory-based case studies, the insights from the literature are used to examine and explain the dynamics of anticipatory governance processes. **Chapter 3** picks up on questions 1 and 2 to examine approaches through which futures conceptions steer climate decision-making in West Africa. **Chapter 4** answers questions 1, 2 and 3 in its examination of dominant approaches to anticipatory governance in a global community on food systems foresight and scrutinizes what this means for realizing sustainability transformations. **Chapter 5** picks up on questions 1,

2 and 4 in its analysis of dominant approaches to anticipatory governance in various sustainability contexts across the globe and interrogates how dominant approaches open up or close down what are seen as possible futures and viable governance commitments. These empirical studies provide important insights into anticipatory governance processes in various sustainability contexts, with a focus on climate change and its impacts on food systems, but the implications of the research findings go beyond these domains (section 6.4). The empirical insights are also used to refine the analytical framework and further conceptualize anticipatory governance.

1.4. Theoretical contributions to main bodies of literature

The conceptual and empirical insights from this thesis primarily contribute to the further conceptualization of anticipatory governance (section 1.3.1). However, the connection between future studies and anticipation and environmental governance in this research also means that there is an able opportunity for both disciplines to learn from the theoretical and empirical insights generated (sections 1.3.2 and 1.3.3). Finally, the research provides important empirical insights into the dominant dynamics of anticipatory governance for scholarship on the politics of anticipation (section 1.3.4). The envisioned theoretical contributions to each of these bodies are explained below.

1.4.1. Unpacking diverse understandings of anticipatory governance

This thesis foremost contributes to the further conceptualization of anticipatory governance, an emerging concept that has spread across a dispersed set of social science and interdisciplinary sustainability science literatures. Most broadly, anticipatory governance can be understood as "the evolution of steering mechanisms in the present to adapt to and/or shape uncertain climate futures" (Vervoort & Gupta, 2018, p. 104). However, the concept is differently understood across those literatures with different ontological and epistemological underpinnings (chapter 2). The term anticipatory governance is most closely linked to responsible research and innovation to understand how diverse societal actors ex-ante steer technological progress (Barben et al., 2008; Guston, 2014). Another domain where anticipatory governance scholarship is growing is that of sociotechnical change, to analyze the use of biotechnology (Gupta, 2013), nanotechnology (Anderson, 2007; Barben et al., 2008) and emerging calls for geoengineering (Flegal & Gupta, 2018; Talberg et al., 2018). Furthermore, public planning scholars have developed the anticipatory governance of national security risks (Fuerth, 2009). Environmental governance scholars advanced thinking on the anticipatory governance of socioecological systems to increase the resilience of coupled ecosystems and livelihoods under a changing climate (Boyd et al., 2015). This body of work connects to work on resilience (Folke et al., 2005) and complex systems (Rosen, 1985; Young, 2017). Anticipatory governance for climate mitigation and adaptation is

concerned with anticipating climate change to advance adaptation (Hurlbert & Gupta, 2016; Quay, 2010) while others posit anticipatory governance as going beyond adaptation in a more proactive form of governance that pushes governance actors to overcome reactive, and antagonistic, tendencies (Nuttall, 2010; Vervoort & Gupta, 2018). In a similar vein, anticipatory governance is considered to be an intrinsic but more limited part of reflexive governance (Pickering, 2019), while others have built on the analytical framework in this thesis to further thinking on how to make reflexivity an intrinsic part of more futures-literate anticipatory governance processes (Mangnus et al., 2021). In answering the first research question, I comprehensively typologize those diverse understandings of anticipatory governance. First, I unpack the conception of the future embedded in notions of anticipatory governance, the implications for actions in the present, and the ultimate aims intended to be realized. Furthermore, the framework that results from this extensive review helps to examine anticipatory governance processes in diverse sustainability context across the globe and this empirical work helps to further conceptualize anticipatory governance.

1.4.2. Futures studies and anticipation

Much anticipatory governance scholarship argues for employing methods and tools that have been brought forward by futures studies scholarship and practice (Bradfield et al., 2005; Inayatullah, 2013; Van Der Heijden, 2005). However, anticipation has not been analyzed through the lens of anticipatory governance to examine the steering effects of processes of anticipation. Therefore, I see my research primarily as an inquiry into the governance of anticipation. Thinking about and planning for the future is as old as humanity (Andersson, 2018), but most foresight – as a more strategic and systematic practice - originates in military planning strategies in World War II from where it spread into various domains and disciplines, most importantly to the civil domain and the corporate world through the research and development (RAND) corporation (Van Der Heijden, 2005), and Cybernetics in the 1950s (Pickering, 2010). RAND developed key foresight tools that are still used today, such as the Delphi technique which elicits and synthesizes expert opinion about future decisions in a collective and structured way, systems analysis for simulation models, and its successor scenario technique (Bradfield et al., 2005). Kahn, a systems analyst at RAND coined the term scenarios inspired by the film industry. The language that Kahn developed still inspires much scenarios work today, describing scenarios as multiple, equally plausible futures that serve as test-bed for policies and plans (Van Der Heijden, 2005; see for a few interesting examples of plausibilistic scenario-guided policy advice Lord et al., 2016; Mason-D'Croz et al., 2016). The book 'The Year 2000' (Kahn & Wiener, 1967) put scenarios on the map as the most strategic tool to think about the future for policy planning in the corporate world. The first scenarios followed a traditional "predict-and-control" approach to planning but

replaced the single line forecast by a probabilistic assessment of alternative futures to determine a "most likely" projection (Van Der Heijden, 2005). Soon, this probabilistic assessment was considered less advantageous and accurate over forecasting approaches and a more intuitive plausibility approach was developed relying on causality (Van Der Heijden, 2005) but this still incorporated a belief that planning must be based on at least some predictability, otherwise it would be a waste of time (Andersson, 2018). Pierre Wack, a planner at Shell, brought scenarios to the company (Bradfield et al., 2005; Van Der Heijden, 2005; Wack, 1985). These developments (most prominently but not exclusively) laid the foundation for futures studies, with scenarios, Delphi panels, and other foresight methods as tools for market making and management of the future in the present (Bradfield et al., 2005).

Futures work stepped into the domain of environmental governance when a diverse group of academics and decision-makers came together in Rome in the late 1960s to discuss global future challenges and formed the Club of Rome. Their 1972 publication 'Limits to Growth' was an important milestone for thinking about environmental futures. It argued that pollution, population growth, industrialization, food production and resource depletion will reach the limits to growth on the planet (Meadows et al., 1972) and thus called for global action. The first United Nations Conference on the Human Environment was held the same year and also advocated global action to protect the environment and advocated global environmental assessments and management (United Nations, 1972); this constituted another major signpost of growing calls for more sustainable futures. The United Nation's Intergovernmental Panel on Climate Change was created in 1988 to synthesize existing climate change science in its five/six yearly synthesis reports and special reports as important tools for the UN's climate negations (IPCC, n.d.). Scenarios that have been created under the auspices of the IPCC (but not part of its publication cycles) include the Representative Concentration Pathways (van Vuuren et al., 2011) and the more recent Shared Socio-economic Pathways (Riahi et al., 2017). These scenarios explore how developments such as technological innovation and climate policy affect emission levels by combining narratives, climate models and integrated assessment models (IAMs) (Alcamo, 2008; Moss et al., 2010). Other major environmental assessments include UNEP's Global Environmental Outlook and the Millennium Ecosystems Assessment (van Vuuren et al., 2012).

Futures work and environmental science have increasingly cross-fertilized over the last decade to explore environmental futures in norm-setting global institutes and informed global and national decision-making. They can thus be considered to serve as spaces of connectivity through which ideas about pasts, presents and futures flow and materialize (Urry, 2016), but little research has been done into the ways in

which anticipation processes shape our understanding of the future and implications for actions in the present (Pulver & VanDeveer, 2009; Vervoort & Gupta, 2018). This research makes an important contribution to understanding how the growing number of anticipation processes in different sustainability contexts embed diverse approaches to steering (research questions 1 and 2) and their implications for realizing sustainability transformations (research question 3) and for the opening up or closing down of future possibilities (research question 4).

1.4.3. Governing sustainability transformations

Anticipatory governance in the environmental domain is primarily concerned with realizing sustainability transformations (Burch et al., 2019) and connects to a wide array of environmental governance scholarship. Governance research analyzes the ways in which society is or can be steered through people and institutions in new directions to solve societal challenges (Kooiman, 2003; Pierre & Peters, 2000), with environmental governance particularly focusing on environmental problems that require new forms of governing through collective action (Evans, 2012). Environmental governance is thus inherently future-oriented and transformative, in the sense that it focuses on deliberate interventions that help realize a more sustainable future (Driessen et al., 2012). However, anticipatory governance makes the future-orientation in environmental governance scholarship explicit by analyzing the growing role of anticipation in steering environmental futures (Vervoort & Gupta, 2018; Granjou et al., 2017). As such, it is closely linked to literatures on governance for transformations and governance of transformation (Burch et al., 2019; Patterson et al., 2017) and this thesis explains how different ideas of anticipation and transformation connect (chapter 4).

Adding a governance lens to anticipation opens up questions about what it means to stretch the time horizons of key governance interventions: the incentives, knowledge, institutions, decision-making and behavior underlying them (Lemos & Agrawal, 2006). Some scholars see anticipation as a strategic tool for decision-making about long-term future uncertainties by developing flexible mechanisms for changing conditions (Quay, 2010, 2015); others point to questions of power in informing decisions about the future (Sova et al., 2015). These debates connect anticipatory governance with environmental politics, particularly issues of the power in visions of the future that challenge the assumption of the neutrality of visions, e.g., future equity (Flegal & Gupta, 2018) and intergenerational justice (Okereke, 2018). Research has also pointed to the role of knowledge and language in constructing the object of governance (Hajer & Versteeg, 2005), such as authoritative assessments that de facto govern environmental futures (Gupta & Möller, 2018). However, the ways in which anticipation steers efforts to realize sustainability transformations have not been comprehensively analyzed. Through the

connection of futures studies and environmental governance, this thesis provides novel and holistic insights into how approaches to anticipatory governance intend to realize sustainably transformations in diverse contexts across the globe (and research question 3 is dedicated to this inquiry). In general, the thesis is meant as foundational work for future research agendas that connect to the aforementioned important concerns. The empirical and conceptual insights could be useful to research on the role of transparency in guiding effective and legitimate anticipatory governance (Gupta et al., 2020). Or it can help examine who has agency to frame future problems and make authoritative decisions about the future (Stripple & Pattberg, 2014; van der Heijden et al., 2019), or what a long-term future-orientation would mean for rethinking institutional structures (Beunen & Patterson, 2019; Hoffman et al., 2021).

1.4.4. The politics of anticipation

The focus on dominant approaches (research question 2) and their implication for action (research questions 3 and 4) means that the role of power is central to this thesis, and as such the research builds strongly on insights brought forward by Science and Technology Studies (often referred to as STS) and anthropology. Their constructivist perspectives on futures work have been pivotal to examine and explain dominant dynamics in anticipatory governance. Scholars have provided key insights into the construction of knowledge and its usage in decision-making about the future. Jasanoff (2004, p. 35) noted that "science is a form of organized work, a site of politics, a marketplace of ideas, an exercise in meaning-making, and an instrument of power." In this line of thinking, it no longer suffices to believe that anticipation presents neutral, or value-free responses and outcomes. Visions of the future shape discourses and practices of governance and thereby structure the life worlds of societies (Jasanoff & Kim, 2015). The work on imagined communities (Anderson, 2006), social imaginaries (Taylor, 2004), sociotechnical imaginaries (Jasanoff & Kim, 2015) and fictional expectations (Beckert, 2016) help us think about the importance of the ways in which ideas about the future materialize and become collectively shared and how these frames, in turn, shape our understanding of what needs to happen. STS scholarship connects and informs environmental politics in studies on the contested role of science in understanding and shaping uncertain future socioecological and socioecological progress, in biotechnology (Gupta, 2013; Jansen & Gupta, 2009), nanotechnology (Anderson, 2007; Macnaghten, 2009) and climate engineering (Bellamy et al., 2012; Gupta & Möller, 2018; Low, 2021). It also informs debates on the de facto governance effects of vanguard visions that have not yet been institutionally stabilized (Flegal & Gupta, 2018). These studies point to the ways in which grand narratives of technological progress define the public good or delimit and control risk in projects aimed to develop technologies. Foresight processes are thus sites where science and policy are co-produced, and this thinking informed analytical

approaches that position futures as performance, such as techniques of futuring as a lens through which to analyze anticipation in, amongst others, discourse analysis and dramaturgy (Hajer & Pelzer, 2018). Another example is multicriteria mapping which opens up a dialogue about frames of the future, competing visions and social concerns (Bellamy et al., 2013).

Another set of scholarly works on dominant visions, mainly in anthropology and history, pointed to how futures are occupied by present-day interests projected into the future (Anderson, 2006; Escobar, 2020; Sardar, 1993). Their work has been important to understanding what dominates in a pluriform world and what pushes other worldviews out. Andersson (2018) noted that Kahn's scenarios intended to engage with the plurality of world developments but were regardless a continuation of the status quo, i.e., the American capitalist hegemony in a modernization logic and rationalist tradition. Clashes between this hegemony and rivaling conceptions of world futures emerged during and after the Cold War, which raised attention for the plurality and uncertainty of human life, politics, and imagination (Andersson, 2018; see also for an analysis of Soviet futures Rindzevičiūtė, 2016). Escobar (2020) argues that much futures work embeds 'one-world thinking', i.e., the ontological assumption of the existence of one real and a possible world which is according to him a form of modernist and masculinist political thinking. In his essays on futures of Afro- and Latin-American women, he demonstrates how this worldview disempowers minority groups in having decisive power to change things globally. Instead, there is a plurality of imaginations, many ways in which humanity aspires to, anticipates and imagines pasts and futures (Appadurai, 2013) and gives meaning to and constructs worlds (Goodman, 1987). These insights increasingly merge with novel forms of anticipation. Thinking on pluralism informs methods that use scenarios as tools for worldmaking (Vervoort et al., 2015) and ethnographic experiential futures that help make futures more visible and tangible (Candy & Kornet, 2019). This thesis is informed by and contributes to this research in two ways. First, the extent to which these more critical and plural forms of anticipation inform the anticipatory governance of sustainability transformations has not been empirically and comparatively researched in diverse contexts across the globe. Second, the insights give shape to a focus on dominant dynamics in anticipatory governance and their implications.

1.5. Research design and methodology

This thesis draws on relativist thinking and embeds a constructivist epistemology. I see the nature of reality as being dependent on the observer, and knowledge about reality as a construct of ideas, concepts, and theories about reality. This also implies that my findings are influenced by my (Western and secular) ideas and I consider this important

to emphasize. In line with this, the methodology is qualitative and interpretative (see appendix 1.1 for an overview of all units of analysis, methods and data collected). The literature review in chapter 2 is a narrative-style interpretative review to understand and explain different approaches to anticipatory governance in a representative sample of literatures within the social sciences and interdisciplinary sustainability sciences. Such a qualitative and interpretative approach was chosen to synthesize implicit and explicit understandings of anticipatory governance and to develop an analytical framework – and such an approach is considered more suitable for this aim than a systematic literature review which is often paper-centric or author-centric (Rowe, 2014). Three analytical elements (conceptions of the future, implications for the present, and ultimate aims) guided the review of the literature and pointed to four diverse approaches regarding these three elements. The four approaches were presented as four narratives on these three elements; these narratives served as heuristic tools to identify how the approaches identified in the literature relate to practice across diverse sites (Bartlett & Vavrus, 2017).

The 'four approaches' framework was then applied to various case study contexts across the globe to deductively examine anticipatory governance in practice and inductively refine the framework. Each case study was thus theory-driven (Toshkov, 2016). Chapter 3 applies the 'four approaches' analytical framework to understand what approaches dominate, chapter 4 connects the framework to the framework on transformations (Feola, 2015) to understand how the (dominant) approaches connect to different conceptions of transformations and chapter 5 connects the framework to the notion of opening up/closing down (Stirling, 2008) to understand how anticipatory governance opens up or closes down future possibilities.

Case study research has several qualities that made it most suitable for this research. Most case studies have a deductive and inductive process, which helps the further conceptualization of anticipatory governance. The inquiry often starts with developing theoretical propositions to guide data collection and analysis (Yin, 2003); in this case, the literature review guided the theoretical propositions. In addition, case studies are particularly suitable to study phenomena in their natural context in research contexts that have no clear boundary between the subject and context (Yin, 2003): in this case, the object (anticipatory governance processes) and their contexts (e.g., the diverse social, political and cultural contexts where these processes were studied) also have no clear boundary. By contrast, controlled experiments need clear boundaries (Hopkin, 2010). Case studies are pivotal to obtaining a holistic and in-depth view of the research object (Verschuren & Doorewaard, 2010) with sensitivity to empirical complexities (Flyvbjerg, 2006). In relation to this, the proximity of the research to reality is considered to create a

deeper understanding and avoids bias as the research object can 'talk back' (Flyvbjerg, 2006; Ragin, 1992). As part of case study research, data is gathered and triangulated in an open way (Yin, 2003), in a more flexible design compared to surveys and experiments to adjust to changing situations (Verschuren & Doorewaard, 2010). In this case, data and methods were triangulated, and in chapter 5 multiple researchers were involved in the interpretation of findings. The inquiry relies on multiple sources that are examined synchronously to iteratively explore and refine research findings (Kleining & Witt, 2000). Methods included in this study are literature and document reviews, snowballing, interviewing and focus groups. This means that findings are confirmed, rejected, and adapted based on new discoveries. Such replication logic is considered to create a more in-depth understanding with robust findings and advance the generalizability and validity of data (Baxter & Jack, 2008).

The empirical chapters (3-5) together present a most different case study design context to analyze anticipatory governance in contexts independently of each other (Verschuren & Doorewaard, 2010). The carefully selected case study contexts provide context-dependent knowledge to generalize insight into anticipatory governance for four regions of the Global South as well as insights at the global level: insights into a global community of practice in chapter 3, comparative cross-regional insights in chapter 5 and Global North – Global South relations throughout the thesis. The breadth of anticipation processes is comparatively analysed. This is the most obvious method in the social sciences to test theoretical propositions and analyze phenomena (here anticipatory governance) as a broader trend (Hopkin, 2010). Comparison across cases allows for the interpretation of trends and explains what can be attributed to the subject or to the context. I followed a hierarchic approach to case study analysis to find explanations for similarities and differences between the cases (Verschuren & Doorewaard, 2010). In each case study contexts, the cases are first analyzed as a sequence of separate cases before analyzing the case as a whole. More information on the content of each chapter is presented in the next section.

1.6. Thesis roadmap

The thesis is structured as follows. The next chapter, **chapter 2,** analyses how anticipatory governance is understood across a wide range of scholarly fields on three elements: a) how the future is conceived in terms of its knowability and manageability, b) what the implications are for present-day actions, and c) to what ultimate aim the future is engaged with. The literature review identifies four diverse approaches to anticipatory governance and culminates in an analytical framework to assess anticipatory governance in practice in the subsequent chapters. **Chapter 3** then applies the analytical framework on anticipatory governance to examine how anticipation processes steer climate action

in a climate-vulnerable context: West Africa. In a single case study design, it analyzes written and spoken statements in reports, literature, policy documents, semi-structured interviews and online communication. The research demonstrates that there is a hybridity of approaches, explains why certain approaches become dominant, and what the implications of dominant and marginalized approaches may be for the democratic and transformative potential of anticipatory governance. Next, **chapter 4** connects the framework with a framework on transformation to research what different approaches to anticipatory governance mean for steering actions to transform food systems. It is a case study of a global initiative of foresight practitioners working on food systems transformations across the globe that analyzes their perspectives in a survey, a two-day workshop and interview. The study helps understand what approaches dominate and why and what the implications are for realizing sustainability transformations. The final empirical chapter, **chapter 5,** connects the framework to the notion of opening up and closing down to investigate what approaches to anticipatory governance mean for the framing of the space of future possibilities and possibilities for action. This is a cross-regional case study that compares anticipation processes in four regions of the Global South: West Africa, South Asia, Southeast Asia, and Central America and analyzes written and spoken perspectives in reports, literature, policy documents, semi-structured interviews, online communication and focus group discussions.

Combining this conceptual and empirical focus allows me to address all four research questions in a cross-cutting way. I come back to this in the conclusions chapter, **chapter 6**, which answers each of the research questions and discusses the contribution of the thesis to the conceptualization of anticipatory governance and wider literature.

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CHAPTER 2

Four approaches to anticipatory governance

Different conceptions of the future and implications for the present

2.1. Introduction

In times of accelerating earth system transformations and their potentially disruptive societal and distributional consequences, sustainability research and practice is increasingly focusing on imagining and governing the future (Vervoort & Gupta, 2018). The Paris Climate Agreement's aspirational 1.5 degree target — to strive to keep average temperature increases to 1.5 degrees above pre-industrial levels — has given further impetus to anticipation processes and tools to explore and realize plausible or desirable 'climate futures' (Granjou et al., 2017). With the proliferation of anticipation practices in diverse policy arenas, the (sustainable) future of our societies has become a central element in scholarly and policy debate.

Numerous processes and practices are used today to imagine futures, to question assumptions about what futures are possible and to develop strategies for transformational change (Habegger, 2010). Such anticipation processes often seek to broaden the boundaries of imagination, explore future directions under multiple drivers of change, and guide sustainability transitions and policies under conditions of complexity and scientific uncertainty (Bourgeois, 2012; Habegger, 2010; Pérez-Soba & Maas, 2015; Vervoort & Gupta, 2018). Most formal approaches to anticipation relate to foresight, including qualitative and quantitative scenario planning, visioning and backcasting, horizon scanning, anticipatory gaming and other approaches (Swart et al., 2004; Turnpenny et al., 2015; Wiebe et al., 2018). Other formal anticipation practices include vulnerability and impact assessments. But anticipation also happens without formal methodologies and processes; such informal attempts are also worthy of investigation.

The growing focus on anticipation in sustainability governance points to an important research agenda: to scrutinize the diverse conceptions of the future embedded within diverse perspectives, and how these shape present-day governance and policy choices. While important strands of social science scholarship, including in science and technology studies, responsible research and innovation, geography, environmental governance and futures studies, have long pointed to anticipatory processes as sites of political negotiation (Anderson, 2007, 2010; Mike Hulme, 2009, 2010; Mittelstadt et al., 2015; Nordmann, 2014), a comprehensive analysis of distinct perspectives on anticipatory processes, and their role in imagining, interrogating or seeking to realize diverse climate futures, remains timely and urgent (Vervoort & Gupta, 2018; Pulver & VanDeveer, 2009).

This is the aim of our review. We survey a range of social science and sustainability science perspectives here that engage with conceptions of the future and associated present actions. The organizing concept for our review is the notion of 'anticipatory

governance', broadly understood as *governing (or steering) in the present to engage with, adapt to or shape uncertain futures* (Vervoort & Gupta, 2018; see also Boyd et al. 2015; Fuerth, 2009b; Guston, 2010, 2012, 2014). We see anticipatory governance as part of long-standing debates on governing for sustainability (e.g. Andonova et al., 2009; Biermann, 2007; Bulkeley, 2012; Gupta & Möller, 2018) to which it adds an explicit future-orientation. Understood as such, large swaths of literature in the social and sustainability sciences engage directly or indirectly with anticipatory governance, regardless of whether the term is explicitly used. Our aim here is to critically assess these perspectives, in order to unearth diverse conceptions of the future and implications for governance in the present.

We proceed as follows: Section 2 describes in some detail the methodology we used to conduct our literature review. In section 3 we highlight how social science and sustainability science scholarship engages, both explicitly and implicitly, with the notion of anticipatory governance. In section 4, we draw on this overview to identify *four distinct approaches to anticipatory governance* discernible in the reviewed literature. Section 5 maps onto these four approaches a range of methods and tools of anticipation that they utilize. In concluding, we highlight how the four approaches to anticipatory governance that we identify provide a useful analytical lens through which to assess the ongoing *practices* of anticipatory governance now underway in the climate and sustainability realm.

2.2. Methodology

We explain here how we identified the literature to be reviewed, and how we conduced our review. Our dominant methodology was to undertake a narrative-style interpretative review in order to identify diverse perspectives on anticipatory governance in a representative sample of social science and sustainability science literatures that explicitly and implicitly engage with the term. We relied on qualitative methods that are suitable to our aim of describing, synthesizing and furthering conceptual understanding of a key concept (in our case 'anticipatory governance'), rather than undertaking a comprehensive author-centered or article-centered review that draws on quantitative methods to build or test theory (Rowe, 2014).

While concepts such as anticipation, foresight, futures and forward-looking governance are ever more widely used in social science and sustainability science scholarship, the term 'anticipatory governance' is explicitly used by relatively few strands of writing. We thus identified and reviewed studies that explicitly use this term but also those that address related future-oriented governance.

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2.2.1. Identifying and selecting literature

We identified the literature to be reviewed in three steps, aiming at a representative sample rather than at comprehensiveness. First, we searched for articles in the SCOPUS database that explicitly deploy the term 'anticipatory governance'. Specifically, we looked for articles that contained the term 'anticipatory governance' in the title, abstract or keywords. We limited this search to journals in the social sciences and environmental sciences, as defined by SCOPUS. This step yielded an initial set of 57 articles. Through scanning the titles and abstracts of these 57 articles, we excluded ten that were too far removed from the climate and sustainability domain (dealing, for example, with health or security). This resulted in 47 articles that covered topics such as 'anticipatory risk governance', 'anticipatory governance and foresight', 'anticipatory governance for social-ecological resilience', 'anticipatory climate governance', 'anticipatory governance of emerging technologies', and 'anticipatory governance of innovation'. In a second step, we went through the citations and reference lists of these 47 articles, in order to identify any further articles that explicitly mentioned anticipatory governance (but may not have been captured in our initial search, because they were not categorized as social or environmental sciences within Scopus) (Verschuren & Doorewaard, 2010). This process yielded another 24 articles using this term. In a third step, we scanned the references in these 71 articles to identify related literature that engages with future-oriented governance, without explicitly using the term anticipatory governance. Here we looked for terms such as 'anticipation', 'anticipatory planning', 'anticipatory knowledge', 'anticipatory democracy' but also 'sociology of the future', 'foresight' and 'scenarios'. This yielded another 73 articles, resulting in a set of 144 articles that formed the basis for our review. Through this approach, we sought to identify a broad, representative sample of relevant articles in a large swath of social science and sustainability science scholarship that engages with anticipatory and future-oriented governance.

2.2.2. Process and method of review

We then analyzed these 144 articles to unpack their understandings of anticipatory governance. We looked, specifically, for three elements that often remain implicit and are under-analyzed in studies on future-oriented governance: (i) diverse *conceptions of and engagement with the future*, including its knowability and manageability; (ii) implications for governance and policy *actions to be taken in the present*; and (iii) the *ultimate aim* of engaging in anticipatory governance. We had identified the first two elements as important to scrutinize in an agenda-setting article on anticipatory climate governance (Gupta and Vervoort, 2018), which called for conceptual and empirical scrutiny of how often-implicit conceptions of the future influence present-day policy choices. We thus included these two elements in our present review, and added a third

important and under-analyzed element, namely the ultimate aim of engaging with anticipatory governance.

In scrutinizing the selected literature to ascertain diverse perspectives on these three component elements, we did not pre-specify their possible content. Instead, we read the literature in an open-ended manner, with an eye to identifying inductively the range of ways in which the future was being conceptualized and presented; the governance and policy actions in the present to be taken; and the array of possible ends to be realized. Doing so allowed us to identify four main approaches to anticipatory governance in the reviewed literature, which we present and discuss in detail in Section 4, and synthesize in the form of Figure 2.1.

We also assessed the selected literature against a fourth element: the range of tools and methods of anticipation relied upon in diverse approaches to anticipatory governance, as well as roles proposed for stakeholders. In section 5, we outline diverse anticipatory methods and tools, and their alignment with the four approaches to anticipatory governance identified earlier. Figure 2.2 synthesizes and presents an overview of this aspect of our analysis.

While broad categorizations are immanent to any literature review, we should note at the outset that our intention here is not to imply strict boundaries between these four approaches. Nor do we seek to rigidly link the four anticipatory governance approaches to specific authors, scholarly articles, or research traditions in the social and sustainability sciences. Instead, we view these as ideal types, with our aim being to critically interrogate and broadly map diverse perspectives on an important phenomenon in the study and practice of sustainability: forward-looking anticipatory governance that engages with diverse visions of sustainable futures. We should also note that not all 144 papers we reviewed are referenced in the article, instead, we chose representative writings to illustrate the four approaches we identify here.

2.3. Anticipating and seeking to govern the future: a brief overview

Before presenting the four approaches to anticipatory governance in the following section, we first provide here a broad, general overview of how the concept of anticipatory governance is addressed, both explicitly and implicitly, in the reviewed literature. This broad overview provides the context for our more specific discussion of the four approaches to anticipatory governance in section 4.

2.3.1. Explicit engagement with the concept of anticipatory governance

To start with, the notion of anticipatory governance is explicitly used in four influential strands of social science and sustainability science scholarship.

First, an influential perspective on anticipatory governance has emerged out of a concern with possible disruptive consequences of scientific and technological innovations (Barben et al., 2008; Guston, 2012; Macnaghten et al., 2014; Stilgoe et al., 2013). This perspective connects science and technology studies, responsible research and innovation, and environmental governance literatures. David Guston, a leading scholar in this tradition, defines anticipatory governance as "a broad-based capacity extended through society that can act on a variety of inputs to manage emerging knowledge-based technologies while such management is still possible" (2014, p. 219). In this view, anticipatory governance is a non-predictive approach to enhance present-day preparedness, including through building capacities in foresight and multi-stakeholder engagement, all in order to steer away from possible disruptive impacts of novel technologies in the future (Anderson, 2007; Barben et al., 2008, 2008; Guston, 2012, 2014; Nielsen et al., 2011; Stilgoe et al., 2013). The future is conceived here as being inherently uncertain, but which can nonetheless be acted upon in the present, with a focus on building society-wide capacities to anticipate and navigate future trajectories.

Second, anticipatory governance is explicitly addressed in national security policy analyses, particularly in the United States. Anticipatory governance is envisioned here as governance that can manage crises *ex ante* to prevent their destabilizing effects (Fuerth, 2009b; Ramos, 2014; Boston, 2017; Fuerth & Faber, 2013). Building on Toffler's (1970b) notion of anticipatory democracy, some scholars in this tradition argue for developing new forms of representative governance that can operate proactively "in the face of crushing decisional overload, or political future shock" (Toffler, 1970a, p. xii, see also Bezold, 2006, p. 36; Ramos, 2014). Anticipatory governance is seen here as a way to address future challenges posed by the accelerating rate and complexity of social change. Such perspectives on anticipatory governance focus on the adaptive capacity of national planning systems (Fuerth & Faber, 2013), among others regarding climate change. Studies in this tradition imply that the future can be governed, and risks prevented as long as anticipatory governance is enabled through "a system of institutions, rules, and norms that provides a way to use foresight, networks, and feedback for the purpose of reducing risk" as a means of engaging with the future (Fuerth, 2009a, p. 29). Thus, the future is conceived of as containing reducible risks, which can be acted upon and mitigated through improved planning processes in the present.

A third strand of writing that explicitly engages with the concept of anticipatory governance has emerged in sustainability science, for instance in the area of climate adaptation and resilience (Bates & Saint-Pierre, 2018; Boyd et al., 2015; Hurlbert & Gupta, 2019; Serrao-Neumann et al., 2013). This research engages with extant notions of anticipatory governance (e.g. Fuerth, 2009b; Guston, 2014; R. Quay, 2010) by seeking to provide "an alternative planning approach to address the adaptation challenge" (Serrao-Neumann et al., 2013, p. 441 see also Boyd et al., 2015). This approach seeks to develop proactive strategies to adapt and build the necessary resilience to contend with uncertain environmental futures (Boyd et al., 2015). The novelty lies in seeking to steer away from short-term decision-making to longer-term policy visioning in ways that can anticipate change and help realize more sustainable futures. Such perspectives also highlight the role played in anticipatory processes by local communities and a diverse array of stakeholders (Boyd et al., 2015; Serrao-Neumann et al., 2013; Tschakert & Dietrich, 2010).

Fourth, there is a more critical line of research with explicit reference to anticipatory governance in global environmental governance and environmental policy literatures (Gupta, 2001, 2004, 2011; Jansen & Gupta, 2009; Mittelstadt et al., 2015; Talberg et al., 2018; see also Low, 2017a). Anticipatory governance is understood here as the attempt to govern under conditions of extreme scientific uncertainty and normative conflict over the very existence and nature of future environmental and technological risk and harm (Gupta, 2001, 2004, 2013). These studies in global environmental governance emphasize the need for critical scrutiny of anticipatory practices as contested sites of politics.

2.3.2. Implicit engagement with the concept of anticipatory governance

In addition, three broad fields of study in the climate and sustainability domain engage with processes of anticipation and foresight, without using the term anticipatory governance explicitly.

The first is futures studies with its strong methodological focus on anticipating and imagining futures, including in a sustainability context. While a lack of critical social science scrutiny of future-oriented anticipatory practices, such as scenario building, is noted to be an important research gap (Vervoort & Gupta, 2018), scholars in future studies have spearheaded the study of anticipatory practices and data on which other research communities have relied. Such anticipatory practices are often closely connected to policy to support long-term planning on complex and uncertain issues, such as climate change. Scenario thinking first picked up steam in futures studies in the 1960s, owing to publications such as *The Year 2000* by Kahn and Wiener (Kahn & Wiener, 1967; also Wack, 1985) and the launch of a specialized journal *Futures* in 1968.

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Since the late 1960s and early 1970s, envisioning environmental futures have been a matter of global concern, due to publications such as *Limits to Growth* by the Club of Rome in 1972 (Meadows et al., 1972) and the 1972 United Nations Conference on the Human Environment in Stockholm (Granjou et al., 2017). The growing concern with long-term thinking and assessments of futures has also been taken up in fora such as the Intergovernmental Panel on Climate Change Assessment Reports, including its Shared Socio-Economic Pathways (Riahi et al., 2017), as well as in integrated assessment models (O'Neill et al., 2014), UNEP's Global Environmental Outlook, the Millennium Ecosystems Assessment and other assessments (Bell, 2001; Kok et al., 2007; van Vuuren et al., 2012).

As a result of decades of such global scientific assessment work, of which scenarios are a key component (Loveridge & Street, 2005; van Notten et al., 2003; Vervoort et al., 2015), futures studies offer extensive research and insights on anticipatory methods to explore climate-impacted futures (Swart et al., 2004). It focuses on imagining and representing multiple alternative climate futures to guide climate mitigation and adaptation decision-making, under conditions of complexity and uncertainty (Sova et al., 2015; Vervoort et al., 2015). All strands of futures studies include anticipatory objectives (Rossel, 2010) but they are characterized by different epistemologies (Ramírez & Selin, 2014; Wilkinson & Eidinow, 2008). Some strands of futures studies are concerned with probabilistic foresight, which assumes that probabilities can be assigned to multiple futures. In this view, by analyzing how present-day driving forces steer future outcomes, one can guide policy planning and determine policy measures and investments. Other strands of futures studies are more concerned with viewing futures and the plausibility assigned to them as socially constructed (Ramírez & Selin, 2014; Wilkinson & Eidinow, 2008).

A second research field can be broadly defined as focusing on transformations and systems resilience (Feola, 2015; Folke, 2006). Within this diverse and interdisciplinary space, anticipation is often seen as a way to advance the transition of complex systems towards more sustainable trajectories (Loorbach et al., 2017; Rotmans & Loorbach, 2009). Here, anticipatory engagement with potential futures is seen as essential to support sustainability transitions and transformations (Hansen & Coenen, 2014; Mok & Hyysalo, 2018), where processes of anticipation "act as harbingers of the future" to support pro-active, long-term planning of societal innovation, including through deliberation (Loorbach, 2010; Rotmans & Loorbach, 2009, p. 190). Related literature on resilience sees anticipation as part of proactively governing social-ecological systems towards sustainability (for a review of conceptual approaches to transformations, (Chaffin et al., 2016; see Feola, 2015; Patterson et al., 2017). Also here, anticipation is seen as a prerequisite for transformations. This includes both anticipation of the unintended

consequences of social and technical innovation as well as possible opportunities for changing the system (Chaffin et al., 2016; Hebinck et al., 2018).

A third, critical domain of thinking on anticipation focuses on interrogating the normative claims underlying anticipatory processes and the potential disconnect between anticipating futures versus making present-day choices in governance. For example, Bell emphasizes that "futurists have done a great deal of practical methodological work on the prediction problem, but they have done less to justify their judgments of preferable futures" (Bell, 2001, p. 72). Recent writings have emphasized how reflexivity about the politics of future-oriented anticipation processes is missing in most futures studies, particularly regarding how the future is framed and what power such frames have over present governance (Vervoort & Gupta, 2018).

Such critical thinking on anticipation is also a mainstay of research in science and technology studies, sociology of the future, and responsible research and innovation (Bellamy, 2016; Jasanoff & Kim, 2015; Jasanoff & Markle, 2008; Nordmann, 2014; Selin, 2008). A key focus in such writings is on how practices of anticipation — and the ideas of the future expressed therein — are sites of political conflict and negotiation. For example, Selin (2008, p. 1892) suggests that "as social scientists begin to weave their own accounts of futures, they should pay attention to the politics of such rendering". Writings in this vein also engage with the notion of "sociotechnical imaginaries" by Jasanoff and Kim (2009, 2015), who define such imaginaries as "collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order, and attainable through, and supportive of, advances in science and technology" (Jasanoff & Kim, 2015, p. 4). This line of research then interrogates how such sociotechnical imaginaries frame the possibilities for action in the present and have performative effects by casting some futures as more desirable, attainable, or even imaginable than others. For example, Esguerra (2019) investigates the socio-material politics of different 'future objects'. Anderson (2010) offers an analysis from the perspective of geography about how the future is problematized as indeterminate or uncertain, and investigates different ways of engaging with such 'problematic' futures, including through reliance on, inter alia, pre-emption, precaution, and preparedness.

2.4. Four approaches to anticipatory governance: diverse conceptions of the future, actions in the present and ultimate aims

With this broad overview of both explicit and implicit understandings of anticipatory governance in the literature, we now turn to distilling similarities and differences across them, in terms of: the conceptions of the future, implications for present actions, and

ultimate aims to be realized. This allows us to delineate four distinct approaches to anticipatory governance in the reviewed literature.

In distilling diverse *conceptions of the future,* we scrutinized assumptions about the knowability and manageability of the future. Our review yielded four (ideal-typical) ways in which the future is being conceptualized and engaged with in the literature: (1) assessing *probable (and improbable)* futures; (2) contending with multiple *plausible* futures; (3) imagining diverse *pluralistic* futures; and (4) scrutinizing the *performative* potential of future imaginaries.

In distilling associated *actions in the present*, we inductively identified four ideal-typical categories of present-day actions flowing from diverse conceptions of the future. These included: (1) formal planning and strategy development; (2) building broad-based societal preparedness and capacities; (3) mobilizing diverse actors; and (4) interrogating discursive and material effects in the present.

Finally, with regard to *ultimate aims*, we inductively identified the following four ideal-typical ends to be realized through engaging with anticipatory governance: (1) to mitigate or reduce future risk; (2) to reflexively navigate diverse uncertain futures; (3) to imagine and co-create new futures; and (4) to shed light on the political implications in the present of speculative future imaginaries.

Through combining these diverse ways of engaging with the future, associated present actions, and ultimate aims, we distill four broad approaches to anticipatory governance discernible in social and sustainability science scholarship. We describe these below and summarize them also in Figure 2.1.

2.4.1. Approach 1: Probable futures, strategic planning and risk reduction

The first approach to anticipatory governance that we identify here assesses probable and improbable futures and prioritizes strategic planning in the present, with the ultimate aim of future risk reduction. This approach is most clearly discernible in perspectives in the public policy and planning literature that explicitly deploy the notion of anticipatory governance as well as in some probabilistic futures studies. There are some similarities between this and the second approach, namely that both see futures as complex and uncertain; however, proponents of approach 1 predominantly argue that future risks can be prevented, and future opportunities can be shaped.

Conception of the future: This first approach to anticipatory governance is concerned with identifying and assessing the probability of different futures. It assumes that future

risks and uncertainties can be made partially knowable and manageable, and that such knowledge can be gained by reducing scientific uncertainty and complexity regarding the directions of future change. In this approach, probable futures are identified by analyzing patterns of the past, which can shed light on and help to explore future trends and their probabilities (see e.g. Börjeson et al., 2006; Cuhls, 2003). At the same time, there is also a concern with exploring improbable/low-likelihood futures that may have a high impact on society. Part of the rationale for exploring improbable futures is to develop knowledge infrastructures for detecting early warnings of low-probability but high-impact contingencies (Fuerth, 2009a; Fuerth & Faber, 2013).

Actions in the present: Flowing from the manner of engaging with the future as above, this approach to anticipatory governance focuses on prioritizing 'mission-oriented' policy action in the present, through analyzing the policy consequences of futures with different probabilities (Fuerth & Faber, 2013). In this view, scientists, engineers and policymakers, or policymakers in whole-of-government approaches, can strategically prioritize and plan the future in the present, pre-empt future threats (Fuerth & Faber, 2013; Stockdale, 2013) and protect long-term societal interests and future investments (Boston, 2017). According to Fuerth, anticipatory governance "improves the capacity to organize planning and action in ways that mobilize the full capacities of governments, and … speed[s] up the process of detecting error and propagating success" (Fuerth, 2009b, p. 31). Thus, the future is conceived as containing reducible risks, which can be acted upon in the present through improved knowledge infrastructures and strategic planning processes.

Ultimate aim: The aim here is to reduce future risks, by strategically designing policy trajectories that minimize and steer away from high-risk scenarios (Kuzma et al., 2008), stay ahead of destabilizing developments (Cuhls, 2003; Fuerth, 2009a) and thereby 'win the future' (Fuerth, 2009b; Fuerth & Faber, 2013) and 'safeguard the future'. In this view, expert-driven strategic planning can help to steer towards a more desired future in which risks are reduced and opportunities are seized.

2.4.2. Approach 2: Plausible futures, enhanced preparedness and navigating uncertainty

The second approach to anticipatory governance we identify here envisions multiple plausible futures and calls for enhancing preparedness and building capacities in the present to be able to reflexively navigate diverse (uncertain) futures. This approach is discernible in writings on responsible research and innovation and some strands of climate policy and governance literatures, as well as anticipation-focused scholarship in the interdisciplinary transitions and transformations literature. Thematic foci

here include future environmental and societal impacts of climate change as well as governance of novel technologies, such as nanotechnology, biotechnology, or geoengineering (see e.g. Douglas & Stemerding, 2014; Fonseca & Pereira, 2014). Even though some similarities exist with approach 1, this approach emphasizes the need to enhance preparedness to reflexively steer sociotechnical developments in mitigating potential future harms.

Conception of the future: This approach sees more fundamental and irreducible uncertainties in the future. This makes multiple future trajectories possible that are all plausible and that cannot be ranked or reduced to one single most likely future (Guston, 2014; Michelson, 2016; see also Selin, 2011). Considering that multiple plausible futures exist, and that plausibility itself is considered a matter of individual and group subjectivity (Ramírez & Selin, 2014), their content can only be legitimately envisioned through broad deliberation (Boyd et al., 2015; Guston, 2014; Rotmans & Loorbach, 2009).

Actions in the present: An engagement with the future that recognizes multiple plausible future trajectories then calls for the development of adaptive capacities and a state of preparedness in the present, to navigate diverse future trajectories. Such preparedness should involve a broad range of actors in reflexive modes of future-making as well as futures-based decision-making (Guston, 2014; Sadowski & Guston, 2016). Guston (2014), for example, highlights the need for reflexivity in contemplating technological trajectories and progress, such that contingencies and possible disruptions can be better anticipated and prepared for *ex ante*. Future stakes should be brought into a reflexive conversation in dialogic spaces that include scientists, engineers and policymakers (Davies & Selin, 2012; Wiek et al., 2013).

The call for upstream public engagement (Fuller, 2009; Macnaghten, 2009; Macnaghten et al., 2014) is hence critical for this second approach. It is seen as important is to include the concerns and hopes of lay publics who can support more socially robust technological development or climate adaptation planning (Lister et al., 2015; Nykvist et al., 2017; Serrao-Neumann et al., 2013). Anticipatory methods are used to exchange knowledge between experts and lay people, with anticipation understood here as being more about "practicing, rehearsing or exercising a capacity in a logically, spatially, or temporally prior way, than it is about divining a future" (Guston, 2014, p. 226).

Ultimate aim: Whereas in the first approach, anticipatory governance aims at reducing future risks, this second approach focuses on preparedness to adapt to technological innovation and socioecological change, with the ultimate aim being to reflexively navigate uncertain futures (see also Pickering, 2019).

2.4.3. Approach 3: Pluralistic futures, societal mobilization and co-creating alternatives

The third approach to anticipatory governance that we identify here is concerned with imagining diverse pluralistic futures, in order to mobilize societal actors in the present to co-create desired futures. It draws primarily on perspectives in futures studies and views on anticipation and anticipatory governance in the sustainability sciences. From these perspectives, the socially constructed nature of futures means that all notions of plausibility are subjective: different futures are more or less believable for different audiences. This approach is thus most concerned with collectively imagining radical futures with the aim of co-creating transformative futures.

Conception of the future: This third approach is similar to the second approach inasmuch as it also sees the future as having multiple trajectories that are largely unknowable. It adopts, however, a more explicitly transformative stance. This approach reacts in particular to probability-based and plausibility-based concepts of the future that are seen as too limiting, since plausibility is still defined in terms of how futures relate to the present. Ramirez and Selin (2014) for example propose to open up the exploration of future worlds beyond the limiting ideas of plausibility that are tied to the present. Since all knowledge about the future is shaped by interaction and depends on interpretations of the world, different societal notions of the future represent fundamentally pluralistic future worlds (Patterson et al., 2017; Robinson & Herbert, 2004; Zehfuss, 2002). Vervoort et al. (2015) hence tie this fundamental plurality of futures to a plurality of societal presents and pasts.

Actions in the present: Scholars in these traditions thus reject the duality between present and future, expressing a postmodern ontology that prioritizes interaction between multiple present and future worlds that can be co-created and mobilized through collective action. In this perspective, actions in the present call for prioritizing the imagining and development of pluralistic and actionable pathways to change that can bring together and mobilize societal actors in novel configurations (Swart et al., 2004). All assumptions for change processes can be investigated and all action trajectories can be tested to make them socially robust under various future conditions. Rossel (2010, p. 74) explains, furthermore, that, "robust does not mean 'true' nor 'definitively ascertained'", but "recognized, shaped, used and perceived as relevant by a variety of social constituencies", as opposed to one expert or interest group. The collective imagination of new and more sustainable futures is seen as a first step to realizing and achieving alternative futures (Hajer & Pelzer, 2018; Hajer & Versteeg, 2019). One way to do so is to bring societal actors together to imagine new futures through new pathways for change, which can be acted upon in the present (Robinson et al., 2011). Anticipation

in this approach is thus about mobilizing stakeholders to imagine futures and bring these futures to life. It is about co-creating desirable futures through social processes, but also about which future challenges to engage with (Vervoort et al., 2015).

Ultimate aim: This approach makes the closest connection between futures and anticipation on the one hand, and sustainability transformations and transitions on the other (Hajer & Versteeg, 2019; Hebinck et al., 2018). Thus, scholars investigate anticipation here in contexts where new configurations of societal actors are brought together for radical change (Bennett et al., 2016), with the ultimate aim of co-creating new and more transformative futures (Bendor, 2018; Sova et al., 2015; Hajer & Pelzer, 2018; Robinson & Herbert, 2004).

2.4.4. Approach 4: Performative futures, critical interrogation, and political implications

The fourth approach to anticipatory governance we identify here engages with the future primarily to emphasize the performative power of future imaginaries, in shaping present-day choices and governance trajectories. This perspective is thus most concerned to interrogate and shed light on these performative effects, in order to reveal their political implications for and in the present. This approach is most fully articulated in writings in science and technology studies, sociology of the future, and critical (global) environmental governance. There are certain similarities between this and the preceding two approaches, including seeing the future as unknowable and calling for opening decision-making to lay publics. However, this approach is most fundamentally concerned with interrogating the performative power and politics of engaging with and imagining the future.

Conception of the future: In this fourth approach, the future is marked by irresolvable uncertainties and unknowns. Any attempt to reduce it to something that is manageable inevitably privileges particular ways of thinking and specific priorities. All claims about the future are seen here as political interventions, as representations or "fabrications of the future" (Jasanoff & Kim, 2015, p. 337) that have performative effects in the present (Selin, 2008; Anderson, 2010). All claims about the future, even when developed through deliberative processes, have the power to call into being specific futures by shaping present-day choices. This could be, for example, through limiting future climate mitigation and adaptation possibilities to the pragmatism of current regimes (Pulver & VanDeveer, 2009; Sarkki et al., 2017; Sova et al., 2015), or shaping how novel climate engineering technologies are conceptualized and *de facto* governed in the present (Gupta & Möller, 2018; see also Talberg et al., 2018). Frames about the future can include both utopian and dystopian visions that create distorted images of social realities

and "colonize" the future (Selin, 2007, p. 197). For example, the framing of "climate emergencies" may legitimize and prioritize the development of socially and politically problematic technological solutions in the present (Bellamy, 2016; Gupta, 2019; see also Macnaghten et al., 2014).

Actions in the present: Given its focus on the performative power of future imaginaries, this approach is most interested in interrogating the discursive and political implications and consequences of such imaginaries for present-day choices (Esguerra, 2019). A key concern is the power of expert knowledge and scientific expertise in calling into being, and engaging with, diverse futures. In discussing the role of science in responses to climate change (Hulme, 2010), climate engineering (Low, 2017; Gupta & Möller, 2018) or other domains of sustainability, such an approach to anticipation questions whether expert-driven visioning is merely a technical process that can objectively and neutrally engage with the future (see also Mittelstadt et al., 2015). In this view, claim-making about the future must instead be analyzed as a site of political negotiation and conflict (Gupta, 2011; see also Jansen & Gupta, 2009; Talberg et al., 2018). The key focus is to identify the discursive effects of frames or fabrications of the future as they are generated and advanced through practices of anticipation; and to study how these exert power over the present. A priority is to interrogate and be cognizant of how claim-making about the future can hold the present hostage (Nordmann, 2014).

Ultimate aim: In this approach, the ultimate aim of engaging with anticipatory governance and critically interrogating future visions and imaginaries, is to shed light on their performative effects and political implications in the present, including how future imaginaries benefit or exclude certain policy choices, trajectories, sectors, investments, or interests of actors. This approach hence seeks to bring attention back to the present and to the difficult political choices and trade-offs that require redressal now, rather than in an imagined future (Nordmann, 2014). In Figure 2.1 below we map and visualize these four approaches to anticipatory governance. On the horizontal axis, we illustrate the continuum of views on conceptions of the future that we have discussed above. The vertical axis shows the continuum of views on implications for actions in the present. The four boxes capture the key elements of the four approaches, with the conception of/engagement with the future in red text, the actions to be taken in the present in blue, and the ultimate aim in black.

As we discuss in the conclusion, this mapping of anticipatory governance approaches also serves as an analytical lens through which to further explore the nature and implications of ongoing practices of anticipatory governance, as they are now underway around the world.

Figure 2.1 diagram content:

How is the future conceptualized?

Probable and improbable · Plausible · Pluralistic · Performative

With what implications for the present?

Planning:
Assessing probable and improbable futures in order to help inform strategic policy planning **to reduce future risks**

Building capacities:
Exploring plausible futures in order to build adaptive capacities and preparedness **to reflexibly navigate diverse (uncertain) futures**

Mobilizing:
Imagining pluralistic futures in order to mobilize diverse societal actors **to co-create new futures**

Interrogating:
Scrutinizing the performative power of future imaginaries in order to interrogate **and shed light on their political implications in the present**

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Key: Red: what conception of/engagement with the future; blue: how these intersect with actions to be taken in the present; **black bold**: why/to what end: the desired ends of engaging in/with anticipatory governance

Figure 2.1. Approaches to anticipatory governance: diverse conceptions of the future and actions in the present

2.5. Methods and tools of anticipation: overlapping use and varying ends

Having described four approaches to anticipatory governance, we now discuss the tools and methods of anticipation used within, but also across, these four approaches. The reason for this separate section is that the four approaches to anticipatory governance, and methods used herein, are not straightforwardly aligned. Although certain tools and methods align more with a given approach, similar methods and tools can also be used by distinct approaches to anticipatory governance. Furthermore, a single anticipation process can use multiple mechanisms, methods and tools (Vervoort et al., 2014). For example, one can combine quantitative models with participatory scenario or visioning processes to gain insights into the future drivers that may be difficult to imagine (Mason-D'Croz et al., 2016). The purpose of this section, however, is not to explain the use of diverse methods of anticipation in anticipatory processes, but rather to analyse which

methods align with which approach to anticipatory governance, and whether some methods are used across different approaches. We conclude our discussion by presenting an overview, in Figure 2.2, of how tools and methods of anticipation map onto the four approaches to anticipatory governance.

2.5.1. Anticipatory tools and methods to assess probable and improbable futures (Approach 1)

Two sets of anticipatory tools are referred to most often by those subscribing to the first approach to anticipatory governance that we identified, given its focus on calculating probabilities of future risks and on hypothesizing alternative courses of action. These include tools that extend the horizon of awareness to detect risks in the future, as well as tools that set short-term policy priorities based on long-term strategizing (Fuerth, 2009b).

In the first category are tools such as Delphi methods, horizon scanning or future commissions, all of which are intended to enhance the capacity of planners to monitor future events, analyse potential implications, simulate alternative courses of action, ask unasked questions, and issue timely warnings (Boston, 2019; Li & Porter, 2018; Fuerth & Faber, 2013). Additional methods relevant here include cost-minimizing scenarios, forward-looking information services, econometric model calculations, technological forecasting, climate statistics, impact assessments, time series analyses and trend analyses (Bradfield et al., 2005; Edwards, 2010; van Notten et al., 2003).

In the second category are tools that set short-time policy priorities based on long term strategizing. These include policy analysis, budget analysis, organizational crowdsourcing, public learning, online community tools, risk assessment and scenario analysis (Bezold, 2006; Fuerth, 2009a, 2009b; Ramos, 2014). The envisioned role of science, including social science, and scientific methods is to guide expert-analytical processes and to identify probable future pathways; the role of lay publics is often limited (Cuhls, 2003).

2.5.2. Anticipatory tools and methods to explore plausible futures (Approach 2)

Numerous tools are used in exploring multiple plausible futures, the focus of approach 2 (Quay, 2015). Some are generally more associated with probabilistic foresight, such as simulation modelling and weak signal-type approaches. However, one can apply the modelling approaches and weak signal approaches to sets of scenarios that are not ordered by likelihood but include a range of futures that are considered plausible (Sampson et al., 2016; Wender et al., 2012), therefore still falling within a "plausibility envelope". Other methods common to both approaches 1 and 2 include strategic visioning and backcasting, combined with tools to assess risks, vulnerabilities and monitor

changing climate conditions (Boyd et al., 2015; Dougill et al., 2010; Fazey et al., 2015; Nicholls et al., 2008; Rogers, 2011; Wardekker et al., 2010). Methods that are prioritized here include those designed to transfer knowledge from experts to local knowledge holders and facilitate bottom-up community involvement in decision-making. Thus, similar methods as used in approach 1 are used in approach 2 as well but are intended to strengthen the anticipatory capacity of governing stakeholders and the agency of vulnerable groups (Boyd et al., 2015; Nuttall, 2010; Tschakert & Dietrich, 2010).

Vulnerable groups in developing countries are of particular concern here, given that access to information, knowledge networks and learning tools is perceived to be scarce at the community level. Thus, in approach 2, participatory methods—including participatory vulnerability mapping, participatory modelling, and participatory scenario explorations — are seen as pivotal to facilitating knowledge transfer from experts to lay groups and for adapting livelihoods, institutions, and ecosystems to uncertain futures (Dougill et al., 2010; Ostrom, 2010; Tschakert & Dietrich, 2010; Voinov & Bousquet, 2010). Equally important for the use of such methods is the balancing and combining of scientific knowledge with citizen knowledge by engaging a variety of stakeholders, such as local governments, scientists, corporations, community networks and governmental organizations (Boyd et al., 2015; Dougill et al., 2010; Nuttall, 2010). The focus is on building anticipatory capacities in a deliberative fashion (Wiek et al., 2013).

Finally, consensus conferences, citizens' juries, deliberative mapping, and deliberative polling and focus groups are also used to explore plausible futures (Bellamy et al., 2012; Chilvers, 2010; Stilgoe et al., 2013). These tools can stimulate expert-driven interaction between scientists and engineers (Harvey & Salter, 2012; Sadowski & Guston, 2016) but also bring in the public through "upstream public engagement" (Conca, 2019; Guston, 2014; Macnaghten, 2009). Such methods can also improve interaction between scientists and publics, which is seen as crucial for a better mutual understanding of values and goals (Guston, 2010) and the sharing of positive lessons, securing legitimacy, and realizing socially robust technologies (Anderson, 2007; Macnaghten, 2009; Stilgoe et al., 2013).

Similar methods are also proposed in the more constructivist futures studies and critical social science literatures that underpin approaches 3 and 4 (as discussed further below). There, they might be deployed to mobilize diverse actors, thus aligning with the third approach, or to critically interrogate frames of the future, thus aligning with the fourth approach.

2.5.3. Anticipatory tools and methods to imagine pluralistic *futures (Approach 3)*

In this approach, participatory futures methods and tools are used to mobilize stakeholders to collectively imagine pluralistic transformative pathways. Various methods for the development of participatory futures are used with the understanding that multiple scenarios represent multiple incommensurable future worlds. This differs from the, often implicit, understanding most common in the second approach: that there is a single, shared reality from which multiple future trajectories are possible within the boundaries of plausibility (Vervoort, 2015). These innovations and experiments are ideally employed to "embrace uncertainty, discomfort and knowledge gaps, and the connected need to capture and make productive fundamental plurality among understandings of the future" (Vervoort et al., 2015, p. 62). Visions, scenarios, and back-casted pathways are intended to mobilize collective action towards more desired futures (Bennett et al., 2016; Kok et al., 2007; Robinson et al., 2011; Sova et al., 2015; Vervoort et al., 2014). Simulation gaming plays an increasingly important role among the tools associated with this approach (Vervoort, 2019) and for "thinking beyond positioned views on today's desirable state" (Sarkki et al., 2017, p. 559). Methods and tools also include other forms of community dialogues, training, education, and experimentation (Garb et al., 2008; Karlsen et al., 2010; Mayer, 2009). Though a number of these methods overlap with the second approach, the focus here is on creating new shared futures with the purpose of realizing them, as distinct from the focus in approach 1 on navigating uncertain futures in a more adaptive mode.

Notably, because of the interest in imagining and realizing pluralistic futures, there is a stronger focus within this approach 3 on methods that allow for the creation of future visions and scenarios that can be engaged with as fully embodied and realized experiences. Such 'experiential futures' methods (Candy & Dunagan, 2017) include turning scenarios into interactive theatre (Baena, 2017); creating exhibitions (Hajer and Versteeg 2019; (Bendor et al., 2017) and design workshops; various experientially focused games from VR games to live action role playing games (Vervoort 2019); and integrating futures into present day environments such as cityscapes (Candy & Dunagan, 2017). Such methods can and sometimes are used for futures developed from approach 2 as well, but the match between experiential futures and approach 3 is more common because of the explicit interest in bringing new desired futures to life.

2.5.4. Assessing how imagined futures are performative *(Approach 4)*

Methods and tools deployed in critical strands of scholarship on anticipatory governance are, to some extent, similar to those used in other approaches as well, including future scenarios, technology assessment, integrative deliberation, and vision assessments. However, here such methods are either the subject of, or used for, critical interrogation

(Bellamy et al., 2012; Fonseca & Pereira, 2014; Mittelstadt et al., 2015; Selin, 2007, 2008). An example of such critical application is analysis of future narratives and images, which is used to question the limiting assumptions about what futures are possible, to open up dialogue for exploring novel and alternative pathways, and to interrogate the political implications of future visions and pathways for the present (Selin, 2008). Anticipation tools serve here as heuristic devices to identify diverse futures (Sarkki et al., 2017; Talberg et al., 2018) and to democratize anticipatory knowledge production. Here, anticipation mechanisms are primarily investigated as future framings with important political implications in the present (Biermann & Gupta, 2011; Vervoort & Gupta, 2018), rather than as a proxy for merely knowing futures. In this view, participatory and inclusive anticipation practices are vehicles to interrogate and open up dominant framings of the future.
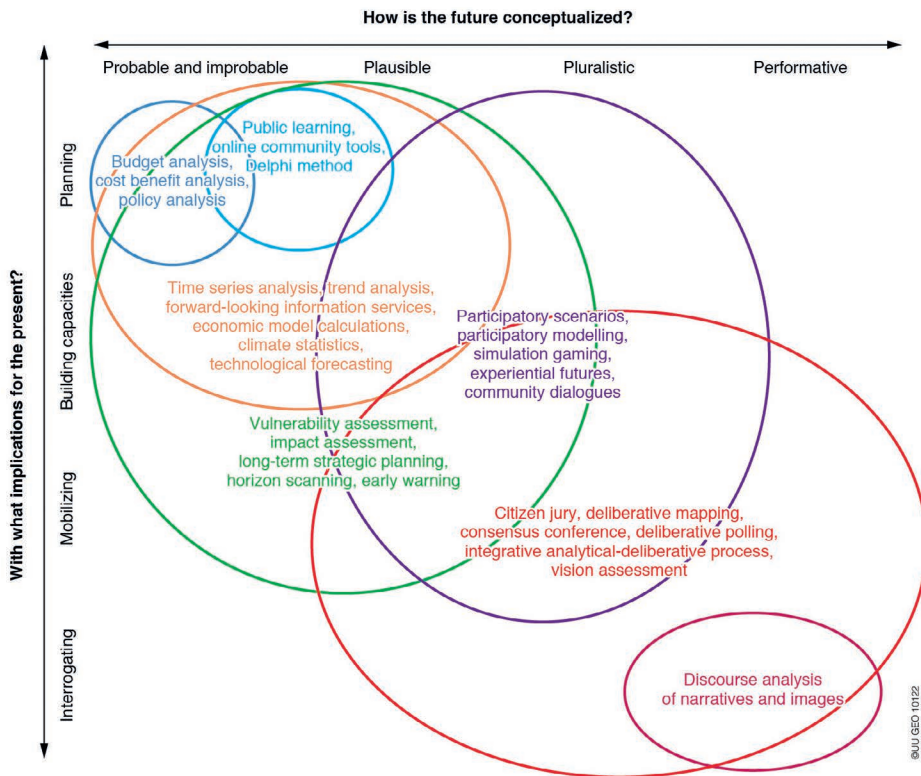
Figure 2.2. Engaging with the future, acting in the present: diverse tools and methods of anticipation

In this section, we discussed methods and tools that are used in and across four approaches to anticipation and anticipatory governance. Figure 2.2 maps these methods and tools onto our continuum of four approaches to anticipatory governance. The boxes

detailing the four approaches are not repeated here again, in order to improve the readability of the figure.

As Figure 2.2 illustrates, many of these methods overlap and can be used across these continua and approaches. The crucial distinction lies thus not so much in type of method used in the four approaches — these can be similar — but in the ends they serve. These ends can vary significantly, as can the associated perceptions of the future and actions in the present (for a recent extensive review of anticipatory tools and methods in envisioning climate engineered futures, see Low & Schäfer, 2019).

Our analysis supplements hence the insight of Anderson (2007, p. 158), who argues that different methods and tools of anticipation "produce different epistemic objects through which future possibilities and potentialities are disclosed, objectified, communicated and rendered mobile, through the very way in which they are employed". As our analysis suggests, even if the anticipatory methods are similar, the ways they are employed can vary because of the diverse conceptions of the future they take as a starting point, the actions to be taken in the present that they prioritize, and the ends they seek to achieve.

2.6. Conclusion

This article has reviewed scholarly writings on anticipation and anticipatory governance in the social science and interdisciplinary sustainability science literatures. Our focus on explicit and implicit notions of anticipatory governance across a wide range of research fields makes our analysis different both in scope and intent from existing typologies of engagements with the future, particularly in futures studies research, which have focused more narrowly on futures methods and content (see e.g. Bradfield et al., 2005; van Notten et al., 2003; Wilkinson & Eidinow, 2008). We have identified four approaches to anticipatory governance here, each of which embodies different conceptions of the future and actions to be taken in the present, in order to realize different ends. Divergences across these elements allowed us to identify and map four distinct and internally coherent approaches to anticipatory governance.

We visualized these four approaches to anticipatory governance in Figure 2.1, with the x-axis depicting a continuum of diverse conceptions of the future; and the y-axis depicting the distinct implications for actions in the present. We mapped and summarized the content of each approach to anticipatory governance in the boxed text, including here the ultimate aim as well.

We also analyzed the tools and methods of anticipation that these four approaches rely on, finding that many of these are common to more than one approach. In Figure 2.2 we

mapped the most widely used anticipation methods and tools onto our four anticipatory governance approaches (as shown in Figure 2.1), illustrating that similar methods are used in more than one approach to anticipatory governance, even as they serve distinct ends. Our review thus also builds on and complements the analysis in Low and Schäfer (2019), who investigate the conceptions of the future inherent in specific sets of methods and tools (in a climate engineering context).

In concluding, we should emphasize again, as we did at the outset of our analysis, that our categorization of four approaches to anticipatory governance is not meant to imply hard boundaries between them, nor to suggest silos of scholarly inquiry that rigidly adhere to specific claims and assumptions. Instead, we recognize that the four approaches —and the diverse and overlapping scholarly perspectives underpinning them—cross-fertilize and engage with each other. In distinguishing these four approaches, our aim is to identify ideal-types that serve an analytical purpose: to map and shed light on how distinct ways of imagining and engaging with the future have implications for present-day research and practice in climate and sustainability governance.

Our aim also is to provide an analytical lens through which to further analyze the (likely to be) 'messiness' of anticipatory approaches in practice, whereby different conceptions of the future, actions to be taken in the present, and ultimate aims might co-exist in a single anticipation process. This may be the case because different groups of researchers or practitioners collaborate and bring to the table different perspectives. While this could lead to novel outcomes, the result could also be conflict or an uncomfortable subservient role becoming assigned in practice to certain approaches – such as anticipatory activities aimed at creating novel, pluralistic futures (approach 3) having to fit their outcomes into a process dominated by probabilistic assessments (approach 1) or vice versa; or researchers focused on plausibility (approach 2) struggling to engage with a process focused on imagining alternative desirable futures (approach 3).

However, more deliberate and complementary combinations can also be imagined. For instance, an anticipation process may take as starting point a "multiple future worlds" approach (3) to imagining the future development of human societies and technologies, but then use a "multiple plausible trajectories" or even "most probable future" approach (approaches 2 or 1) to population or climate change projections. In this way, those involved in a process may choose to assign plausibility or likelihood assessments to specific drivers, which then feed into the imagining of more radically pluralistic worlds (Vervoort et al., 2015). Finally, when considering complementarities, there is much potential for work that falls under the critical and interrogative approach 4 to open up reflective spaces for the other approaches. Critical approach 4 can identify and create

new spaces for imagined futures, and for the inclusion of new groups of societal actors and their perspectives. For instance, Low & Buck (2020) investigate the extent to which responsible research and innovation (RRI) perspectives are an attempt to bring insights relating to performative futures (approach 4) to enrich approach 2's focus on enhancing societal preparedness and adaptive capacities.

Related to this, our mapping also serves to highlight that the scholarly perspectives that underpin the four approaches identified here vary in their degree of engagement with anticipatory governance on the ground. Thus, we see our categorization as useful not only because it helps to identify similarities and differences across scholarly engagement with concepts of anticipation and anticipatory governance, but also because it can serve as an analytical lens to assess ongoing *practices* of anticipatory governance that are now underway in various global contexts.

In doing so, a number of questions merit further scrutiny. For instance, an important first-order question is: what types of anticipatory practices are dominant in and around policy processes, and which conception of the future do they take as a starting point? What are the desired ends of engaging with anticipatory governance in policy environments? Our own experience working with anticipatory climate governance processes in the field indicates that approach 1, focused on mitigating future risk, is far more common in policy environments than any of the other approaches – since it connects more with dominant, pre-existing conceptions of the future among policy makers, in terms of likelihood and risk, as well as with their interest in the development of long-term plans with predictable outcomes. In a similar finding for the specific domain of climate engineering, Low and Schäfer (2019) indicate that participatory foresight associated with what we characterize as approaches 2 and 3 here still plays a minor role in research on futures, when compared to probabilistic modelling.

If this is the case, what opportunities are missed in the relative lack of prevalence of the approaches 2, 3 and 4 in practice? What impact might a greater mainstreaming of these other approaches have on anticipatory governance practices, in terms of the inclusion of more plausible context scenarios, more fundamentally pluralistic desirable futures, and more critical investigation of the basic assumptions underpinning anticipatory governance practice? What preconditions would be needed for this, in terms of the future-related skills, backgrounds, and conventions of those involved in climate and sustainability governance? Questions raised about different approaches in practice are very relevant also in climate-vulnerable regions of the developing countries, where anticipation processes are proliferating in climate policy and planning but have not

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been much researched (but see Biermann & Möller, 2019; Macnaghten et al., 2014; Shi et al., 2016; Vervoort & Gupta, 2018).

Finally, it is important to consider that while we believe the four approaches to anticipation identified in this paper cover the breadth of what can be found in diverse relevant literatures, this does not mean that other approaches to anticipation cannot be imagined. It will be worth investigating what other, entirely distinct approaches might be possible, and what such approaches might yield in addressing significant sustainability and climate challenges.

Our identification of four approaches to anticipatory governance allows for better scrutiny of such proliferating practices of anticipation in climate policy and planning contexts around the world. Our aim here has been to further understanding of their nature and implications for research and policy-making, and how they prioritize a range of present-day actions in the effort to realize diverse visions of transformative, climate-safe futures. Finally, we see our framework as offering the potential for reflexive interdisciplinary communication across a range of anticipation and anticipatory governance research communities, in order to clarify linkages and explore synergies between these approaches.

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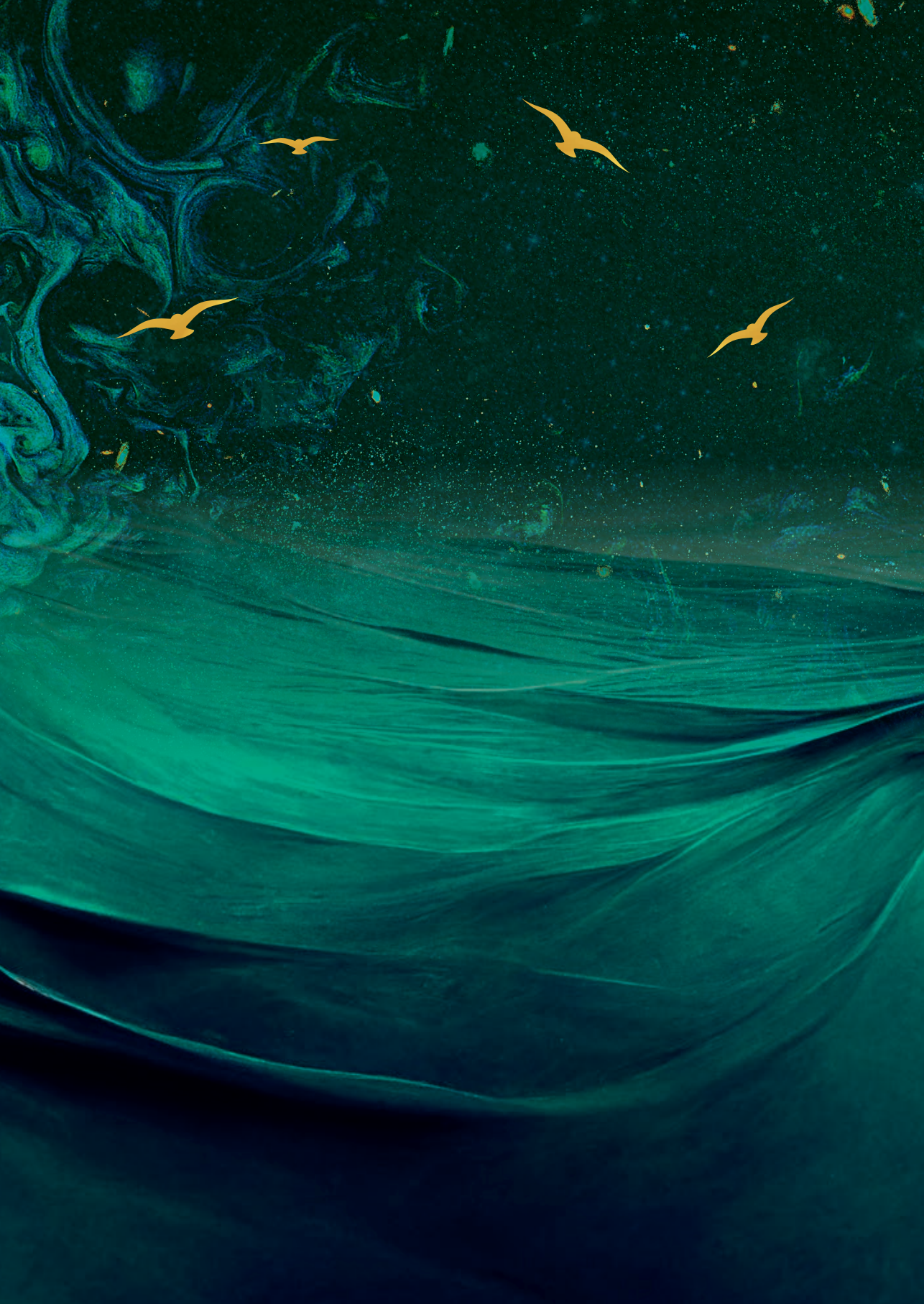
CHAPTER 3

Approaches to anticipatory governance in West Africa

How conceptions of the future
steer climate action in the present

3.1. Introduction

The adoption of the Paris Agreement served as a catalyst for many countries to gain support for addressing their climate futures (Jordan et al., 2018; Sova et al., 2015a). Many anticipation methods and tools are used to explore climate futures below a 1.5-degree temperature increase (Mason-D'Croz et al., 2016; Vervoort et al., 2014; Riahi et al., 2017). Anticipation is a broad term for processes that explore futures and guide actions in the present (Muiderman et al., 2022) and is commonly associated with formal foresight (see for existing typologies Bradfield et al., 2005; Sardar, 2010; van Notten et al., 2003; Wilkinson & Eidinow, 2008). Foresight typically includes model-based scenarios (van den Berg et al., 2016), participatory scenarios (Hebinck et al., 2018), back-casting (Quist et al., 2011; Robinson et al., 2011), and formal visioning processes (Wiek & Iwaniec, 2014). But methods such as vulnerability and impact assessments, cost-benefit analysis, risk analysis and technology assessments are also used to explore futures and inform action in the present (Muiderman et al., 2020; Turnpenny et al., 2015).

With the growing focus on anticipation is parallel concern is growing of the extent to which the future is subject to steering (Vervoort & Gupta, 2018). Anticipation practitioners often do not specify their conceptions of the future and how they hope to intervene in governance contexts (Henrichs et al., 2010; Muiderman et al., 2022). However, futures are neither determined, nor fully open (Urry, 2016); assumptions about the future shape how we visualize the future and decide upon the future in the present, such investments in certain sectors and prioritization of groups (Vervoort & Gupta, 2018; Granjou et al., 2017). Consequently, acting on some futures can have destructive effects on other futures (Paprocki, 2019). Examples include the image of a desiccating Sahel that slowed down international responses to the extreme rainfall and floods in 2010 (Tschakert et al., 2010; see also Hulme, 2001; Batterbury & Warren, 2001), or policies promoting biofuels that resulted in land grabbing in Ghana (Tsikata & Yaro, 2011). Futures work has also been criticized for maintaining dominant belief systems (Andersson, 2018; Urry, 2016), particularly those of the Global North (Appadurai, 2013; Escobar, 2020; Sardar, 1993).

It is thus important to examine *how* conceptions of the future steer actions in the present, particularly beyond the Global North. The lens of anticipatory governance allows for such scrutiny. Anticipatory governance means, most broadly, the governance of uncertain futures in the present (Vervoort & Gupta, 2018). Consequently, it takes an explicit future-orientation in sustainability governance debates. A research agenda on anticipatory governance is growing but has largely ignored the Global South (Macnaghten et al., 2014; Vervoort & Gupta, 2018). More generally, global sustainability governance has remained western-oriented (Sénit & Biermann, 2021) and countries in

the Global South rely on western science and technologies to govern climate futures (Akamani, 2016). This points to an urgent research agenda and the aim of this paper: to examine the conceptions of the future in methods and tools of anticipation and how they impact actions in the present to govern climate futures in the Global South.

This paper examines anticipatory governance processes in a climate-vulnerable context - West Africa. Addressing the research gap in this region is important and urgent because West Africa is considered one of the world's regions that will be most impacted by climate change (Heinrigs, 2010; Lee et al., 2021; Niang et al., 2014; Sylla et al., 2016), least able to cope with its impacts and largely dependent on international donor funding to govern climate change (Noblet et al., 2018; Tschakert et al., 2016; Yaro & Hesselberg, 2016). In this context, processes of anticipation are examined using a recently developed analytical framework on anticipatory governance. The framework identifies four distinct approaches to anticipatory governance in terms of their conception of the future, implications for the present and ultimate aims (Muiderman et al., 2020). This paper is the first application of the analytical framework to this domain. Consequently, it provides important empirical insights into how conceptions of the future steer climate action in the Global South, and in West Africa in particular, and contributes to the conceptualization of anticipatory governance.

3.2. Four approaches to anticipatory climate governance

Anticipatory governance is a concept that is growing in prominence in the social sciences and interdisciplinary sustainability sciences to examine futures work. Scholarly fields include research and innovation, science and technology studies, transition and transformation studies, and future studies. These various fields understand the notion from very distinct ontological, epistemological and normative starting points, and not all necessarily employ the term itself (Boyd et al., 2015; Vervoort & Gupta, 2018; see also Fuerth, 2009; Guston, 2014). Therefore, a recent literature review analyzed different understandings of anticipation and anticipatory governance across these different bodies of literature (Muiderman et al., 2020). The authors identify four distinct approaches in terms of the conception of the future, implications for actions in the present and ultimate aims intended to be realized (Muiderman et al., 2020). These elements have often remained implicit in future-oriented processes and as such the framework provides a new lens to address this gap. The four approaches are:

1. **Approach 1: Probable Futures, strategic planning, reducing risks**
The first approach to anticipatory governance draws on perspectives in public policy and planning literature and probabilistic futures studies. It presents futures as scientifically

uncertain and complex, but anticipation processes can assess probable and improbable future risks to inform strategic policy trajectories to reduce future risks.

2. Approach 2: Plausible futures, building capacity, navigating uncertainty

Approach 2 draws on perspectives in responsible research and innovation literature and strands of climate policy and governance. The future is conceived to contain irreducible uncertainties that cannot be ranked in any way. Anticipation processes are used to explore diverse plausible future trajectories in a participatory. This allows for building adaptive capacities and preparedness in the present to diagnose and navigate diverse, uncertain futures as their trajectories unfold.

3. Approach 3: Pluralistic futures, mobilization, co-creating new futures

Approach 3 is primarily identified in futures studies literature and sustainability sciences. It conceives future as embedding multiple future worlds, that are shaped by interaction and diverse interpretations of the world. Anticipation processes can imagine these plural worlds by mobilizing diverse societal actors to collectively develop pluralistic, actionable pathways to generate a new and (more radically) transformed future.

4. Approach 4: Performative futures, interrogation, political Implications

Approach 4 builds on perspectives in science and technology studies, sociology of the future, and critical (global) environmental governance. It envisions futures as imaginaries that are speculative. Anticipation processes can interrogate futures on their performative power, by examining how futures privilege actors, interests and framings to identify their political and material consequences in the present.

As a second step are a set of methods and tools of anticipation mapped onto the framework and this shows that some processes align with given approaches, while other methods and tools cross-fertilize with multiple approaches (see figure 3.1, Muiderman et al., 2020). For example, cost-benefit analysis aligns predominantly with approach 1, while simulation modeling can be used as probabilistic assessment (approach 1) and plausibilistic exploration (approach 2).

In this paper, I argue that anticipation processes contain often-implicit assumptions about the future that steer actions in the present. Therefore, these processes need to be examined for their political implications. I use the four approaches outlined above as heuristics to understand, describe and explain the conceptions of the future embedded in anticipation processes, their implications for actions to be taken in the present and the ultimate aims intended to be realized. In this framing, methods and tools as infrastructures or spaces of connectivity that facilitate the exchange of ideas (Barry,

2020) and are therefore the starting point for this inquiry into anticipatory climate governance in various contexts of Western Africa.
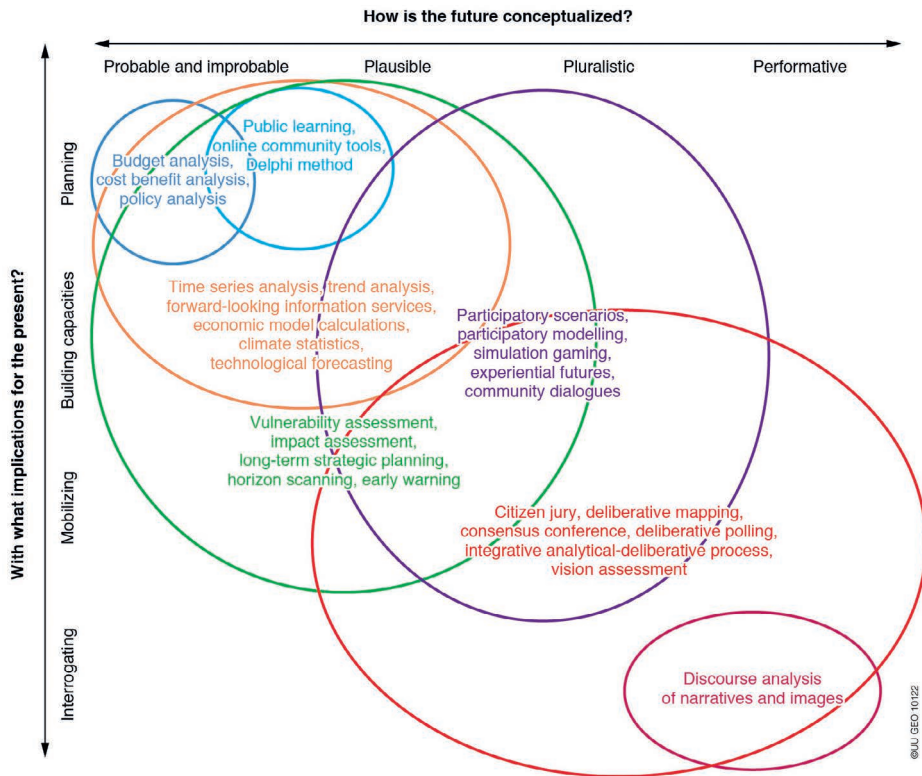
Figure 3.1. Diverse tools and methods of anticipation

Caption: The horizontal axis in the figure visualizes 'the conception of the future' and the vertical axis 'implications for steering in the present'. The circles represent a non-exhaustive set of methods and tools of anticipation for each of the approaches

3.3. Methodology

This section describes the methodological approach to the empirical analysis. I first describe the case study and then explain how data was collected.

3.3.1. Case study region: West Africa

This paper presents a qualitative case study of anticipatory climate governance processes in West Africa using the analytical framework on anticipatory governance by Muiderman et al. (2020). Climate change is projected to have a larger impact on the West African region than elsewhere in the world, particularly in its arid Sahel zone (Sylla et al.,

2016) where land temperatures are projected to rise faster than the global land average (Niang et al., 2014). The region has one of the world's highest poverty, unemployment and illiteracy rates (Heinrigs, 2010). Climate change is considered an important driver of rapid social transformation in West Africa, including urbanization, migration, growth in food imports and price fluctuations (Lambin et al., 2014). Similarly, the social and environmental context is impacted by, amongst others, conflicts, land privatization, encroachment of large-landholders at the expense of community landownership, changing donor policies and priorities and international infrastructural projects (Lambin et al., 2014; Mertz et al., 2012). Consequently, climate change is considered as being a development that quickly pushes West Africa's social and environmental systems beyond their coping capabilities (Heinrigs, 2010; Yaro & Hesselberg, 2016). However, the extent and direction of climate change is considered highly uncertain because of already high seasonal, decadal and regional climate variability (Lee et al., 2021; Niang et al., 2014; Tschakert et al., 2010). Climate data sets that model this region are less complete and climate learning tools more scarce than in the Global North (Tschakert et al., 2016).

Following the ratification of the UNFCCCs Paris Agreement and the Sustainable Development Goals in 2015, international and national policymakers shifted the focus from addressing more present-day climate vulnerabilities to future climate challenges. Countries received, amongst others, support in drafting their National Adaptation Plan (NAP), to articulate medium-term and long-term adaptation needs (UNFCCC, n.d.). Each country follows a different path. Some countries focus on mainstreaming climate adaptation in diverse sectoral plans CGIAR, 2015) and others on integrating across sectors (Akamani, 2016; Sova et al., 2015b; Niang et al., 2014). Thus, a growing focus has been on anticipation processes to support this transition to more long-term future-oriented climate policy development (Noblet et al., 2018; Vervoort & Gupta, 2018). However, anticipation processes are still considered to be ineffectively integrated into policy plans (see e.g. for Senegal Noblet et al., 2018), particularly due to ad-hoc responses at the local level (Niang et al., 2014).

Thus, this study considers West Africa as a region in the Global South where examining anticipatory climate governance is urgently required. For the analysis, five countries in West Africa are considered, which are among the most vulnerable to climate change: Ghana, Niger, Mali, Burkina Faso, and Senegal (Huq & Ayers, 2007). I follow the justification as outlined by Förch et al. (2011), where they emphasize a) high climate impacts and related environmental problems; b) high poverty rates and a population depended on agriculture; and c) employment of anticipation processes. The analysis documents the written statements in 30 process reports and policy documents, and perspectives of 14 interviewees.

3.3.2. Data collection

I consider the type of methods and tools of anticipation as a starting point for the analysis of which approach(es) to anticipatory governance might be taken. Therefore, the first step was to identify methods and tools that have been used to anticipate climate futures in West-Africa that are intended to inform decision-making processes. The aim was to explore their nature and to map how they relate to the analytical framework. The intention was not to cover all methods and tools illustrated in figure 3.1. Therefore, I started my search for research on anticipation processes on Scopus using the following keywords: [country] AND development AND policy AND climate AND change AND future. I read all abstracts and included papers with at least two of the following keywords: future, adaptation, anticipation, scenario, and foresight. This resulted in 11 papers that discussed anticipation processes in the climate adaptation domain. In addition, I looked on Scopus, Google Scholar and Google for national and sectoral policies (e.g., agricultural policies) policies that prioritize climate adaptation, including government websites and UN websites (e.g., adaptation-un.org).

However, since policies were rarely published online, I added a snowball technique as second data collection method. I shared my findings - the list of policies and processes found so far - with several regional experts working on the foresight-policy interface who then provided additional input into the findings. The snowballing started with the regional experts of the Research Program on Climate Change, Agriculture and Food Security (CCAFS) of the Consultative Group on International Agricultural Research (CGIAR). This is a large international network of research institutes that was established in 1971 to achieve future food security and a partner in the research project. Some of their experts helped to identify influential anticipation processes and climate policies. Based on these findings, other experts were contacted, and so on in order to triangulate data and validate findings (Verschuren & Doorewaard, 2010). Selecting anticipatory governance processes thus occurred in a parallel-iterative rather than linear-serial process. Consequently, I learnt more about the case context which helped to select cases (Verschuren & Doorewaard, 2010; Bryman, 2012).

For each country, I set the scope to approximately six prominent anticipation processes and climate policies that had been initiated after 2008. I also included a few processes with a regional orientation (see the 'regional' row in Table 3.1). All climate policies were at the national level. Table 3.1 below illustrates the selected anticipation processes.

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Table 3.1. Documents reviewed and three processes analyzed in-depth (in blue)

Country		Reports and academic articles		Policy documents
Senegal	1.	*Climate models and policy workshops*	1.	Emerging Senegal Plan 2014-2035 (2014)
	2.	Ordered probit model	2.	National Adaptation Plan for the Fisheries and Aquaculture Sector in the Face of Climate Change Horizon 2035 (2016)
			3.	Program of Acceleration of the Cadence of Senegalese Agriculture (2014)
			4.	Prospective Study 2035
Ghana	3.	Participatory scenarios workshop	5.	National Climate Adaptation Master Plan (2015)
	4.	Downscaled climate change scenarios	6.	Shared Growth and Development Agenda II (2014)
			7.	Coordinated Program of Economic and Social Development Policies 2017-2024
			8.	National Climate Adaptation Master Plan (2015)
Burkina Faso	5.	Climate projections	9.	National Climate Adaptation Plan (2015)
	6.	*Participatory foresight analysis workshop*	10.	National Rural Development Plan II (2018)
	7.	Practical consensual tool		
Mali	8.	Cost-benefit analysis	11.	National Strategy for Climate Change and the National Climate Plan of Action (2011)
	9.	Participatory foresight workshop	12.	National Climate Adaptation Plan (2016)
			13.	National Agricultural Investment Program (PNISA) (2015-2025) (2014)
Niger	10.		14.	Nigeriens Nourish the Nigerian Initiative (2012)
	11.		15.	The Strategic Framework for Sustainable Land Management 2015-2019 (2014)
	12.		16.	Sustainable Development and Inclusive Growth Strategy (2035 Vision) (2016)
Regional	13.	Population scenarios and climate scenarios		
	14.	Error correction model		
	15.	Process-based crop model		
	16.	Times series of climatic events		
	17.	*Workshop on climate information and generation*		

As a third step, I examined three processes of anticipation to further analyze the implicit and explicit ways in which conceptualizations of the future impact actions in the present (see the three projects written in *italics* in the grey boxes of Table 3.1). I chose processes that are (a) diverse in terms of the type of method/tool used, but (b) have in common an intention to inform decision-making. This allowed me to analyze (i) if processes align with a given approach or multiple approach and (ii) how conceptions of the future are perceived to relate to actions in the present. The first anticipation process includes the climate models and policy workshops of the African Monsoon Multidisciplinary Analysis (AMMA-2050) program that has supported national climate adaptation planning in West Africa with climate scenarios and policy workshops. The second process is the participatory foresight process of the Future Scenarios Project of the CGIAR research program on Food Security, Agriculture and Climate Change (CCAFS). Here, socio-economic and climate scenarios of a wide range of future drivers of change up to 2050 are developed to guide policy formulation. The third process is the workshop on climate information and generation of the West African Biodiversity and Climate Change (WABiCC) Program. This is a large five-year program in which many future-oriented capacity building activities are organized to support countries in the formulation of National Adaptation Plans (NAPs). This third step in the analysis builds on 14 Skype and online semi-structured interviews with people working on both sides of the anticipation-policy interface. This included at least the designer/facilitator of the anticipation process (e.g., the workshop facilitator, modeler, etc.), an intermediary person (e.g., someone responsible for stakeholder participation and policy engagement), and a policymaker or person responsible for policy follow-up. The interviews were structured according to important topics (based on the analytical framework) yet without a fixed outline, to capture perspectives and frames of the interviewees better inductively.

3.3.3. Data analysis
All data were analyzed in a qualitative case study approach that is suitable to the aim of describing, interpreting, and furthering conceptual understanding of anticipatory governance. The qualitative case study approach is an open way of gathering and triangulating data – in this case the interpretation of texts and interviews. Rather than seeking to give a systematic overview of anticipation processes in a quantitative manner, the aim of this research is to scrutinize anticipatory governance approaches in a narrative type of interpretative analysis. I used several research techniques - literature and document review, snowballing and interviewing - in parallel to iteratively explore and refine the research findings. The dialogue between exploration and discovery of new findings is a seen as a key quality of qualitative case study research (Kleining & Witt, 2000) as it allows for obtaining an in-depth understanding and holistic picture of the research object as a whole (Verschuren & Doorewaard, 2010; Yin, 2003) with sensitivity

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to the empirical complexity (Flyvbjerg, 2006; Hopkin, 2010). As a result, the analysis of (grey) literature on anticipation, policy documents and interviews provided a more holistic picture of the diverse ways in which anticipation processes steer present-day decision-making.

The research presents both an deductive inquiry into anticipatory governance in practice and an inductive inquiry into the utility of the analytical framework based on the practice-oriented research (Toshkov, 2016). The analytical framework guided the research questions. The written statements in the 30 documents were first categorized in two tables: one focusing on the anticipation processes (see appendix A) and on focusing on the policy processes (see appendix B). I examined these documents on the methods and tools of anticipation that had been used, the stakeholders involved and the way in which anticipation was seen to impact decision-making. Then, three processes were additionally analyzed based on perspectives shared in semi-structured interviews to further examine more implicitly embedded conceptions of the future in anticipation processes, their implications for actions in the present and the ultimate aim intended to be realized.

3.4. Approaches to anticipatory climate governance in West Africa

This section presents the findings from analyzing the anticipation processes. Section 4.1. first examines written statements regarding 30 anticipation processes on the types of methods and tools used, the stakeholders involved and the way in which anticipation was seen to impact decision-making. Section 4.2. analyzes written and spoken statements on three diverse processes regarding their conceptions of the future, implications for actions in the present and ultimate aims intended to be realized.

3.4.1. Anticipation processes and decision-making

3.4.1.1. Anticipation in research and practice

The statements in anticipation research and practice illustrates that a combination of multiple and diverse methods and tools are used in a single project (see appendix 31 for details). Processes include primarily quantitative scenarios that asses probable (and improbable) futures based on the modelling of crop-, macroeconomic or climatic trends (see e.g., Burkina Faso's National Climate Adaptation Plan, Ministry of Environment and Fishery Resources, 2015). These scenarios are sometimes used as standalone processes (see e.g., the SARRA-H model in the Sudanese and Sahelian savannas), but are often combined with participatory processes such as policy workshops (e.g., AMMA-2050 in Senegal). In addition, a few qualitative participatory scenario methods focused on exploring multiple plausible futures with diverse stakeholders: academia, policy, private sector, and civil society.

Almost all processes were organized and funded by international donor organizations (e.g., the World Bank, UNDP and NEPAD), national donor governmental agencies (e.g., USAID and DFID), and research and development institutes (e.g., CIRAD and CGIAR). These organizations collaborate with West African partners such as ministries and research institutes to co-design the processes and involve more stakeholders. West African governments sometimes requested donor organizations to design a process. (e.g., the Burkina Faso government asked CCAFS). Only two processes seemed to be fully designed by African organizations (but funding information was not provided for one of these two).

Statements about the way in which anticipation should inform decision-making differ in levels of explicitness. Particularly the more quantitatively and prediction-oriented forms of anticipation (e.g., the error correction model of the University of Ghana) provide recommendations without making explicit how those should inform decision-making. Some state the intention to inform decision-making without specifying a policy process (e.g., the practical consensual tool of the Institut d'Application et de Vulgarisation en Sciences). Others involve policymakers early in the design of the process to foster policy uptake without specifying how and where recommendations should be used (e.g., the Climate projection of AMMA-2050). Finally, a few processes state the intention to be designed specifically to guide formulation of a specific policy process (e.g., the CCAFS Scenarios workshop in Burkina Faso). Anticipation practitioners much more clearly describe the design of the process than how they aspire to intervene in policy and governance contexts.

3.4.1.2. Anticipation in policy documents

Reviewing policy documents presents a bit of a different picture (see appendix 3.2 for details). Visioning processes are primarily used as a starting point instead of quantitative scenarios. As such, a vision for the country is set to a specific time horizon and policy priorities and ambitions are determined for reaching this vision. Visions can be based on more formal deliberative processes to include perspectives of various stakeholders (e.g., Niger's Strategic Framework for Sustainable Land Management). However, visions can also be considered to have been legitimized during elections (e.g., Ghana's Coordinated Program of Economic and Social Development Policies). Visioning processes are rarely standalone processes and are complemented with formal or informal back casting approaches that help determine short, medium, and long-term interventions (e.g., the Emerging Senegal Plan). Furthermore, visions are often combined with model-based scenarios to assess macroeconomic trends (e.g., Ghana's Shared Growth and Development Agenda II) or climatic trends (e.g., Senegal's National Adaptation Plan for the Fisheries and Aquaculture Sector in the Face of Climate Change Horizon 2035).

Other combinations include a strategizing tool (EIDOS, Mali), and participatory scenario analysis that was quantified in a policy simulation tool (Threshold21, Senegal).

Policy documents mention to rely on donor funding for the design and implementation of anticipation processes, but such information was not as detailed as in the reports and literature. For example, anticipation processes were often stated to have been initiated by the national government without specifying the department and its funding partners. In addition, there is generally little information about the design of the process and how its recommendations were used to inform decision-making was generally; and when provided, it was scattered throughout the policy document. Most clear accounts of the use of anticipation were the publication of quantitative scenarios in figures and graphs, but for participatory processes is it much more difficult to trace how recommendation informed decision-making.

3.4.2. Three processes: conceptions of the future, implications for actions in the present and ultimate aims

The section now moves onto an examination of three processes that are diverse in terms of the type of methods and tools used but have in common an intention to inform decision-making. This allows for analyzing if anticipation processes align with a given approach or multiple approaches to anticipatory governance. Additional interviews were conducted to complement the analysis with perspectives regarding often-implicit conceptions of the future, implications for actions in the present and the ultimate aims intended to be realized.

The first process is the West African Biodiversity and Climate Change (WABiCC) Program, a large five-year program where many future-oriented capacity building activities are organized to support countries in the formulation of National Adaptation Plans (NAPs). The process was initiated and designed by Tetra Tech ARD in association with Palladium, the Center for International Earth Science Information Network (CIESIN) of the Colombia University, PCI Media, Pact Inc and Born Free USA, and funded by USAID. In 2018, WABiCC organized a series of workshops facilitated by CIESIN (Columbia University) in West African coastal countries (Cote d'Ivoire, Ghana, Guinea, Liberia, Sierra Leone and Togo) to deliberatively discuss how climate information, generation and use could be improved in policy trajectories for future climate adaptation and coastal resilience. In its 2018 workshops series in West African coastal countries, WABiCC focused on improving the access to and understanding of high-quality portals and models. Participants worked for the meteorological services, ministerial departments (including water resources, agriculture, climate change, agriculture, food security and energy), the Environmental Protection Agency. During the workshops,

climate scientists presented key (global) portals that give access to climate projections, after which participants self-reviewed and peer-reviewed key departmental policies on the quality of and gaps in climate information.

The second process is the Future Scenarios Project of the CGIAR research program on Food Security, Agriculture and Climate Change (CCAFS). In this process, socio-economic and climate scenarios are developed to guide policy formulation. The process was initiated by CS-CSPA, the Ministry responsible for the PNSRII. In 2016, the government of Burkina Faso invited CCAFS to run a participatory scenario process to guide the reformulation of Burkina Faso's second National Plan for the Rural Sector (PNSRII, 2016-2020) after its precursor had come to the end of its term. CGIAR funded the process. Diverse stakeholders were included: research institutes, governmental bodies, civil society and private sector. Stakeholders explored a wide range of possible environmental, future economic, political, geopolitical, social and cultural changes up to 2050 and discussed their dynamics. The two most salient drivers were then mapped onto two axes that formed the basis for four diverse scenarios.

The third is the African Monsoon Multidisciplinary Analysis (AMMA-2050) program that has supported national climate adaptation planning in West Africa with climate scenarios and policy workshops. The process was initiated and designed by the African Monsoon Multidisciplinary Analysis (AMMA-2050) and funded by DIFD (Future Climate for Africa). The AMMA-2050 program developed multiple quantitative scenarios of diverse future trends, based on crop and convection permitting modelling. These were discussed in policy workshops, amongst others with the West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL) in Ouagadougou, Burkina Faso (WASCAL & AMMA-2050, 2018), as well as through a collaboration with research organization Climate Analytics (funded by the German Ministry of Environment and GIZ) who organized several workshops at national and district levels, including a participatory scenarios workshop. Participants to these workshops were researchers and local and national policymakers.

3.4.2.1. WABiCC climate information workshops

Conception of the future: WABiCC focused on understanding scientific uncertainty inherent to climate modelling over longer time horizons as well as the disagreement between prominent climate models on the direction of climate change (Interview, 19 March 2019). This is needed as the West African Sahel zone is marked by trends of both dryer and wetter climate, and the natural variability makes it harder to detect climate change. Moreover, detecting local temperature changes is much more difficult than

global ones. It is considered that by contrasting multiple models scientific uncertainty about the direction of change can be reduced.

Implications for actions in the present: WABiCC work sought to align its work with the NAP process in particular: "We want to help them [policymakers] to better understand how they can better structure the process and make sure that their views are updated with accurate information to do the NAP" (Interview, 04 October 2018). Through its workshops, WABiCCs intended to build institutional capacities to generate, use and manage climate information. This included changing the mind-sets of policymakers to learn to plan under scientific uncertainty in the absence of objective data and rely on 'robust enough' data and interaction with external experts. Capacity building concerns focused amongst others on the national meteorological services who have been underfunded since the countries' independence.

Ultimate aim: WABiCC aimed to increase preparedness and resilience to future climate risks.

3.4.2.2. CCAFS participatory scenarios

Conception of the future: The Future Scenarios Project pointed to the fundamental uncertainty of the future and developed a participatory scenario process that explores a wide range of plausible futures according to stakeholders from public and private sectors. The scenarios narratives were developed in a consensual fashion.

Implications for actions in the present: The scenarios served as a tool for strategic policy planning and investment decisions and to this end CCAFS engaged directly with the PNSRII policy processes. The recommendations intended to make the policy more robust to multiple uncertain future directions as perceived by a variety of stakeholders. It considered to be of great value:

> "By getting stakeholders on board it allows for discussing policy priorities. The scenario process was seen as something coming from external, it is not a national process per se, it's CCAFS who's leading it. As such, people are just try to be honest, transparent between each other vis a vis the process - seeing the scenario as the common agreed consensual process to undergo the identification of actionable recommendations." (Interview, 08 October 2018).

The PNSR II was believed to have been significantly improved by the processes. However, the document does not explicitly describe the process nor its impact on

policy reformulation. The deliberative approach to scenario building was considered too political to write in the document.

> *"If you go through the current version of the PNSR, you will hardly see a clear recommendation as it was highlighted through the scenario processes. This means that to really see the implication you have to read thought the lines. [...] The way of wording things in the policy doc cannot be as clear as from the recommendations. And we are not the only contributors. So, in a political way they'll go for a more diplomatic way. But definitely, I think that it has a large impact. They won't mention - thanks to the scenario process, we were able to do this etc… - it's not the right jargon"* (Interview, 08 October 2018).

Ultimate aim: The SP/CPSA wanted to obtain technical expertise on how to mainstream climate adaptation measures into rural development sectors, but the Futures Scenarios Project aimed to introduce more fundamental uncertainties to predication-oriented policymakers and increase the reflexive navigation of futures.

3.4.2.3. AMMA-2050 climate scenarios and policy workshops

Conception of the future: AMMA-2050 focused on "*a science understanding of climate change using data from convection permitting modelling of future scenarios*" and "*provide key messages about what we can confidently say about a changing climate in West Africa*" (Communication, 22 March 2019). This was partly driven by data scarcity: "*In Senegal we didn't have a good quality of data [...] the national meteorological office do a little bit of climate projections but only since the last 10 years*" (Interview, 19 April 2019).

Implications for actions in the present: AMMA-2050 intended to build institutional capacities for promptly using scientific information on future climate variability for medium-term development planning processes (WASCAL & AMMA-2050, 2018). This focus was partly due to its donor:

> *"The most important thing for the BMU, the ministry of environment in Germany, was the capacity building. We do capacity building [they said]. That was very specific for this project, a lot of work, but really good to do it "*(Interview, 19 April 2019).

From the onset, they sought to engage with policymakers to use the climate projections in support of identifying long-term adaptation options (Visman et al., 2017). As part of this effort, AMMA-2050 collaborated with Climate Analytics who used the AMMA-2050 data to produce vulnerability reports and organize policy workshops (Bah et al., 2019; Faye et al., 2019; Sadio et al., 2019). Climate Analytics organized, amongst others,

a participatory scenarios workshop to improve "*policymakers' understanding of climate science for better long-term science-based decisions*" (Interview, 19 April 2019). The Secretary General of the Ministry of Environment and Sustainable Development underlined the policy relevance of the project in a public video (PAS-PNA - Science-Based National Adaptation Planning in Senegal, n.d.), but at the time of research low institutional capacities were delaying the mainstreaming of outcomes into national, sectoral, and regional policies.

Ultimate aim: AMMA-2050s aimed to identify climate vulnerabilities and reduce climate-related risks.

3.5. Discussion and conclusions

In this article, I analyzed anticipation processes in a climate vulnerable context of the Global South – West Africa. These processes are examined through an analytical framework that identifies four approaches to anticipatory governance in the social science and interdisciplinary sustainability sciences (Muiderman et al., 2020). Each of the four approaches in the framework embed a different: a) conception of the future; b) implication for actions in the present; and c) ultimate aim to be realized with anticipatory governance. The framework further illustrates that some methods and tools of anticipation generally align with a given approach and others with multiple approaches. Two key findings emerge from the analysis that are discussed here.

The first insight identified is that the anticipation processes often complement multiple methods and tools of anticipation aligning with approaches 1 and 2. Quantitative scenarios and visioning processes are most often used to imagine futures, as well as a few participatory scenario exercises. These methods and tools are used in combination with diverse participatory processes (such as policy workshops) to discuss impacts and adaptation options. The two dominant approaches are used in several hybrid forms, as illustrated by the three examples examined in detail. The first WABiCC process is fundamentally probability-focused and conceives future uncertainty as something that can be reduced to arrive at a most likely future, as associated with approach 1. The intended actions in the present are building institutional capacities for planning under scientific uncertainty, which is approach 2 in service of 1. The ultimate aim is to increase resilience to future climate risks, which combines the aims of approaches 1 and 2. The second CCAFS process explored plausible futures, as associated with approach 2. The actions for the present and the ultimate aim also aligned with approach 2 from the practitioner's perspective, namely to strategize robust planning processes to navigate future risks more reflexively. However, from the policy perspective anticipation informed strategic planning to reduce future risks, as associated with approach 1. Finally, the

AMMA-2050 process assessed probabilistic future processes, which is associated with approach 1. The process seeks to develop a science-based understanding of climate adaptation strategies, which is approach 1 action with language borrowed of 2. The aim is to reduce future risks, also associated with approach 1. This hybridity is an important finding, as it indicates that the fundamental assumptions underpinning the approaches are mixed. The three examples illustrate that anticipation processes can start from one conception of the future (probable or plausible) to inform actions in the present that combine approaches 1 and 2, and sometimes also to realize such combined aims. Nevertheless, there is a tendency to formulate actions in a more technocratic way – as shown by the dominance of approach 1 over approach 2, and absence of approaches 3 and 4. This absence is the second key insight.

3.5.1. Conflicting assumptions within hybrids of approaches 1 and 2

The hybrid approaches thus recognized the deeper uncertainties and complexities of futures to some extent, but predominantly propose linear and technocratic forms of actions to reduce future risks as most viable and desirable intervention in the present (approach 1). For example, actions to build capacities focused on supporting institutions to 'get the science right' - seeing capacity building as a vehicle for better knowing and managing climate risks (see e.g. AMMA-2050, n.d.; USAID, 2017) rather than for a better navigation of diverse uncertain futures, as associated with approach 2. Fundamental uncertainty is reduced to risk – which assumes that a more objective and calculable account of the future is possible (Maechler & Graz, 2020). This clashes with the principles of the plausibilistic tradition (approach 2), which depicts future uncertainty as incalculable, and in demand of some form of subjective judgement (Andersson, 2018). The actions proposed for the present assume that the future can be made partially knowable and manageable – which conflicts with recognizing deep uncertainty. Language is thus used of approach 2 but its principles are abandoned.

The role of stakeholders in participatory processes also epitomizes the dominance of approach 1 over approach 2 in the hybrids. Most projects had a participatory component but the dialogue about future possibilities was relatively closed. For example, the WABiCC process aimed to transfer knowledge from experts to policymakers. This relates more to approach 1 than to approach 2, which would be more of an open dialogue and knowledge exchange about possible futures (Wiebe et al., 2018), or approach 3, which would be the co-creation of alternative futures, or an approach 4 type of critical examination of anticipation. The participatory scenario exercise by Climate Analytics and AMMA-2050 sought to improve policymakers' scientific understanding of climate change (approach 1). Thus, participatory approaches to anticipation do not necessarily aim to give participants agency over *how* and *what* futures are imagined, as associated

with approaches 3 and 4. Instead, they ask participants to help determine politically sound pathways from expert-based future possibilities. Such statements were made Burkina Faso's National Climate Adaptation Plan: "stakeholder empowerment is essential for successful implementation and behavioral change" (Ministry of Environment and Fishery Resources, 2015, p. 59), using the term empowerment in a paradoxical way - to advance buy-in of adaptation measures.

For approach 2 in particular, researchers have argued that a lack of full engagement with what is associated with approach 2 here can result in inadequate efforts to build the adaptive capacities of those whose futures are at stake. Others also argued that by focusing primarily on a technology transfer of capacities one does not really connect to the local institutional context (Croxatto et al., 2020) and may constrain policy processes (Dessai et al., 2009). Several interviewees indeed pointed to such challenges, for example, they encountered a lack of institutional capacities to implement the recommendations from anticipation processes as to how to build exactly those institutional capacities (e.g., in the case of the meteorological services). In short, while the examples in this study point to a dominance of a technocratic orientation in the hybrid of approaches 1 and 2, there are several issues that may arise when in practice, as the framework helps bring to light. Alternatively, participatory approaches with agentic perspective, as associated with approaches 3 and 4, as seen to provide opportunities for building local learning spaces for anticipatory capacities (Tschakert & Dietrich, 2010) and such new configurations of approaches are important to explore.

3.5.2. Placing politics central in anticipatory governance

The absence of approaches 3 and 4 has several implications for the anticipatory governance of climate change in West Africa. Approach 3 helps engaging with the constructed nature of futures by mobilizing new coalitions of actors who can co-create more radically transformative futures (Hajer & Versteeg, 2019; Mangnus et al., 2019), for example, in experimental and experiential methods (Candy & Kornet, 2019; Vervoort et al., 2022). In addition, approach 4 helps in the interrogation of visions of the future, by seeing anticipation as an inherently uncertain and normative process and a site of conflicting social interests (Urry, 2016). Anticipation can open up critical dialogue about what futures to engage with and make futures work more reflexive (Bellamy, 2016; Mangnus et al., 2021). Both these approaches accommodate maintaining more open-ended governance commitments, a focus on future risks as calculable and manageable (approach 1), which tends to reveal the contested nature of anticipation (Andersson, 2018; Gupta, 2011). As such, approaches 3 and 4 address the political role of science in informing decision-making about the future – since decisionmakers often turn to science for guidance on policy issues that are most uncertain and where political

stakes are high (Jasanoff, 1987). The processes in this study illustrate how scientific and the policy process are considered as separate processes; scientists focus on getting the science 'right' and decision-makers can focus on making science-based decisions. Another example is that decision-makers are considered to have a normative vision for the country aligning with existing policy agendas and turn to anticipation for quantitative expert-based future scenarios. As such, the political process (normative) is separated from the scientific process (descriptive and quantifiable). Consequently, climate anticipation and decision-makers each consolidate their authoritative power (Shackley & Wynne, 1996) instead of pointing to the ways in which epistemic authority is used to legitimize and steer policy choices (Gupta & Möller, 2018; Jasanoff, 2004). Stakeholder deliberation is considered pivotal to legitimately making decisions about uncertain futures (Boyd et al., 2015). However, the contested nature of future engagements is often concealed. For example, a process of concealing occurred when deliberate forms of anticipation processes were considered to be subjective judgements and less transparently communicated; this was done to not frustrate the decision-making process. In general, the policy documents analyzed lacked transparently regarding how the outcomes of participatory foresight processes were translated into the document. By contrast, visualizations of quantitative scenarios (visualizations such as graphs and descriptions of model-based climate scenarios) are frequently used to legitimize policy choices. Interviewees referred to a process of depoliticization of subjective outcomes of participatory anticipation. What are essentially value-laden choices are turned into so-called 'rational choices' (Andersson, 2018). Most importantly, the findings illustrate that also much participatory anticipation lack an agentic perspective, where those who are affected by change have the ability to determine what the future may look like. In addition, Tschakert & Dietrich (2010) also argued that participatory approaches without agentic perspective, as associated with approaches 3 and 4, miss opportunities for building local learning spaces for anticipatory capacities. These findings point to important blind spots in the anticipatory governance of climate action in West Africa.

3.5.3. Consequences for anticipatory climate governance in West Africa
The ways in which approaches 1 and 2 are used in hybrid form might be specific to West Africa, and climate change decision-making especially. Researchers have pointed to the greater scientific uncertainty of climate change in West Africa than elsewhere in the world due to decadal and seasonal variability (Niang et al., 2014), which has drawn in the international community to increase scientific certainty about future climate change. Temperatures are expected to rise faster compared to global averages (Niang et al., 2014; Sylla et al., 2016) and the ability to cope with its impacts lowest (Yaro & Hesselberg, 2016). Researchers and decision-makers have thus called for anticipation that reduces scientific uncertainty and builds institutional capacities for anticipating

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those risks. The challenge is thus great and the implications huge for a region that this already severally impacted. Nevertheless, the findings in this study identify that in the search for a more future-oriented governance of climate change, it is important to create equal opportunities for imagining and shaping futures. Such ambitions have been set in the Paris Agreement, the Sustainable Development Goals, the National Adaptation Plans and the African Union's Agenda 2063 (African Union, n.d.), to which many of the projects included in this research aim to contribute to.

However, rather than making futures more inclusive, anticipation practitioners and researchers run the risk of making anticipation an exclusive process, determined by Western science and technical expertise, which consequently includes out local worldviews and needs. Scholars have argued that anticipation often represents imagines of the world that are based on western science and western notions of what a modern society should look like in the future (Escobar, 2020). These visions are often very differently visualized by local communities (Paprocki, 2019). Therefore, questioning if anticipation processes tap into existing power imbalances or exacerbate them is important. Particularly in places with weak regulation and high scientific uncertainty of climate change impacts, are the places where international organizations are considered to have more authoritative knowledge and are consequently more powerful in shaping policy discourses (Boamah, 2014). There is an urgent role for the international community that is involved in shaping climate futures to approach anticipation in ways that open up and democratizes futures (Macnaghten et al., 2014).

However, this study points to tendencies to depoliticize anticipation. Such findings endorse and complement research in other contexts that pointed out that international organizations rather distance themselves from their political role and prefer apolitical claims (Kothari, 2005; Louis & Maertens, 2021). The work of international organizations is inherently political as they are involved in shaping global problems, but they interpret the world's most pressing problems in technical ways – trough quantification and categorization that portray knowledge as value-free - and meet them with technical solutions and assistance (Louis & Maertens, 2021). It is thus important to give approaches 3 and 4 a more prominent place in efforts to create more inclusive and equitable climate futures. While the other approaches each propose some form of stakeholder deliberation, provide approaches 3 and 4 more agency to stakeholders, and the fourth uses anticipation solely for the purpose of shedding light on power imbalances, as these futures create expectations and actions through which power imbalances further materialize. Examples include the overreliance on western science and technology which is seen to have left little room for the integration of local knowledge in climate governance and have had reverse effects on societal transformation (Eriksen et al., 2011; Akamani, 2016).

Particularly the focus on technological solutions for climate change have paralyzed societal mobilization in West Africa (Brockhaus et al., 2012) and marginalized issues of power and equity (Tschakert & Dietrich, 2010).

3.5.4. Reflections on the framework

Applying the analytical framework on anticipatory governance has helped to identify implicit conceptions of the future and examine their implications for actions in the present. The anticipation processes were an important entry point for the analysis, as these are sites where the material (goods and people) and immaterial meet (ideas and visions of the future). Various excellent typologies exist on different types of anticipation processes (see e.g. van Notten et al., 2003; Loveridge & Street, 2005), combinations of processes (Henrichs, et al., 2010; Wiebe et al., 2018), or their role in decision-making (Turnpenny et al., 2015) to which the framework adds insights into implicit conceptions of the future as they are embedded in anticipation processes and their steering effects. As such, I saw the anticipation processes as spaces of connectivity through which past experiences connect to future imaginations and ideas materialize (Urry, 2016).

Applying the framework to the West African context addressed an important empirical gap and provided new insights into the steering effects of future visions. It can be seen as a first step in opening up new research agendas on the political role of international organizations engaged in anticipation processes. Future research can look into the ways in which future visions reassert western authority (Kothari, 2005) or may colonize the future (Feola, 2019; Gram-Hanssen et al., 2022). Given the interdisciplinary research context in which anticipatory governance processes take place is the framework helpful for anticipation practitioners to become more aware of their political role and make more explicit what (hybrid) approaches to anticipatory governance are used and the implications for actions in the present.

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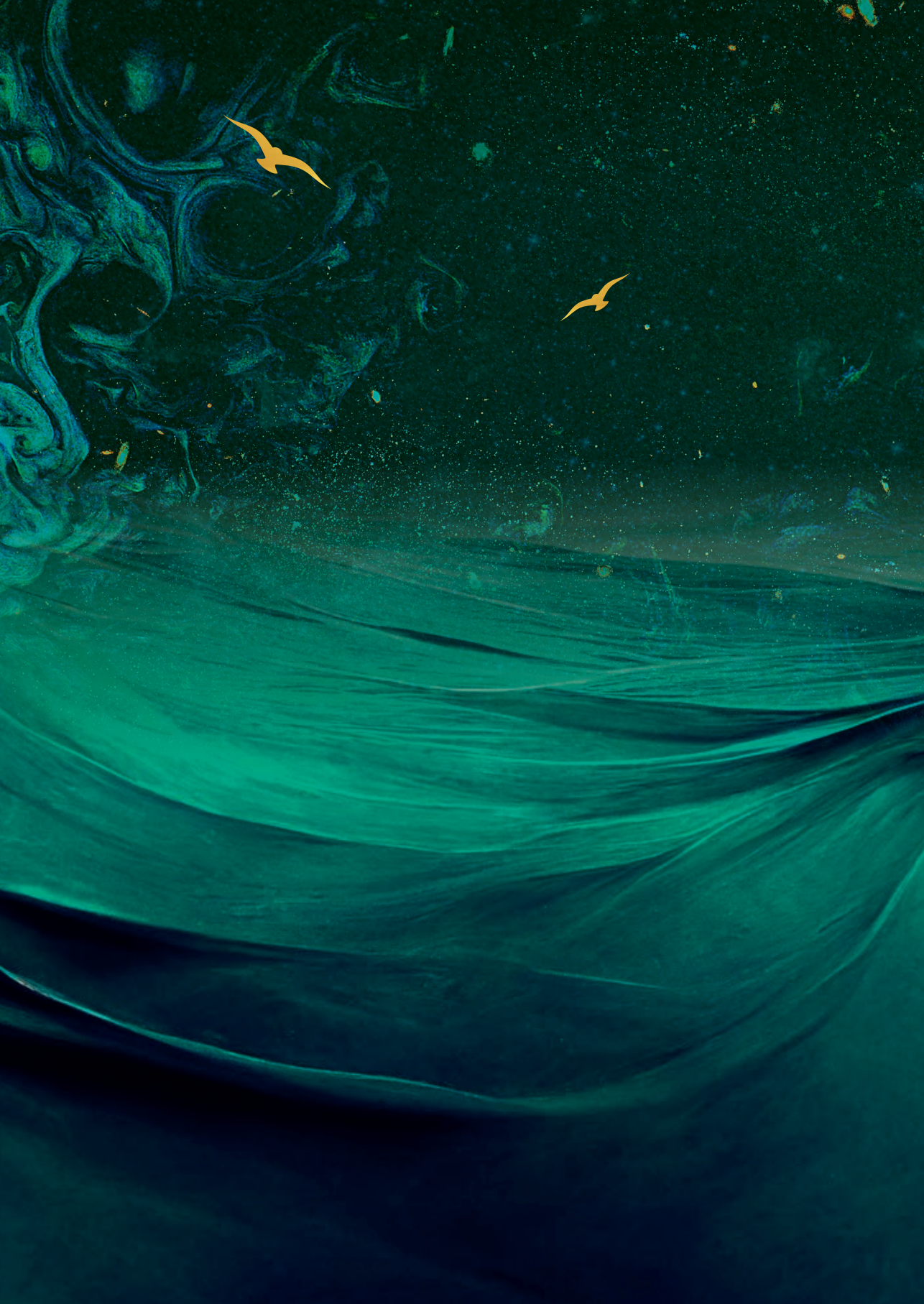
CHAPTER 4

Anticipatory governance
of sustainability transformations

Hybrid approaches and dominant perspectives

4.1. Introduction

Diverse anticipation methods and tools have been used for decades across different domains - increasingly to support strategy and action toward sustainability transformations (Henrichs *et al.*, 2010; Wiek *et al.*, 2012; Pereira *et al.*, 2019). *Anticipation* can be understood as a general term for formal or informal processes that attempt to make sense of uncertain futures (Vervoort & Gupta, 2018). Foresight methods and tools are most commonly associated with anticipation processes, including, amongst others, scenario planning, visioning and back-casting, horizon scanning, and gaming (Swart, Raskin and Robinson, 2004; Jordan and Turnpenny, 2015; Wiebe *et al.*, 2018). Other methods and tools not commonly labelled foresight can nonetheless be anticipatory in character, since they explore futures in order to inform policy processes in the present. These include, among others, risk assessment, environmental impact assessment and real-time monitoring of changing sustainability conditions with an explicit future-orientation (Rogers, 2011; Fazey *et al.*, 2015). *Anticipatory governance* as a concept refers to governance processes in the present that seek to use anticipation to engage with uncertain futures in order to guide action in the present (Vervoort and Gupta, 2018; Burch *et al.*, 2019; see also Boyd *et al.*, 2015; Fuerth, 2009; Guston, 2014). A research agenda on anticipatory governance has emerged from across critical social sciences research traditions, including science and technology studies, responsible research and innovation, and environmental policy and governance (Muiderman et al. 2020). Salient questions brought up include: whose visions are articulated in anticipation processes, what kind of futures they point to and how these visions have implications for actions in the present (Vervoort and Gupta, 2018)?

Sustainability transformations take place through interconnected and often messy (non-linear) dynamics between environmental, societal, technological and economic systems (Patterson *et al.*, 2017). One key sustainability challenge is transforming the food system to a more sustainable system - both in terms of human and planetary health (Herrero *et al.*, 2020). The framing of 'transformation' is inherently anticipatory as it shifts the focus of practitioners and policymakers to envisioning more sustainable futures and identifying pathways for actions in the present to achieve transformational change (Feola, 2015; Patterson *et al.*, 2017; Burch *et al.*, 2019). In this context, structured, deliberate anticipation processes are considered particularly useful for engaging with the non-linearity and boundary-spanning structure of complex system change through their exploration of relationships between a wide range of drivers of change and the broadening of perceptions of what is possible (Habegger, 2010; Pérez-Soba and Maas, 2015). Just like other key sustainability domains, the food systems domain has seen a strong proliferation of anticipation approaches, from global assessments to local

participatory foresight processes (Vervoort *et al.,* 2014; Hebinck *et al.,* 2018; Ingram and Zurek, 2018; Mangnus *et al.,* 2019).

However, futures are not neutral spaces (Selin, 2011). Anticipation processes are sites of political negotiation, where these messy future dynamics are made sense of and processes of prioritization and inclusion are shaped (Anderson, 2010; Granjou, Walker and Salazar, 2017; Vervoort and Gupta, 2018). Despite the seeming consensus that transformation of food systems is needed and anticipation can support these processes (Hebinck *et al.,* 2018; Ingram and Zurek, 2018; Mangnus *et al.,* 2019; Klerkx, 2020), anticipation practitioners often do not specify explicitly or fully what their assumptions about the future are (Vervoort and Gupta, 2018) nor how they hope to intervene in policy and governance contexts (Garb, Pulver and vanDeveer, 2008; Henrichs *et al.,* 2010). There is a need to critically investigate how assumptions about the future in anticipation processes impact on present-day actions that seek to contribute to sustainability transformations.

In this article, we connect and mobilize theory on anticipatory governance and transformations to understand how, in practice, assumptions about futures and their impacts on present action shape the anticipatory governance of sustainability transformations in the food systems domain. Our case is one of the foremost global anticipation initiatives focused on food systems change: Foresight4Food. Foresight4Food is a global network of international foresight practitioners working on the future of food security and food systems. To this end, we apply a new analytical framework on anticipatory governance that identifies four distinct approaches to anticipation which have not been empirically tested before. Guided by the framework, we examine the Foresight4Food initiative in terms of (a) how diverse processes of anticipation contain different conceptions of the future, (b) how these conceptions inform policy and governance choices in the present to transform food systems and (c) what ultimate aims are intended to be realized. We then connect this framework with an analytical framework on transformations (Feola, 2015) to further examine how these implicit assumptions about the future steer different approaches to transformations. Through this analysis, we identify which approaches might be dominant, and what they imply for sustainability transformations. By doing so, this article brings to light, for the first time, fundamental assumptions about the knowability and manageability of the future, and how such assumptions are embedded in anticipation work that seeks to guide sustainability transformations more generally, and food system transformations in particular.

The next sections are structured as follows. Section 2 reviews scholarly debates on anticipation and transformations and their relevance for governing food systems. In section 3, we explain our methodological approach. In section 4, we apply the analytical framework on anticipatory governance by Muiderman et al. (2020) to examine the diversity of perspectives in the Foresight4Food initiative regarding their conceptions of the future, implications for the present and ultimate aims for engaging with anticipation. In discussing our findings in section 5, we connect this framework to the analytical framework on transformations by Feola (2015) to analyze what these perspectives imply for governing sustainability transformations in the food systems domain and beyond.

4.2. Anticipation for food system transformations

There is a growing role for anticipation to guide future sustainability transformations (Burch *et al.*, 2019) amongst others in global norm setting institutions such as the Intergovernmental Panel on Climate Change (IPCC), its Shared Socio-Economic Pathways (Riahi et al., 2017), the UNFCCC, integrated assessment models (O'Neill et al., 2014), UNEP's Global Environmental Outlook, the Millennium Ecosystems Assessment and other assessments (van Vuuren et al., 2012). A recently developed framework on anticipatory governance provides a new lens to analyze fundamental assumptions made in these ongoing practices of anticipatory governance (Muiderman *et al.*, 2020). The framework identifies four approaches to anticipatory governance within social and interdisciplinary sustainability sciences and focuses on three often implicit and under-analyzed elements, namely: (a) diverse conceptions of the future; (b) the implications for actions to be taken in the present; and (c) the ultimate end to be realized through anticipatory governance.

Scholarly debates on anticipation and transformation are closely related (Burch *et al.*, 2019) - sustainability transformations are often seen as relying on the envisioning of future pathways (Späth and Rohracher, 2010; Wyborn, 2015; Hebinck *et al.*, 2018). There are, however, different perspectives in transformations literature - on how change happens, and on the role of science in guiding transformations (Feola, 2015; Patterson *et al.*, 2017). We argue that this also leads to different roles for anticipation. Feola (2015) reviewed various literatures to identify different conceptions of, and research approaches to, transformation. Figure 4.1 below illustrates these different perspectives on transformations mapped onto two axes: how change happens (from deliberate and actor-driven, to emergent out of wider structural system change), and how the aim of research is framed (prescriptive to descriptive). Feola characterizes research perspectives as either analytic-descriptive (the below left box) or solution-oriented (the top right box).

Table 4.1 Four approaches to anticipatory governance (Muiderman *et al.*, 2020)

		HOW IS THE FUTURE CONCEPTUALIZED?			
		Probable and improbable	**Plausible**	**Pluralistic**	**Performative**
WITH WHAT IMPLICATIONS FOR THE PRESENT?	**Planning**	Assessing probable and improbable futures in order to inform strategic policy planning to reduce future risks			
	Building capacities		Exploring plausible futures in order to build adaptive capacities and preparedness to reflexibly navigate (uncertain) futures		
	Mobilizing			Imagining pluralistic futures in order to mobilize diverse societal actors to co-create new futures	
	Interrogating				Scrutinizing the performative power of future imaginaries in order to interrogate and shed light on their political implications in the present

Table 4.1 shows the four approaches mapped onto a spectrum of views on the conception of the future (horizontal row) and the implications for the present (vertical row). The narratives delineate the four approaches, including the conception of the future (in blue), the implications for the present (in purple) and the ultimate aim for engaging with anticipatory governance (in black).

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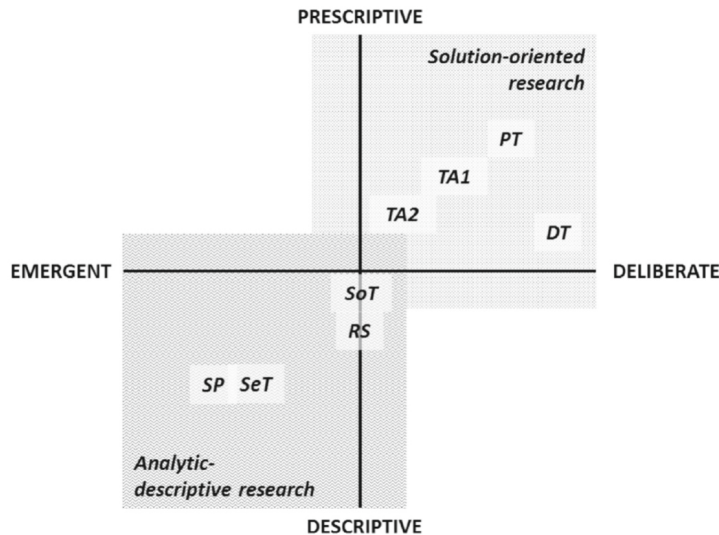
Figure 4.1. Analytical framework on transformations (Feola, 2015)

The vertical axis represents the spectrum of research approaches that relate to how change is seen to happen, ranging from seeing transformation as a deliberate and actor-driven to an emergent process. The horizontal axis presents the spectrum of research approaches that relate to how transformations research is framed, ranging from more prescriptive to descriptive outcomes. The boxes illustrate where different research communities engaged in transformations research are situated, including deliberate transformation (DT), Progressive transformation (PT), Regime shift (RS), Societal transition (SoT), Social practice (SP), Transformational adaptation 1 (TA1), Transformational adaptation 2 (TA2) and Socioecological transition (SeT)

Debates on anticipation and transformation are also connected in the food systems domain. Food systems are generally considered to be in need of drastic transformations, including in terms of climate change mitigation and adaptation (Dinesh *et al.*, 2021). More sustainable food system futures focus on, amongst others, meeting global food and nutritional demands, reducing inequalities in access to healthy food, and addressing its role in environmental degradation and emissions (Ingram, 2011). The concept of 'food system' puts the focus on the interconnected relationships between all activities in the commodity chain, the interactions across scales and socio-economic, environmental, political constraints and impacts (Ingram, 2011; Termeer et al., 2018). Governing future food systems, therefore, entails spanning the boundaries between the diverse sectors, scales, spheres, and between policy and science (Pereira and Drimie, 2016).

Various anticipation processes are used to anticipatory govern sustainability transformations of food systems. Anticipation processes are generally considered useful for engaging with system-oriented principles such as those of food systems (on synergies and trade-offs, dynamics and reflexivity). More formal and systematic foresight are considered particularly useful to explore the multitude of dimensions, scales, and temporal dimensions of complexities and uncertainties of global environmental change to which food systems must adapt (Wiebe *et al.*, 2018). Others have used anticipation processes to help new groups of actors collectively explore options for the radical transformation of food systems, focusing on bottom-up initiatives and including marginalized perspectives (Bennett *et al.*, 2016; Pereira *et al.*, 2021). Anticipation processes in the food systems domain thus take on a variety of methodological approaches in a diversity of methods and tools. They range from global modeling (Mason-D'Croz *et al.,* 2016) and global environmental assessments (van Vuuren *et al.,* 2012) to participatory processes (Hebinck *et al.,* 2018), cost-effectiveness analysis (Landert *et al.*, 2017) and seed initiatives (Bennett *et al.*, 2016) - or combinations of the above (Palazzo *et al.,* 2017) each having their specific foci and limitations regarding what and whose futures can be imagined.

These processes also contribute to different forms of guiding actions in the present. Some discussions are about making food systems more adaptive to global environmental and societal change (Ingram and Zurek, 2018) and investments have been allocated to contribute to incremental change rather than accelerating transformations (Dinesh *et al.,* 2021). Others have used anticipation processes to help new groups of actors collectively explore options for the radical transformation of future food systems through bottom-up initiatives (Bennett *et al.*, 2016; Koretskaya and Feola, 2020). There are thus diverse conceptions of the future embedded in these processes of anticipation as well as different ideas on how anticipation can guide sustainability transformations in the present. These assumptions give shape to decisions regarding who gets to decide

(and how and when) what food system-related innovations are desirable, what change is feasible, whether the focus should be on incremental or radical change, and what parts of food systems (and their political, economic, social and environmental contexts) are included (Duncan, Z. Levkoe and Moragues-Faus, 2019). The framework on anticipatory governance (Muiderman *et al.*, 2020) can bring these assumptions about the future to light and their implications for actions in the present. Connecting these findings to the framework on transformations (Feola, 2015) can help understand what these approaches mean for steering sustainability transformations in the food system domain and beyond.

4.3. Methodology

This section describes the methodological approach used for our empirical analysis. We first describe the case study. Then we delineate how we collected the data, through the use of multiple methods and explain our comparative approach to the data analysis.

4.3.1. Case study: The Foresight4Food Initiative

We utilize a qualitative case study approach in applying the analytical framework described above to analyze anticipatory governance processes within the Foresight4Food initiative. The Foresight4Food initiative was set up in 2017 at the University of Oxford to function as a global platform for foresight practitioners and researchers working on food system, with support provided by the Open Society Foundation, the Australian Centre for International Agricultural Research (ACIAR), The Global Forum for Agricultural Research (GFAR), French Agricultural Research Centre for International Development (CIRAD)/University of Montpellier, and the University of Oxford. The Foresight4Food initiative provides a connecting platform for diverse independent projects that aim to strengthen food systems foresight analysis through quantitative and qualitative methods and tools and improve the linkages between scientific analysis and policy dialogue with stakeholders (Foresight4Food n.d.). Conversations within the initiative have particular focused on transforming global food systems to a more sustainable and resilient path (Foresight4Food, n. d.), for which some projects use foresight as a way to understand future complexities that allow for adapting current food systems to the impacts of climate change, while other projects have a more normative outlook and focus on alternative food systems futures to challenge and transform the status quo.

For our analysis, we draw on a representative cross-section of these projects, taking into account geographic spread and the use of qualitative versus quantitative anticipatory methods.

Our analysis documents the viewpoints and experiences of participants in the Foresight4Food initiative during the period January-June 2020. We sent out a survey in

January to a selected group of people in the initiative, followed by the organization of a workshop in February and interviews in the period January – June. The Secretariat of the Foresight4Food Initiative (of which two members are co-authoring this paper) selected participants based on (a) practical experience with anticipation processes (the initiative also involves members that are predominantly scholars or policymakers), and (b) engagement with a broad range of decision-makers (including in private and non-governmental organizations). A total of 24 participants, who worked for 19 different projects across the globe, took part in our research. In 3 cases (Sentinel, AgMip and CCAFS), 2 or 3 participants joined, but they were working on different geographical locations or scales, and/or using different methods.

Table 4.2 below gives overview of the 19 projects that the 24 participants worked for, and a synthesis of the anticipatory methods and tools they identified as part of their project.

Table 4.2 Overview of projects and their anticipatory methods, according to participants

	Project	**Anticipatory methods used by participants**
1	Agrimonde-Terra	Trend analysis, scenario building with five expert groups using morphological analysis, simulation of scenario impacts on land use, agricultural production and trade through biomass balance model GlobAgri-AgT
2	Poseidon Project	Agent-based model of fisheries
3	Farmers of the Future	Horizon scanning, megatrend analysis
4	Impressions	Participatory scenario analysis and simulation model development, visioning and back casting
5	Senses	Story and simulation, fuzzy cognitive maps, visioning and back casting
6	Social and Environmental Trade-Offs in African Agriculture (Sentinel): 2 participant representing participatory scenarios analysis and quantitative scenario analysis)	Participant 1: Participatory scenario analysis, back casting Participant 2: Simulation land use and land cover, story and simulation, maps of land use change
7	Livestock, Environment and People (LEAP)	Financial analysis of land use optimization, linear mathematical programming of 3 scenarios, cost-engineering framework
8	Sustainable Urban Patterns (SUPat)	Agent-based model, qualitative and quantitative scenarios

Table 4.2 (Continued)

	Project	Anticipatory methods used by participants
9	Agricultural Model Intercomparison and Improvement Project (AgMip): (3 participants representing the Global Economics Model, Regional Economics Model and Regional Integrated Assessments)	Participant 1: Global economic modelling of future food systems scenarios Participant 2: Participatory scenario analysis Participant 3: Scenario used for climate impact assessment for agriculture
10	Food and Agriculture Organization (FAO) The Future of Food and Agriculture	Trends and challenges; Alternative pathways to 2050; Scenario design (narratives) based on identified challenges: stocktaking exercise of internal (FAO) views about emerging challenges for sustainable food & Agriculture, consultative process; Quantification of scenarios models with FAO-GAPS (global partial equilibrium model) and ENVISAGE (Global General equilibrium model, Purdue University)
11	Impact of faster productivity growth	Equilibrium economic simulation model, megatrend analysis, Impact assessment
12	Modular Applied GeNeral Equilibrium Tool (MAGNET)	General equilibrium model simulating impacts of agricultural, trade, land and bioenergy policies on the global economy
13	The Food, Agriculture, Biodiversity, Land, and Energy (FABLE) Consortium	Various modeling approaches (crop model, climate model, biodiversity model), impact assessments model, participatory scenario development, simulation gaming, expert consultation, decision analysis under risk and game theory, and artificial intelligence
14	The Food and Landuse Coalition (FOLU)	Simulation of better futures scenario with current trends scenarios and todays' situation 2020-2050 through GLOBIOM Model
15	The role of livestock in food system resilience in remote, upland regions (ResULTS)	Semi-structured interview following back casting logic, participatory scenario development, and Delphi studies
16	Rural Affairs Monitoring and Modelling Project (ERRAMP)	Integrated assessment model based on story and simulation
17	Climate Change Agriculture and Food Security (CCAFS) Program's Futures Scenarios Project: 3 participants representing the work in Africa, Central America, Bangladesh)	Participant 1: Participatory scenario analysis Participant 2: Participatory scenario analysis Participant 3: Participatory scenario analysis, storyline and simulation, quantified in IMPACT and GLOBIOM models
18	Zero Hunger Zero Emissions (ZHZE)	Participatory scenario analysis, storyline and simulation, quantified in MAGNET Model
19	The Brazilian Agricultural Research Corporation (EMBRAPA) Strategic Intelligence System Agropensa	Participatory scenario analysis, megatrend analysis, expert panels

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In terms of geographical spread, survey participants worked across the globe while workshop participants were mostly based in Europe and North America. The Foresight4Food initiative refunded accommodation, but participants paid for travel costs, which meant that people working or living close to the workshop location or with a travel budget were able to come. Participants represented projects that are led by a consortium of research institutes and international organizations located in the Global North and/or NGOs located in the Global South, with financial support of donor organizations (such as GIZ and USAID), research councils (such as the UK Research Council and the Swiss National Science Foundation), international agencies (such as IFAD, the World Bank and FAO) and philanthropy (such as the Open Philanthropy Project and the Welcome Trust). However, the projects mostly work on food systems in developing countries.

In terms of methods and tools of anticipation covered in the studied projects, the two dominant methods were participatory scenario building (17) and quantitative simulation modelling (18). A variety of other quantitative and qualitative methods are employed in conjunction these anticipation processes, such as financial analysis in the LEAP project, and visioning and back casting and fuzzy cognitive maps in the Sense project. Some projects primarily focus on modeling, such as Poseidon and LEAP, while most combine quantitative and qualitative phases. A qualitative phase can inform a quantitative phase. In the CCAFS Scenarios project qualitative scenario narratives of plausible socio-economic futures with public and private sector stakeholders, which were then quantified using the IMPACT and GLOBIOM models in order to estimate climate impacts and food security changes under these scenarios. Quantitative and qualitative processes can also occur in parallel. For example, IMPRESSIONS, an integrated assessment platform examining what a future above 2 degrees Celsius could look like, used in parallel participatory scenario analysis and simulation modeling to iteratively create scenarios generated by stakeholders. Then, shorter-term policy choices were extracted from visioning and back casting. Also in SUPat, a urban planning project, quantitative and qualitative phase occurred in parallel. Its agent-based model is a collaborative effort combining the expertise and methods (including simulation tools) of designers, planners, scientists to create scenarios for more sustainable city environments (SUPat, no date).

A few projects combined qualitative methods or used qualitative interpretations of existing sources of quantitative information. An example is the Brazilian Agricultural Research Corporation EMBRAPA, which identifies megatrends that impact Brazilian agriculture through a combination of participatory scenario development and qualitative megatrend analysis based on existing quantitative analyses (Embrapa, 2018). As another

example, the Farmers of the Future Project of the European Commission combines horizon scanning with megatrend analysis based on external sources.

4.3.2. Data collection methods

Using the analytical framework on anticipatory governance as a template for our empirical enquiry, we designed a tool to ask questions, which we called a Data Generation Tool (see appendix 4.1). The tool includes descriptive questions related to the design of the anticipation processes, which we called the 'anticipation space', as well as questions about the three component elements in the analytical framework (Table 4.1). Questions in the anticipation space were: (a) What methods and tools were used to engage with the future? (b) Why were these methods and tools chosen? and (c) Who designed, funded and participated? Question in the anticipatory governance space: (a) How was the future conceptualized? (b) What were the implications for policy action in the present? and (c) To realize what ultimate ends? We used the Data Generation Tool to collect data through several methods, these are discussed below.

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4.3.2.1. Survey

As a first data collection method, we sent out an online survey in Google Forms (see appendix 4.2) to a targeted group of Foresight4Food community members to which 12 participants responded. The responses to the survey were used to generate a first dataset, but also to test the usefulness of the framework and feasibility of this study's research aims. Each multiple-choice question had an 'other option' based on which we could assess if our categorizations could be related to the experiences of the participants. No changes to the categorizations were needed based on this feedback. The survey also included broader questions about geographical scale in order to get to know the projects better.

4.3.2.2. Workshop

As a second data collection method, we organized a two-day workshop. A total of 24 Foresight4Food members participated in the workshop, and this group partially overlapped with the survey respondents as eight of the 12 survey respondents were at the workshop. The theory-informed workshop was structured according to each of the six questions in the Data Generation Tool, complemented by a few community-building sessions in support of the Foresight4Food initiative. Each session started with a presentation of the literature review and analytical framework based on Muiderman et al. (2020). We then asked participants whether they could relate to each component element in the analytical framework, as well as the literature underpinning it, or if they would want to add totally different categories (for instance, to complement the existing categories of futures), or change the setup of the workshop program. This did not lead

to changes to the framework, since none were seen as needed by participants. Then, for each session, participants filled in responses per question on the blank Data Generation Tool. Participants worked in pairs to stimulate exchange and debate while examining the other's perspective.

4.3.2.3. Interviews and online communication

As a third data collection method, seven interviews were held during the second workshop day to discuss responses in more detail. The rest were contacted post-workshop. In the following three months, five additional interviews were held, communication with the other 10 participants happened via email. All survey and interview responses were typed into a digital version of the data generation tool (appendix 4.1) and shared with the participants for their verification and adjustment of responses, and also to encourage them to add new insights that may have emerged after the workshop. These interviews and online communications provided more richness on viewpoints regarding the component elements, and on the relationships between elements.

4.3.3. Approach to the data analysis

We analyzed the perspectives within Foresight4Food initiative using a qualitative case study method. This is a well-established method for looking at complex phenomena in their context (Baxter and Jack, 2008) with sensitivity to the empirical complexity (Flyvbjerg, 2006; Hopkin, 2010) and the diversity of viewpoints (Yin, 2003; Baxter and Jack, 2008). As such, it most suited to analyze diverse perspectives on how explicit and implicit assumptions steer decision making and actions in the present.

We proceeded as follows. As earlier stated, the analytical framework by Muiderman et al. (2020) served as the template for the deductive enquiry (Yin, 2003). During the workshop, we presented the four approaches to anticipatory governance as laid out in the analytical framework after which participants self-identified their position within the diversity of perspectives using the Data Generation Tool, and added new viewpoints. Their spoken accounts were then typed into a digital version of the tool, one tool filled in for each participant, and complemented with responses from the other methods (survey, interviews and online communication). The final tool was shared with participants for verification and adjustment. We analyzed and compared responses to the analytical framework on anticipatory governance, using its four ideal-type approaches as heuristic tools for identifying diverse approaches to anticipatory governance within the community. We finally analyzed how these approaches to anticipatory governance relate to different conceptions of transformations by combining the analytical framework on anticipatory governance with the analytical framework on transformations.

Using several research techniques in subsequent order helped establish an iterative process of exploring and refining research findings synchronously (Baxter and Jack, 2008). This replication logic, in which findings can be confirmed, rejected and adapted, is considered to create more in-depth knowledge and robust findings, as well as the generalizability and validity of data (Verschuren and Doorewaard, 2010).

We also complemented this deductive inquiry with an inductive inquiry by probing participants to reflect on the usefulness of the analytical framework as a whole, its diverse relationships between component elements, and add other possible categorizations. This heuristic process, in which exploration and discovery of new findings are in dialogue, has been considered a key contribution in qualitative case research (Kleining and Witt, 2000).

4.4. Results: Anticipatory governance of food systems in practice

This section presents the findings from applying the 'four approaches' analytical framework (Muiderman et al. 2020) to the case study. It analyzes diverse perspectives on anticipatory governance within the Foresight4Food community, relating to the conception of the future, the ultimate aim and the policy implications. We present the findings regarding ultimate aims before the policy implications, as this order is reflective of how the discussion developed.

4.4.1. Diverse conceptions of the future

As we explained above, the analytical framework on anticipatory governance that we are applying here identifies four diverse conceptions of the future: probable (and improbable), plausible, plural and performative futures. Any single project the participants worked on embeds multiple conceptions of the future according to participants - approximately two per project. Within this multiplicity, plausible futures are predominantly imagined: 'probable futures' was mentioned 7 times, 'plausible futures' 21 times, 'plural futures' 10 times, and 'performative futures' only 2 times. Participants regarded the fourth conception, 'performative futures' as least applicable to their work. These conceptions of the future give shape to a variety of anticipation processes.

Futures framed by probability/likelihood (approach 1) were most often executed through modeling exercises by incorporating data uncertainties related to the spread of future trajectories. Some examples started with the present and then explored a range of probable futures (e.g. AgMip). Others examples were more normative, and aimed to identify a most desired future within the spread of probabilities.

Importantly, the distinction between approach 1 – futures framed by likelihood/ probability and approach 2 – futures framed by plausibility and deep uncertainty was the focus of in-depth conceptual debates, and in some instances, a source of confusion. A large group of participants positioned themselves within the probabilistic futures domain, yet there were different understandings of what probable futures can entail and how one can go about assessing such futures. For example, a few participants critiqued the usage of probabilities in futures studies, stating that probability is merely a statistical application assigned to the data assumptions underpinning any single scenario, not of the scenarios as a whole. These participants emphasized that probabilistic scenario analysis cannot identify a most probable future but only probable occurrences under certain conditions and scenario assumptions. This means that probability assessments can be made for a set of scenarios that are not ranked, but instead all considered plausible. On the other hand, a number of participants commented on incorporating fundamental uncertainty (approach 2) in their analyses, while still sticking to approach 1 framings of prediction and probability. All in all, probabilistic futures work seems on the one hand a well-established category of futures work, yet on the other hand part of ongoing debate, especially in terms of its boundaries with approach 2.

Plausible futures (approach 2) were referred to as 'what-if' scenarios to illustrate their exploratory character. The Sentinel project used uncertainty matrices to develop four plausible scenarios with stakeholders (Zurek and Hebinck, 2018). Stakeholders identified drivers and driver complexity across multiple systems (socioecological, sociotechnical, economic, political, geopolitical etc.), as well as commonalities between them. These matrices served as the backbone for scenario development. What-if scenarios were also used to arrive at a most desired future. In Agrimonde-Terra, a desirable future scenario was introduced for land-use and food security in 2050 and contrasted with the drawbacks of the other four plausible scenarios (Mora et al., 2020). Also, several modelling exercises took plausibility as a starting point, by identifying key drivers underpinning the simulation of scenarios in a participatory process focused on multiple plausible scenarios (e.g. Impressions). Participants explained that global modeling exercises rarely result in normative scenarios, but often in explorative scenarios (of global change patterns), whereas national and sub-national modeling exercises allow for identifying preferred future trajectories. To summarize, most, of the work within the Foresight4Food initiative is plausibility focused, but this plausibility orientation is used to shape how the future is engaged with, often with a strong focus on identifying desirable futures.

Participants who positioned their work as focused on pluralistic, normative scenarios (approach 3) were fewer, yet these participants provided thought-provoking viewpoints.

Some participants preferred normative plurality over plausibility, even when they identified plausibility as the focal conception within the project. To these participants, normative plurality is more reflective of reality as scenarios depend on interpretation of the world and are therefore inherently socially constructed (see also Ramírez and Selin, 2014). However, as one participant noted, when projects combine qualitative and quantitative scenario building, plurality 'gets morphed into consensus' in models and can therefore not be maintained. As an interviewee noted, "Models are consensus. They are about probable futures, maybe about plausible futures, but not pluralistic. So, if I say, my model needs data, I implicitly say that pluralism needs to be morphed into something that's no longer there. So, I do workshops, bring people together, start very broad but make one story, a plausible future in which I sweep pluralism under the carpet." (Interview with one of the participants, 7 April 2020).

Models integrate datasets that present data consent rather than plural viewpoints, and as such may represent diverse plausible trajectories but not a plurality of worldviews or worlds. For example, when quantifying narratives, a diversity of information about a wide range of futures with very different accounts and assumptions is translated into something quantifiable and plannable, such as impacts of demographic growth and migration on food availability. Another process of translation is spurred by the widespread use of the global Shared Socioeconomic Pathways developed by the IPCC community as a reference framework for scenario development. These scenarios are five narratives of "plausible major global developments that together would lead in the future to different challenges for mitigation and adaptation to climate change" (Riahi et al., 2017, p. 153). Consolidating scenarios work with the SSPs is considered to increase the robustness of scenarios, but also means that SSP assumptions about global trends can clash with assumptions made by stakeholders at local or national levels. The plurality of futures is thus challenging to maintain throughout the various stages of the anticipatory process.

Only two participants identified performative futures, seen through a critical lens (approach 4), as a conception of the future embedded in their project. Of these projects, one was understood to have combined probable, plausible and performative futures in order to reduce future uncertainties, and was described as thereby using an Approach 4 conception of the future to meet an Approach 1 ultimate end (SUPat). The second example (The Future of Food and Agriculture) combined plausible futures, and an understanding of futures as performative, by collectively sharing and scrutinizing values and interests as a step towards arriving at a desirable future based on shared values, thereby integrating elements of Approach 4 within Approach 2 (FAO, 2017, 2018).

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Apart from these examples, there was least attention for and interest in the performative power that imaginations of the future have over action in the present in the F4F network.

Summarizing the conceptions of the future across the Foresight4Food participants, they predominantly worked with plausible futures, and also with probable and plural futures, including in a number of hybrid forms. A critical lens viewing futures as performative in a societal context was rarely applied.

4.4.2. Ultimate aims

The framework identifies four diverse ultimate aims: reducing future risks, navigating diverse futures more reflexively, co-creating more (radically) transformative futures and shed light on the political implications of futures. Just like with the first dimension (conceptions of the future), most projects in our case study were reported to pursue multiple ultimate aims for engaging with the future. More than half of the participants (13 out of 24) identified three or more ultimate aims. The versatile projects consolidate aims spanning the entire continuum of perspectives identified in the framework (Table 4.1); ranging from risk reduction (Approach 1) to shedding light on political implications of future claims (Approaches 4). In contrast to conceptions of the future, viewpoints regarding ultimate aims were quite evenly distributed: 'reducing future risks' was mentioned 12 times, 'navigating diverse futures' also 12 times, 'co-creating new futures' 10 times and 'shedding light on political implications' 9 times.

Reducing risk involved in future food systems is a core aim for many projects, and almost always mentioned in conjunction with the aim of reflexively navigating diverse futures (Approach 2, e.g. Poseidon project), and the aim of co-creating new (and more transformative) futures (Approach 3, e.g. ERRAMP), and/or by the aim of shedding light on political implications (Approach 4, e.g. Sentinel). Only two participants identified futures risks reduction (e.g. of food insecurities and natural resource depletion) as the sole aim (LEAP and MAGNET).

Reflexively navigating diverse futures is another core aim. It was seen as, amongst others, part of a process in which policy makers can be cautioned of plausible future changes, and also have a deliberative and reflexive process that introduces citizens to innovative new approaches, technologies and practices that are not yet so well-known and attains their buy-in for new policy measures (e.g. Farmers of the Future). Only one project identified the reflexive navigation of diverse futures as the sole aim. This project, IMPRESSIONS, explored the effects of extreme high-end scenarios (+4 degrees global warming and tipping points) in order to stimulate reflexivity in policy instruments and plans by taking such extremes into account.

Many projects in the initiative have the ambition to transform the food system, and consequently quite a few participants positioned themselves within the third approach, without necessarily aiming to radically transform towards new futures. Approach 3 was often mentioned in tandem with Approach 1. For example, one project assessed probable futures to pursue, as part of a wider set of aims, the transformation towards a risk reduced future (e.g., Senses). This hybrid points to the consolidation of present futures instead of a radical transformation. Other projects aim, also as part of a wider set of aims, to co-create transformative futures through plausibility thinking in interrogative spaces; thereby they intersect approaches 2, 3 and 4 (e.g., Sentinel). Two projects identified co-creation of new futures as the sole aim, meaning to realize more desired outcomes in terms of sustainability (The Future of Food and Agriculture and Impact of Faster Productivity Growth).

Shedding light on political implications of food systems change was often pursued through probability and plausibility-focused projects (e.g., AgMip at the regional level and CCAFS in Bangladesh). In these cases, such an aim was pursued by scrutinizing scenario assumptions and distributional effects with a group of stakeholders. Such aims were not explicitly related to a belief that future claims have performative power over the present. Apart from these hybrids, no project exclusively pursued an ultimate aim that seemed similar to Approach 4.

Summarizing the ultimate aims thus demonstrates that the community works towards an interplay of (on average three) ultimate aims which span the entire analytical framework, based on a smaller set of (on average two) futures conceptions that range from probable, plausible and plural, but not performative futures. While all four aims are equally presented, they are part of interesting combinations in which approaches 1, 2 and 3 are most strongly present. Noticeably projects do not resemble clear connections between the three component elements in ideal-type approaches, but rather merge, blend and omit component elements.

4.4.3. Implications for policy action in the present

Finally, the framework identifies four implications for policy and governance choices in the present: strategic planning, capacity building, mobilizing stakeholders and interrogating assumptions. As with the other dimensions of the analytical framework, participants argued that multiple forms of policy action are typically aimed for in a single project. However, informing policy planning stands out. Of the 24 participants, 16 identified informing strategic policy planning as the core policy action in the present; 14 to build capacity and preparedness; only 4 to mobilize stakeholders; and another 4 to scrutinize the political and contested character of futures.

The majority of the participants identified strategic planning as the core type of policy action to be taken in the present. Some of these assertions follow the logic of the narrative associated with Approach 1, namely that a future can be made partially knowable based on analytically informed insights, often generated through simulation modeling, in order to recommend policy action that reduces risks associated with a most likely future. It was said that numbers give guidance, and many policy makers seem to appreciate future visions in terms of likelihood and quantifications. Many pursue policy action in an Approach 1 mode, but based on futures that relate to the other three approaches. For example, a project might focus on imagining plural futures, but use them in order to provide recommendations and critiques to support the prioritization of policy measures. In such a case, the plurality of worldviews is regarded pivotal to the anticipatory process, but not necessarily seen to be maintained when formulating implications for the present.

Another key form of policy action in the present that participants identified was associated with Approach 2: building capacities of decision-makers (as a broad category, including societal organizations such as farmer organizations). Such capacities are seen to be built through, amongst others, the provision of anticipatory tools to better understand and prepare for future changes. Most frequently, participants argued that a mix of Approach 1 and 2 is key – for instance, informing strategic planning in ways that also enhances the capacities for preparedness (for instance, in A common Journey).

The present action associated with approach 3: mobilizing stakeholders to co-create new transformative futures, was mentioned much less often. It was mentioned only by 4 participants, which contrasts starkly with the relative importance of the other two-component elements of Approach 3 (plural futures and co-creating new futures).

The Senses project explicitly identified the mobilization of a diverse group of stakeholders as the implication for policy action in the present, but saw this as part of building their anticipatory capacities for preparedness. The ResULTS and Senses projects also saw mobilizing stakeholders toward new futures as part of strategic planning and interrogating assumptions (merging approaches 1 and 4, Sentinel and ResULTS). The Food, Agriculture, Biodiversity, Land-Use, and Energy (FABLE), combines approaches 1, 3 and 4 in their experimentation with using algorithmic support to identify a country's potential for making steps towards reaching the sustainable development goals and encourage policy makers to be more ambitious. Others used language that can be loosely associated with Approach 3 but here used in service of approaches 1 and 2, e.g., democratic stakeholder deliberation to yield a more strategic policy trajectory and building of anticipatory capacities (e.g. Agrimonde-Terra and Farmers of the Future).

The key result here seems to be that the fundamental principles regarding plurality and political action underlying Approach 3 are abandoned when formulating policy action in the present.

Participants rarely mentioned that the interrogation of political assumptions embedded in future claims (approach 4) was aspired as action in the present, and if so it played a smaller part within anticipatory governance processes more strongly representing approaches 1 or 2. Examples were seeing trade-offs between future choices as contributing to an informed strategic planning process (e.g. ResULTS, e.g. Agrimonde-Terra) which participants classified as being related to approach 4. One project integrated two elements of Approach 4: it identified performative futures as one of its conceptions of the future, and also aspired to shed light on their political implications in the present, yet for an ultimate aim pointed most strongly in the direction of Approach 1 (SUPat). This means that in the few relevant examples in our analysis, the principles underlying Approach 4 were not upheld when it came to guiding action in the present.

Summarizing, while perspectives on the ultimate aims vary, approaches 1 and 2 strongly dominate in terms of the how present action based on anticipation is understood. Although examples were found of policy action associated with approaches 3 and 4, these were much rarer.

Figure 4.2 illustrates our findings, based on a few randomly selected example projects, which are presented in the figure with numbers 1 - 7. One can see there that, in terms of conceptions of the future, many viewpoints align with Approach 1 (see projects 1, 2, 5, and 7); most with Approach 2 (see projects 2, 3, 4, 5, 6, 7); fewer with Approach 3 (see projects 2, 4); and rarely with Approach 4 (see project 5). Also, for the policy implications in the present, many viewpoints align with Approach 1 (projects 1, 3, 6): most with Approach 2 (projects 2, 3, 5, 6, 7); one with Approach 3 (project 2); and none with Approach 4. While randomly selected, these offer a sense of how participants positioned themselves within the Foresight4Food initiative, their hybrid approaches, and dominant perspectives. The ultimate aims are not visualized, but their diversity is explained in the narratives on the right side of the figure.

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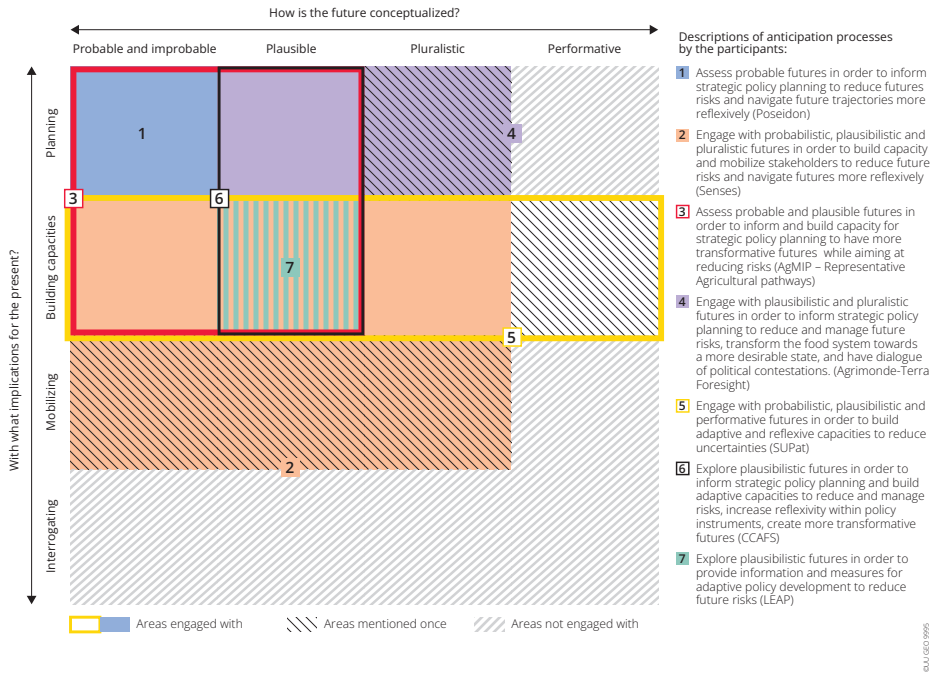
Figure 4.2. Examples of hybrid approaches to anticipatory governance in the Foresight4Food initiative.

The blocks represent a selection of anticipation processes mapped onto the framework based on how participants described the conception(s) of the future (horizontal axis) and implications for the present (vertical axis). The numbers and colors correspond with the narratives to the right. The striped sections illustrate future conceptions and implications that were not mentioned or only once.

4.5. Discussion and conclusions

In this article, we examined anticipation processes in the food systems domain - a domain where sustainability transformations are urgently needed. We analyzed a global case study on food systems foresight through an analytical framework on anticipatory governance that identifies four different approaches (Muiderman *et al.*, 2020). The study represents the first global, empirical analysis of different assumptions about the future and their connections to the steering of sustainability transformations across a network of anticipation projects. Two key insights emerge from the analysis. In this section, we discuss these insights and connect our findings to the analytical framework on transformations (Feola, 2015) to link the four approaches framework to different conceptualizations of transformation.

4.5.1. Hybrid approaches and dominant perspectives: privileging prediction and uncertainty over pluralistic transformation and fundamental critique

The first insight from our empirical analysis is that participants described the anticipatory approaches in their foresight projects and processes to be of a hybrid character, in relation to the four ideal-type approaches presented in the analytical framework. Thus, a given foresight initiative appeared to borrow elements from one or more of the four approaches. Understanding such hybridity and its implications is important, because the four approaches represent different fundamental assumptions about the future. For example, notions of probability and plausibility (which underpin approaches 1 and 2, respectively) were interpreted and used in diverse ways. Furthermore, anticipation processes working from a risk/prediction/probability approach to the future (associated with approach 1) also professed to incorporate deep uncertainty into their engagement with the future (associated with approach 2). However, these processes were still fundamentally concerned with prediction. It could be argued that they do not take approach 2's insights on unknowability and uncertainty fully on board (Ramirez and Selin 2014).

The second insight emerging from our empirical analysis is the dominance of approaches 1 and 2 over approaches 3 and 4, especially in terms of formulating actions in the present. Most anticipation processes in our case study provide recommendations for guiding strategic policy planning (approach 1) and developing participant capacities (approach 2), rather than mobilizing new groups of stakeholders (approach 3) or critically interrogating the assumptions underpinning future-related claims (approach 4). Approaches 3 and 4 are (sometimes) seen valuable for the design of the anticipation process itself – e.g., co-creating plural, aspirational futures, and the investigation of key assumptions - but not as guidelines for actions in the present.

The first insight above about the hybrid character of foresight processes is connected to the second insight about the dominance of probability and plausibility in the foresight design. Often, imagined futures, created to greater or lesser extent using pluralistic and critically deliberative forms (approaches 3 and 4), are translated into more technical and value-neutral outcomes in policy documents. This implies that the openings that are created for plural and critical dialogue in the design of the process are closed down during the formulation of policy and action (Stirling, 2008; see also Bellamy et al., 2013) and that the epistemologies of approaches 3 and 4 that focus on the constructed and political nature of future visions are abandoned.

On the whole, Foresight4food participants predominantly argued that more technical and probability-informed actions associated with approach 1 are most comfortable

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for policy makers and resonated better with the logic of policy environments. The dominance of approach 1 is therefore motivated by the aim to produce policy-relevant outcomes rather than what is fundamentally needed to transform food systems. In the 'present action' element, the pluralistic and critical tendencies of approaches 3 and 4 that focus on the politics of anticipation are subsumed by approach 1 to fit outcomes into the more value-free and technocratic planning preferences of incumbent actors (such as governments). Decision-makers can then take the lead in making political choices and legitimize their actions based on what they perceive as objective expert-based input.

This dominance of approach 1 in the 'present action' element contradicts the diversity of stated ultimate aims underpinning Foresight4Food projects, which, according to the participants, cover all four approaches. An important consequence is that several aims might not be achieved or are not fully pursued. While approach 1 action may be strategically effective in some cases, it is also problematic because it risks neglecting the inherently normative and political nature of futures work (Granjou, Walker and Salazar, 2017; Patterson et al., 2017; Esguerra, 2019).

4.5.2. Different approaches to anticipation connect to different conceptions of transformation

We argued above that conceptions of the future have implications for actions in the present to transform food systems. These assumptions about the knowability and manageability of the future are thus ultimately also about how sustainability transformations take place. If so, how do current approaches and practices of anticipation in the food system domain relate to diverse implications for sustainability transformations?

In Figure 4.3, we map the Muiderman et al. (2020) anticipatory governance framework onto Feola's framing of different conceptions of transformation, and the role of transformation research. This exercise reveals that approach 1 can be understood to correspond with emergent and deliberate understandings of transformation, but in a very particular way. This approach sees the future as partly emergent from larger societal processes, but since these processes can be predicted to some degree, the future is also controllable, and therefore, transformations are seen as deliberate in some sense. Approach 1 analyses are intended to be analytical-descriptive, offering analyses of future trends and contextual developments; but they can also be prescriptive, aiming to 'win the future' (see e.g. Fuerth and Faber, 2013) based on (partially) knowable future developments.
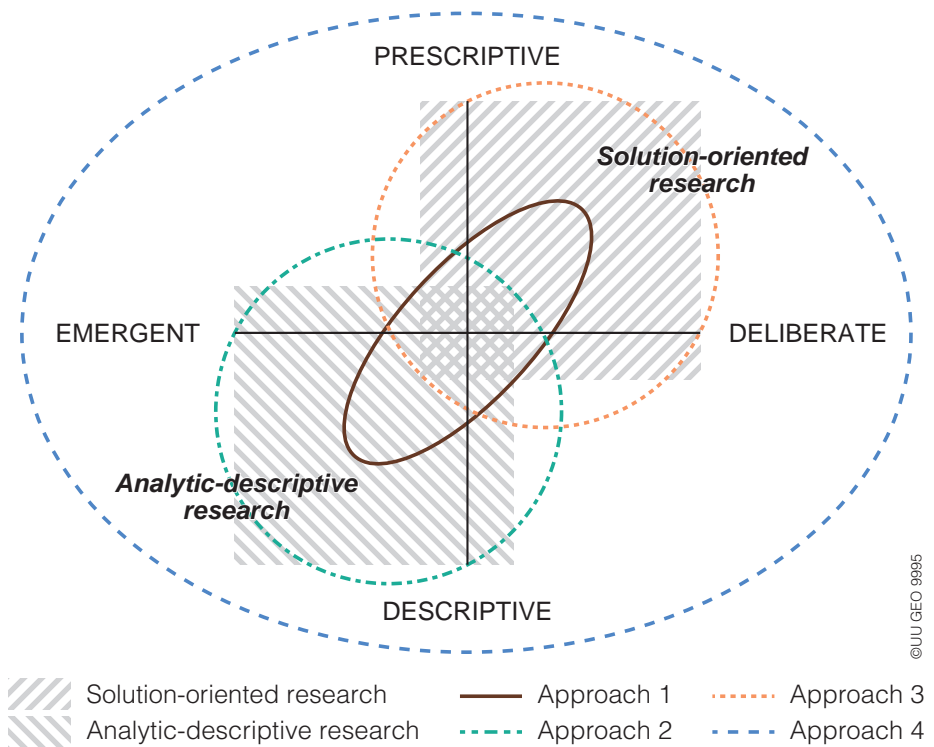
Figure 4.3. The four approaches to anticipatory governance mapped onto Feola's (2015) framework on concepts of transformations.

The vertical axis represents the spectrum of research approaches that relate to how change is seen to happen, ranging from seeing transformation as a deliberate and actor-driven to an emergent process. The horizontal axis presents the spectrum of research approaches that relate to how transformations research is framed, ranging from more prescriptive to descriptive outcomes. These axes identify research approaches as either analytic-descriptive (the below left box) to include perspectives from e.g. social practice and socioecological transition literatures, or solution-oriented to include perspectives from e.g. transformational adaptation and deliberative transformation literatures. The four circles represent the four different approaches from Muiderman et al, 2020 (see table 4.1).

Approach 2 is largely analytical-descriptive, focusing on complexities and uncertainties to be navigated as they emerge – though this also includes some aspects of deliberate action (actors navigating uncertainty) and of prescription (guidance on the navigation). By contrast, approach 3 is mostly solution-oriented and prescriptive, seeing transformations as deliberate action by societal actors and groups based on images of the future in which various stakeholders have agency. However, like its counterpart in approach 2, it also includes some insights on the emergent nature of transformations, and some analytical-descriptive work to support its more prescriptive, deliberate focus. Approach 4 offers a

meta-perspective, seeking to understand and open up the assumptions behind various engagements with the future and its concepts of transformation.

Mapping Muiderman et al.'s four approaches onto Feola's framework offers some key insights for understanding and contextualizing the results in this article, as well as for understanding different approaches to the future more generally. It shows that those working from the perspective of approach 1 overlap to some degree with both approaches 2 and 3. Elements of these approaches are mobilized by approach 1-dominated foresight – in case of approach 2, because of an increasing appreciation of complexity and uncertainty; and in case of approach 3, because of an increasing appreciation for the political nature of deliberate change. In the end, however, approach 1 is based on assumptions about a consensus reality and prediction. This means that neither the full consequences of 'emergent' nor 'deliberate' drivers of transformation are adopted, even if language and tools from approaches 2 or 3 are used. Emergence, accepted fully, would imply deep, irreducible uncertainty (approach 2); while deliberate change, accepted fully, would imply that many actors are attempting to shape the future, and that futures are plural and political (approach 3). Both perspectives ultimately contradict consensus and prediction.

This helps us understand why approach 1-dominated hybrids cannot fully engage with what is needed for the anticipatory governance of sustainability transformations – and taking the meta-perspective of approach 4 can help make these hidden assumptions visible.

4.5.3. Consequences for anticipatory governance for food systems transformations

The dominance of approach 1 in terms of actions in the present has several important consequences for governing food systems. In general, scholars point to the radical shifts that are needed to deal with the many interconnected sets of food system pressures such as climate change (Maye and Duncan, 2017) in reflexive, democratic and radically transformative food system governance arrangements (Duncan, 2015; Termeer *et al.*, 2015; Pereira and Drimie, 2016; Ingram and Zurek, 2018). Radical food systems change can happen through innovation in more grassroots and alternative movements (e.g. agroecology, vertical farming, etc.) as well within more conventional systems (Maye and Duncan, 2017; Herrero *et al.*, 2020; Dinesh *et al.*, 2021). However, it is considered key to shift perceptions and meaning in order to overcome path dependency and bring about structural change (Termeer *et al.*, 2015). Furthermore, sustainability transformations of food systems require alternative visions in politicized policy processes (Duncan and Claeys, 2018).

These needs clash with the current dominance of approach 1 in food systems anticipation, which appears to result in propositions to transform food systems that are more about incremental adjustments to existing (neoliberal) modes of food systems governance than providing structural adjustments to its weaknesses and system failings (Maye and Duncan, 2017). Anticipation processes in line with approaches 3 and 4 can help include diverse perspectives, mobilize different groups, explore alternative futures and criticize assumptions. Without such pluralistic and critical approaches, voices are lost, perspectives are excluded, action become undesirably top-down and capacities for transforming unsustainable systems are waisted (Hajer *et al.*, 2015; Bennett *et al.*, 2016). Using elements of approach 3 or 4 from a fundamentally approach 1 framing closes down such future possibilities in the guise of opening them up (Stirling, 2008).

4.5.4. Ways forward for anticipation in support of sustainability transformations

Engaging with the politics on anticipation means to embrace that sustainability futures are complex and normative, and this should not be minimized or structured to avoid the relations of power and contestations in them (Duncan and Claeys, 2018). Several interesting (combinations of) methods and tools of anticipation offer key avenues for engaging with 'who wants what?'. They also make the question of 'what is possible?' explicitly political (Escobar, 2020). In terms of approach 3, complementing quantitative and qualitative scenario processes with experiential and creative methods might more effectively mobilize the plurality of views in policy action in the present, by building infrastructures for 'worldmaking' or 'future making' beyond established pathways (Vervoort et al., 2015; Esguerra, 2019). Approach 3, with its focus on pluralistic, politically aware visioning and the mobilization of actors is currently opening up in a number of different, fruitful directions. Experimenting with experiential futures (Candy and Dunagan, 2017), game design (Vervoort, 2019), and role-playing can help support processes of imaginative engagement with the future in ways that empower diverse societal actors to take part in reshaping their futures (Vervoort et al., 2015). Anticipation processes could also be informed by approach 4 thinking by, for example, imagining futures with the specific goal to test and challenge how imagination defines the boundaries of understanding what the future may look like (Esguerra, 2019; Low and Schäfer, 2019). Moreover, approach 4 can be crucial to building critical futures literacy as a skill among anticipation practitioners (Goode and Godhe, 2017; Mangnus *et al.*, 2021). And thirdly, on-going work on the discourses and performativity of futures can be expanded and developed (Späth and Rohracher, 2010; see e.g. Altamirano-Allende and Selin, 2016; Hajer and Versteeg, 2019), including questioning who has agency to determine future problems and action in the present (Groves, 2017). These approaches can contribute to making futures work more reflexive in terms of assumptions and their implications for action.

Examining the Foresight4Food initiative through the lens of the novel analytical framework on anticipatory governance recently advanced by Muiderman et al. (2020) and later Feola (2015) allowed us to typologize and systematize implicit assumptions and their implications for sustainability transformations within an influential global foresight community on food systems. In the empirical work, the anticipatory governance framework helped to bring to light often-implicit conceptions of the future in the design of anticipatory processes. Participants expressed that applying the four approaches to their work was an 'eye opener', which helped to elucidate steering effects of diverse approaches on actions in the present. Secondly, it allowed us to demonstrate that anticipation practitioners use hybrid approaches and that certain perspectives dominate within these hybrids. Connecting the analytical framework on anticipatory governance with the analytical framework on transformations further illustrated how fundamentally different assumptions about the future relate to approaches to transformations.

In conclusion, we believe that the insights of this paper have value for 1) those involved in setting more effective and inclusive research and practice agendas for the future of foresight and anticipatory governance of sustainability transformations; 2) practitioners who want to become more reflexive about the consequences of their visions of, and approaches to, the future and the assumptions behind them; and 3) those working on sustainability transformations and interested in using anticipatory processes for more democratic and radically transformative actions. Furthermore, it also highlights the need for reflexivity about the link between anticipatory practices and the nature, depth and direction of food systems and sustainability transformations.

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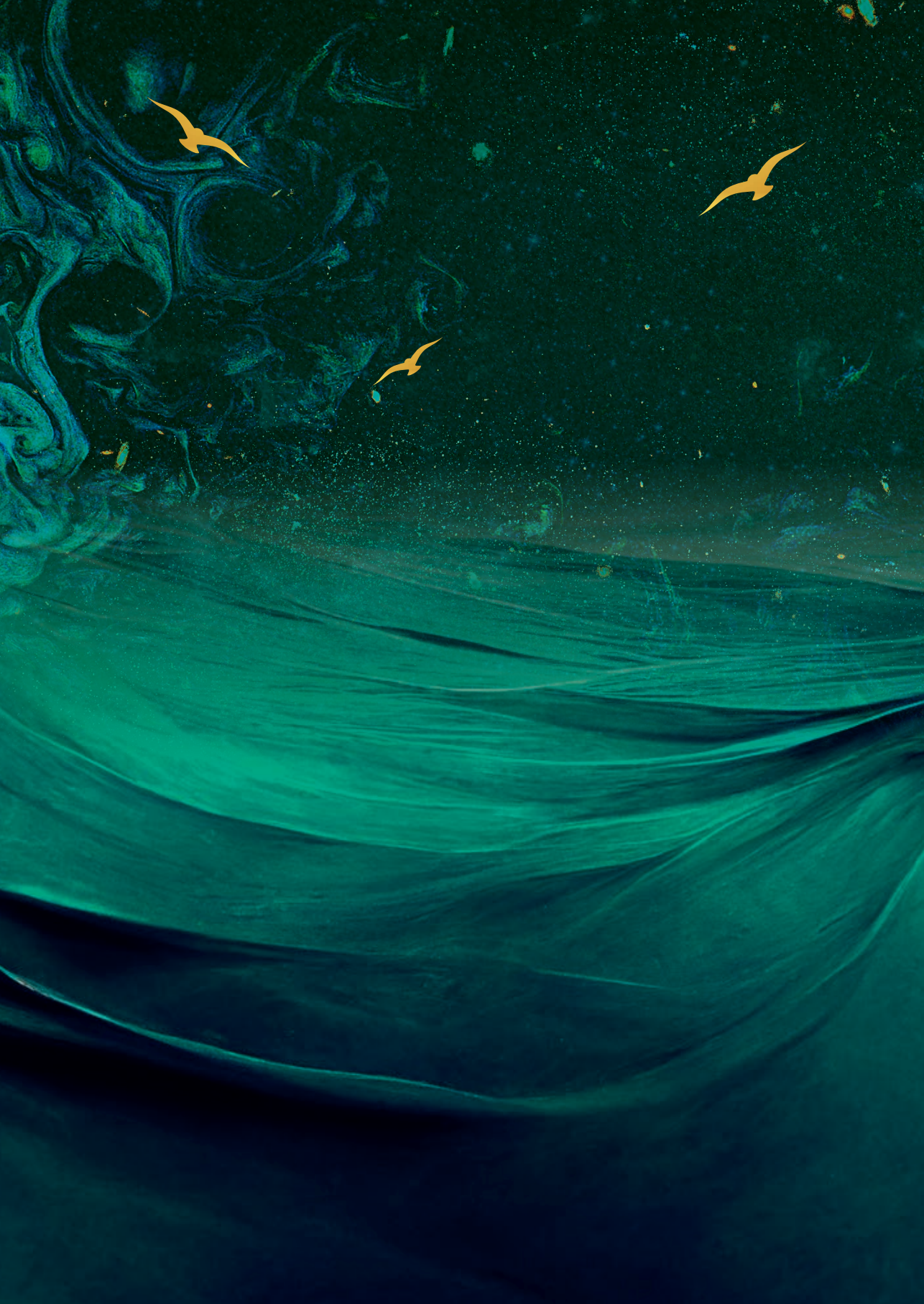
CHAPTER 5

Opening up or closing down anticipatory governance

Findings from diverse contexts across the Global South

5.1. Introduction

Anticipation processes such as scenarios, visioning processes, and simulation gaming have become a key governance mechanism to imagine uncertain climate futures and at least potentially guide actions in the present. These processes have spread throughout different disciplines (Andersson, 2018; Edwards, 2010) and prominent norm-setting institutions such as the Intergovernmental Panel on Climate Change and the United Nations Environment Program's Global Environmental Outlook (Pereira et al., 2021). However, there are very different ideas regarding how anticipation can inform governance across the social sciences and interdisciplinary sustainability sciences (Muiderman et al., 2020). Some consider anticipation processes as useful tools for designing policy trajectories that prevent future risks and hazards (Fuerth, 2009; Fuerth & Faber, 2013) while others point to a lack of reflexive engagement with diverse visions of the future (Pulver & VanDeveer, 2009). These divergent visions have different implications for how futures work can help guide actions in the present (Muiderman et al., 2020). Anticipatory governance is emerging as an integrative, interdisciplinary research agenda that analyzes the steering effects of these emerging processes of anticipation by which is meant most broadly *governing uncertain futures in the present* (Vervoort & Gupta, 2018).

Critical social science scholars have pointed to an important research question. How can anticipation processes be understood as sites of political negotiation, where future dynamics are made sense of, and processes of prioritization and inclusion are shaped? They argue that imagining the future informs the shaping of policy choices in the present (Jasanoff & Kim, 2015; Taylor, 2004; Gupta et al., 2020). Of particular importance to this paper is Stirling (2008) who has pointed to the growing number of deliberative processes that try to engage with – or open up to - future complexities and contingencies in the anticipation of scientific and technological progress, but end up closing them down instead, because of the ways in which power limits what is considered possible and desirable to be explored; and how social actors frame and understand what are viable alternatives (Stirling, 2008; Turnhout et al., 2016). These dynamics are important, others have also argued, because futures can be framed in certain ways, e.g. as future emergencies, to either legitimize socially unwanted action (Bellamy, 2016) or comply with pragmatic solutions available to current regimes (Sarkki et al., 2017; Sova et al., 2015).

The dynamics of opening up and closing down possibilities for action are important to scrutinize in the uncertain and normatively and scientifically contested terrain of futures work (Gupta et al., 2020). Anticipatory governance processes are often still quite prediction-oriented and technocratic (Low & Schäfer, 2019; Muiderman et al., 2022) even

when there are also many processes and practices that have been designed specifically to provide openings for reflexive and critical dialogue about what and whose futures to engage with (Bennett et al., 2016; Bellamy et al., 2013). Technocratic and prediction-oriented anticipation processes close down dialogues, which may have material impacts in terms of action, insofar as they may act on some futures rather than on alternative (and more desirable) futures (Paprocki, 2019).

In this article we investigate how conceptions of the future in influential anticipation processes impact governance actions in various regional sustainability contexts of the Global South. Do they provide openings for more inclusive and reflexive action, or are these processes closed down by incumbent interests and dominant framings of what is considered relevant and credible knowledge and viable present-day actions? In earlier work, some of us have developed an analytical framework that provides a lens through which to examine assumptions about the future and their steering effects in the present (Muiderman et al., 2020). In this article, we connect this framework to the notion of opening up/closing down (Stirling, 2008) to empirically examine the dynamics of anticipatory governance in diverse regions of the Global South. We argue that this question is particularly urgent in developing countries since futures work is seen to be largely based on Global North ideas, methods, research and technologies (Escobar, 2020). While a critical research agenda on anticipatory governance is now emerging most research has focused on the Global North (Biermann & Möller, 2019; Vervoort & Gupta, 2018). This clashes with the fact that many parts of the Global South are particularly vulnerable to challenges such as climate change (Adger & Vincent, 2005; Okereke, 2018) and climate governance actions should fit local and national contexts (Derbile et al., 2016).

Here we present a multi-regional case study in which we qualitatively analyze several anticipation processes through investigating written and spoken statements in policy documents, process reports, interviews, and focus group discussions. Building on these regional analyses, this paper provides novel insights into anticipatory climate governance in diverse contexts of the Global South, a crucial gap in the literature.

5.2. Opening up or closing down anticipatory governance: frames of the future and possibilities for action?

5.2.1. Anticipation and anticipatory governance

The notion of anticipatory governance captures the challenge of how uncertain futures can be imagined and governed in the present (Boyd et al., 2015; Muiderman et al., 2020; Vervoort & Gupta, 2018). Anticipatory governance as a concept was developed in the context

of the responsible innovation of technologies and their future societal impacts (Barben et al., 2008; Guston, 2014), and then adopted in environmental governance (Gupta, 2001, 2011), social-ecological systems literature (Boyd et al., 2015), public planning (Boston, 2019; Fuerth, 2009), and science and technology studies (Davies & Selin, 2012). A wide variety of approaches to anticipatory governance exist in the social sciences and sustainability sciences that are diverse in terms of their conception of the future, implications for the present, and ultimate aims (Muiderman et al., 2020). Muiderman et al. (2020) identify four approaches commonly found across anticipation literatures:

> *Approach 1 assesses futures in terms of probability in order to help inform strategic policy planning to reduce future risks.*
>
> *Approach 2 explores plausible futures in order to build capacities and preparedness to reflexively navigate diverse uncertain futures.*
>
> *Approach 3 focuses on the imagining of pluralistic futures in order to mobilize diverse societal actors to co-create new futures.*
>
> *Approach 4 scrutinizes the performative power of future imaginaries in order to interrogate and shed light on their political implications in the present.*

In a follow-up study investigating a global network of foresight-for-food practitioners in terms of this framework, Muiderman and co-authors (2022) illustrate that in practice, anticipatory processes might align with one approach or (more often) with multiple approaches. Across these approaches, a plethora of methods and tools of anticipation exists, such as modeling (Mason-D'Croz et al., 2016; Sampson et al., 2016), participatory scenario analysis (Kok et al., 2007; Vervoort et al., 2014) and visioning and back casting (Quist et al., 2011; Robinson et al., 2011). Approaches less clearly signposted as anticipation or futuring, such as environmental impact assessments or budget analyses can also be anticipatory in character. Such anticipation methods are not tied to a single conception of the future – they are typically flexible enough to be included in different conceptions of the future as embodied in the four approaches. The framework that developed the four approaches to anticipatory governance has turned out to be a useful tool to examine how assumptions about the future steer actions in the present in specific empirical contexts. In this article, we take a step further and connect this framework to the notion of opening up/closing down to understand how different approaches to anticipatory governance open up or close down future possibilities to diverse framings and assumptions and open up possibilities for action or close them down towards existing policy frames.

5.2.2. Opening up or closing down governance

The focus on stakeholder participation in sustainability governance processes has resulted in new institutions, processes, and tools (Stirling, 2008). Perspectives from outside (of science) are, for example, more often said to be important to legitimately formulate decisions about the future (Ravetz, 1999; Macnaghten, 2009) as doubts persist about the nature and solution of future problems (Esguerra, 2019; Gupta, 2011). As a result, much of the futures work in sustainability governance contexts is at least partially participatory and involves stakeholders such as policymakers, local NGOs, and researchers to balance diverse interests and knowledge. However, processes that involve diverse stakeholders are often still dominated by linear and deterministic notions of technological process and affect policy debates just as much as 'narrower' expert-based processes (Stirling, 2008). Stirling points to a tension in the growing calls for stakeholder participation by incumbent interests, who then close down the possible range of possibilities rather than opening them up (Stirling, 2008). This expresses itself, for instance, in implicit and predetermined policy commitments that push for clear, authoritative, prescriptive policy recommendations rather than open-ended political processes (Stirling, 2008; see also Bellamy et al., 2013).

Closing down, in short, also happens in processes that aim to open up future possibilities through both deliberate and unconscious actions (Stirling, 2008). More deliberate and strategic choices that contribute to closing down include, for example when knowledge is repackaged to make it attractive to and respond to the needs and political agendas of policymakers (Sarkki et al., 2017). A similar dynamic is at play in the selection of what is considered policy-relevant knowledge (Turnhout et al., 2016). Less conscious forms of closing down can take place when processes educate instead of empowering participants and do not necessarily lead to more democratic prosses and social agency (Stirling, 2008). Another example would be the calibration of a variety of deliberation-generated inputs into consensus and unanimous recommendations for standardized procedures (Turnhout et al., 2016). Closing down is thus shaped by factors generally considered as 'external' to analysis and appraisal and therefore not always rendered visible. But it can have a decisive role in determining what actions are considered possible in the potential to realize diverse futures.

Contrastingly, maintaining a truly open dialogue means focusing on questions of power. As Stirling (2008) points out, important questions come to the fore. For example: Who determines what futures are included? How are uncertainties interpreted? How are alternative futures are characterized (e.g., as relevant or not)? To what extent are findings justified rather than criticized? Processes that open up possibilities might discuss neglected issues, marginalized perspectives, ignored uncertainties, disputing

knowledges, and alternative options in a pluralistic rather than consensual form (Dryzek and Niemeyer 2006). The key is reflexivity regarding different framings, alternative assumptions, and possibilities (Stirling, 2008). Opening up also means to transparently report on divergent interpretations in policy advice - if and how alternative courses of action would be preferable under different framing conditions and also in relation to the real world of divergent contexts and values (Stirling, 2008). This avoids premature lock-in effects and the devaluing of alternative futures. The figure below presents the framework for anticipatory governance connected to the notion of opening up/closing down, as discussed by Stirling.

Figure 5.1. The opening up or closing down of anticipatory governance

Figure 5.1 illustrates how the framework on anticipatory governance and the notion of opening up and closing down connect. It illustrates that closing down or opening up anticipatory governance relates to the level of opening up or closing down of future possibilities to different framings and assumptions about the future (horizontal axis in figure 5.1). In addition, it also relates to the level of opening up of possibilities for action or closing down towards existing policy frames (see vertical axis in figure 5.1). Moving from approaches 1 to 4, anticipation processes are increasingly explicit and sensitive to diverse framings and futures assumptions. In terms of their connections to present-day action (the grey arrow), however, they might be understood by incumbent actors (governments, business leadership) as being further away from familiar or common approaches to planning. This does not mean that they are necessarily less actionable – for instance, approach 3 focuses on pluralistic futures but often for the purpose of mobilizing concrete political and transformative action by new groups or coalitions of actors. But classic planning approaches can often be perceived as the most 'actionable', compared to the actions in the present envisaged in the three other perspectives.

In the context of these four approaches, approach 1 closes down future possibilities through assumptions about probability that may seem to provide a comprehensive image of future risks and thus the most salient form of action. However, many of these assumptions may be challenged for the non-inclusive and limited ways in which they frame the world. Approach 2 opens up to diverse courses of action and involves diverse stakeholders (including also communities affected by measures) but the exploration of uncertainties and complexities typically needs boundaries, a prioritization of drivers, and consensual recommendations, and its technical, systems-based nature can close down possibilities because of its prominence in exclusive and technocratic processes. Approach 3 focuses on pluralistic processes with societal stakeholders where the focus is on agency to bring about change and certainly offers more opportunities for opening up possibilities for action; though this often means creating new organizations, communities, and institutions to realize action. Approach 4 explicitly opens up to issues of power in assumptions and framings of the future, but because of its mostly critical, academic mode, it can disconnect from providing actionable guidance – and thus not lead to more democratic anticipation.

5.3. Methodology

5.3.1. Data collection
We selected four diverse regions in the Global South: West Africa, Central America, Southeast Asia, and South Asia. We selected four regions where the Climate Change, Agriculture and Food Security (CCAFS) Program, an organization part of the research

consortium, held foresight processes to guide climate decision-making. The regions are diverse in socio-economic, political, and security conditions, but have climate vulnerability and dependence on foreign assistance in common. The authors (four of whom worked for CCAFS at the time of research) have extensive networks and experience working on foresight for anticipatory governance in these four regions, and could therefore rely on valuable access to anticipation processes (Vervoort et al., 2014). In these regional contexts, we wanted to focus on the most vulnerable countries and therefore limited our scope to five countries in each region. We included those countries with the lowest GDP: a) Ghana, Senegal, Mali, Niger, and Burkina Faso for West Africa, b) Honduras, Belize, El Salvador, Nicaragua, and Guatemala for Central America, c) Laos, Vietnam, Cambodia, Philippines, and Indonesia for Southeast Asia, and d) Bangladesh, Sri Lanka, Pakistan, Nepal, and India for South Asia. We later added Costa Rica as a 21st country; while Costa Rica does not fit our GDP criteria, its unique approach to anticipation helps support a stronger analysis by contrast. The set includes 3 low-income countries, 14 lower-middle-income countries and 1 upper middle income with high poverty and inequality, and 1 upper middle income with high inequality (The World Bank, 2020). Within these countries, we searched for influential examples of anticipation and limited our scope to processes that aimed to inform climate governance.

We proceeded as follows. A team of four researchers (one for each region, of which the first author was the global coordinator) searched academic literature for publications on processes of anticipation. We searched on Scopus using the following keywords to include anticipation that intended to inform policy: [country] AND development AND policy AND climate AND change AND future. We read all abstracts and included papers with at least two of the following keywords: future, adaptation, anticipation, scenario, and foresight. This resulted in 11 academic articles on anticipatory processes in West Africa, 1 paper in Central America, 5 in Southeast Asia, and 0 in South Asia. We then looked for important national climate policies on Google, including government websites and UN websites (e.g., adaptation-un.org) to examine if anticipation was used. Third, as we noticed that many policies were not published online, we used a snowball technique and asked foresight experts in each region to help verify and complement the selection of anticipation processes and policies found. The snowballing started with the regional CCAFS experts, who pointed to influential anticipation processes and climate policies. Based on these findings were other experts contacted, and so on (Verschuren & Doorewaard, 2010). Through this snowball technique, another 4 processes were included for West Africa, 0 for Southeast Asia (because there were already many relevant policy documents included that had used anticipation), 13 for South Asia, and 14 for Central America. In addition, we included national and sectoral policy documents that address climate change and had been initiated in the last decade (since 2008, as the research

started in 2018). In addition, 15 policy documents were selected in West Africa, 16 in Southeast Asia, 13 in South Asia, and 12 in Central America. This set of academic papers, reports, and policy papers were first analyzed to identify the methods and tools of anticipation and their relation to decision-making.

We continued our search for more implicit assumptions about the future and its implications for the present with in-depth scrutiny of twelve anticipatory climate governance processes (three per region, see table 4.1). From the broader set, we selected processes that were similar in their explicit recommendations for policy impact, yet different in the type of method or tool that had been used. As such, we focused on diversity in the types of processes to see if they aligned with some or multiple approaches. In each region, interviews were held (41 in total) with people working on the anticipation-policy interface, including at least the designer/facilitator of each anticipatory process (e.g., the workshop facilitator, modeler, etc.), an intermediary person (e.g., responsible for stakeholder participation and policy engagement), and a policymaker or person responsible for policy follow-up.

As a final step, we organized six focus group discussions dedicated to the inquiry of opening up or closing down of anticipatory governance: in Bangkok, Thailand (17-18 July 2019), Dhaka, Bangladesh (17 Augustus 2019), Guatemala City, Guatemala (3 October 2019), San Salvador, El Salvador (19 October 2019), Niamey, Niger (31 January 2020) and Ouagadougou, Burkina Faso (6 February 2020). In each session, we shared and discussed findings with groups of 10-20 participants, including policymakers, researchers, and representatives from civil society. We asked participants in an open-ended manner about their perspectives regarding opportunities and challenges for formulating actions in the present based on anticipation and conveying this to incumbent actors. In Niamey and Ouagadougou, a survey was also shared with similar questions to equally capture each participant's input.

5.3.2. Comparative Analysis

We used a qualitative-comparative case study method to describe, interpret, and further conceptual understanding of anticipatory climate governance processes in the Global South. The comparative method is a well-established method in the social sciences to test theoretical propositions and research phenomena in fields of study where controlled experiments are impossible (Hopkin, 2010). We thus considered this method highly suitable for our aim to interpretatively and comparatively analyze if anticipatory governance opens up or closes down future possibilities in future visions and associated present-day actions.

The case study method helps to explain phenomena such as anticipatory governance within their context (Flyvbjerg, 2006; Verschuren & Doorewaard, 2010) and allows for interpreting similarities and differences across the diverse contexts in this research. The analytical framework on anticipatory governance (Muiderman et al., 2020) provided the theoretical context for our research as well as the notion of opening up and closing down (Stirling, 2008) (see figure 5.1). We used the four approaches as heuristics (Bartlett & Vavrus, 2017) to discover and 'trace' approaches to anticipatory governance in anticipation processes across diverse sites, and the notion of opening up/closing down to further interpret the external dynamics within approaches.

The qualitative multi-sited case study allowed for an open way of gathering and triangulating data – in this case, the interpretation of texts and perspectives. We used several techniques in parallel - literature and document review, snowballing, semi-structured interviewing, and focus group discussions – in parallel to an iterative and open-ended exploration and refining of research findings. These synchronous processes also increase the validity of the study (Kleining & Witt, 2000; Yin, 2003). We identified what methods and tools are used by practitioners and policymakers to anticipate climate futures and their intended role in decision-making in 21 countries. Then, we scrutinized for 12 processes how assumptions about the future impact actions in the present and to what ultimate aim (see table 4.1). Finally, we analyzed for each of the 12 processes dynamics of opening up and closing down, as well as for the broader region.

Rather than focusing on countries or regions, our unit of analysis is the anticipation process. However, we decided to structure our comparative analysis according to the four regions, to open-endedly explore if regional differences and similarities exist that help explain why certain approaches dominate and dynamics of opening up/closing down occur. We followed the logic of a hierarchical approach to comparative case study research (Verschuren and Doorewaard 2010), which consists of two separate phases. We first examined the anticipation processes as a sequence of separate cases for each region (Sections 4.1.- 4.4.) and then compared across the regions (Section 5) what approaches to anticipatory governance are taken and if they open up or close down future possibilities.

5.4. Approaches to anticipatory climate governance in four regions

This section discusses the findings in the four regions: West Africa, South Asia, Southeast Asia, and Central America.[1] Appendices 5.1 – 5.4 list for each region the anticipation reports and literature and policy documents reviewed, and interviews and focus group discussions held. The table below lists the 12 processes that were examined in detail.

Table 5.1. Twelve processes examined in detail

West Africa	South Asia	Southeast Asia	Central America
Climate modelling and policy workshops under the African Monsoon Multidisciplinary Analysis	Quantified participatory scenario narratives for the 12th Five Year Plan for India	Climate change and sea level rises scenarios of the Vietnam Institute of Meteorology, Hydrology and Climate Change	Urban development scenarios for the Sustainable Tourism Master Plan in Belize
Data generation and collection workshop under the West African Biodiversity and Climate Change	Participatory foresight process for the 7th Five Year Plan in Bangladesh	Climate forecasts and foresight for Climate Action for ASEAN Agriculture Resilient Societies 2020	Environmental assessment for the National Climate Change Adaptation Strategy for the Agri-Food Sector of Honduras
Scenario-guided policy reformulation of Burkina Faso's Rural Development Plan II	Two sets of scenarios for the Bangladesh Delta Plan 2100	Qualitative and quantitative scenarios for the Lower Basin Mekong Development Strategy	Quantitative and qualitative scenarios for Costa Rica's Intended Nationally Determined Contribution process

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5.4.1. Anticipatory governance processes in West Africa
5.4.1.1. Anticipation processes

Following the ratification of the UNFCCCs Paris Agreement most West African countries have shifted their priorities from adapting to present-day vulnerabilities towards the anticipation of more long-term climate vulnerabilities (Noblet et al., 2018). The anticipation processes reviewed for West Africa (see appendix 5.1 for a full list of anticipation processes analyzed) combine methods and tools; the majority starts with model-based scenarios, such as climate modeling (e.g., impact of precipitation) and crop modeling (e.g., impact of temperature rise and precipitation changes on crop yields) to

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1   Each section presents a synthesis of a study that is also published as a standalone regional working paper by one of the co-authors of this paper: South Asia (Muzammil et al., 2021), Southeast Asia (Peou et al., 2021) and Central America (Veeger et al., 2021). The West Africa analysis was published as a journal article (Muiderman, 2022).

assess future climate change (e.g., Burkina Faso's National Climate Adaptation Plan). And then combine this with participatory methods to discuss policy options, for example serious gaming and a policy forum (e.g., AMMA-2050 in Senegal), or a participatory approach to monitoring and evaluation (A practical consensual tool for water policy in Burkina Faso, Gahi et al., 2015). A few processes started with participatory scenario methods to explored multiple plausible futures with diverse stakeholders (academia, policy, private sector, and civil society) – and sometimes quantified these narratives. Only a few processes used budget analysis.

The policy documents we reviewed often start with a normative future vision for the country and to this end use quantitative (and sometimes qualitative) scenarios to determine which policy measures are needed to realize this future, for example macroeconomic trend analysis (e.g. Ghana's Shared Growth and Development Agenda II) or climatic trend analysis (e.g. Senegal's National Adaptation Plan for the Fisheries and Aquaculture Sector in the Face of Climate Change Horizon 2035 uses the IPCC scenarios RCP 4.5 and 8.5 in two global models). Visions are also developed in a participatory way (e.g., Niger's Strategic Framework for Sustainable Land Management), but some policy documents stated that visions were legitimized through elections (e.g., Ghana's Coordinated Program of Economic and Social Development Policies).

Almost all of these processes were organized by consortia of academic institutes and governmental agencies and were organized and funded by international organizations and donors, including the World Bank, UNDP and NEPAD, donor governments and agencies, such as USAID and DFID, and developmental research institutes such as CIRAD and CGIAR. These organizations collaborate with West African partners, such as ministries and research institutes, to co-design the processes and involve more stakeholders.

5.4.1.2. Conceptions of the future, implications for actions and ultimate aims

The first example, the West African Biodiversity and Climate Change (WABiCC) Program organizes, amongst others, participatory workshops to improve access to and understanding of high-quality portals and models to increase preparedness and resilience to future climate risks for coastal areas, in a hybrid approach of 1 and 2. The focus on science-based risk mitigation was needed because according to one interviewee "*looking at the NAP (National Adaptation Plan) reports and the NAPA (National Adaptation Program of Action) process, national communications, I often found that the climate information provided in this region that were leading to the selection to adaption policies was oftentimes not very good*" (Interview, 19 March 2019). The project hopes to change the

mind-sets of policymakers to plan under scientific uncertainty through reliance on robust data and strengthened interaction with external experts.

The African Monsoon Multidisciplinary Analysis (AMMA-2050) Program uses mainly crop and convection permitting modeling to assess probable futures and organizes workshops with policymakers to build institutional capacities for science-based planning to mitigate future risks, which is mainly approach 1 with some approach 2 action.

The Food Security, Agriculture and Climate Change (CCAFS) Future Scenarios Project sees futures as more fundamentally uncertain and complex and explores plausible futures to be able to navigate them as they emerge (approach 2). The CCAFS scenarios were used to guide the reformulation of Burkina Faso's Rural Development Policy II (2016-2020) to make it more robust to diverse futures. However, the policy document and policy makers stated to appreciate the processes for its technical assistance in reducing future risks, thereby using approach 1 language.

5.4.1.3. Opening up/closing down
Both the WABiCC and AMMA-2050 programs embed an approach 1 conception of the future and pursue a combination of approaches 1 and 2 actions – embedding language on deep uncertainty and capacity building within a linear planning approach. Both programs also aim to reduce risk and increase resilience (also 1 and 2). These processes opened up to include multiple sources of scientific information but maintained a relatively exclusive processes. The CCAFS process followed approach 2 but ended up being used by policy makers for linear planning strategies – thereby reducing equally plausible futures to a consensual and most likely future and reframing futures as technically informed in a way that was not originally intended by the anticipation process.

Focus group participants shed further light on the closing down dynamic. Participants saw the future as a relatively closed and predetermined space - credible futures are those that can be assessed by science. According to multiple interviewees should anticipatory governance therefore support the evidence-base of policies and get the science right about future climate change to inform decision-making more accurately beyond subjectivity and perception. Future uncertainty was considered a problem of science - it can result in underestimation or overestimation (e.g., of yields) and misinform planning. Processes that explicitly engage with inherent future uncertainties and subjectivity, such as participatory scenarios work, are considered less authoritative than model-based scenarios. Some described participatory scenarios as the second-best option: "It depends

on your projection and on your resources what you can do, because if you don't have the capacity to do a simulation, then you cannot do anything. You can go to participatory scenario because you don't have anything else so you do what you can" (Interview, 19 April 2019). Others very much appreciated the methodology for the inclusion of voices, and open yet structured dialogue. "*It made them [policymakers] aware of the importance of the synergy with national research institutions and to take advantage of knowledge at different levels: from community, national, regions.*" (Participant to the focus group discussion in Ouagadougou, 6 February 2020)

Participatory scenarios processes are thus valued for the process, but not necessary the outcome, which may explain why the knowledge produced in the participatory processes is not transparently communicated in the policy document while it does visualize two quantitative scenarios that were developed in a parallel FAO process.: *The way of wording things in the policy document cannot be as clear as from the recommendations. [...] They won't mention - thanks to the scenario process, we were able to do this etc.... it's not the right jargon.*" (Interview, 08 October 2018). Different hybrids thus exist of approaches 1 and 2, but there is a tendency to align actions with approach 1 and connect to existing policy frames.

5.4.2. Anticipatory governance processes in South Asia
5.4.2.1. Anticipation processes
South Asian countries were considered to take quite a technocratic stance to anticipatory governance and focus anticipation on risk management. In South Asia, the majority of anticipation processes investigated (see appendix 5.2 for a full list of anticipation processes analyzed) focused on quantitative forms of foresight, e.g., climatic trends analyses generated by several climate models (Muzammil et al., 2021), and complemented by a variety of other participatory or policy strategizing methods. Four processes included participatory scenario processes. All but three were translated into policy.

Multilateral organizations mostly fund anticipation, such as the World Bank, UNDP, UNEP, GEF and European Union (EU), who partner up with donor governments and organizations such as USAID and DfID, UK, and international developmental research institutes such as the IDRC. They work in consortia to design and run the process and work with governmental organizations in the countries, and in fewer instances with civil society and private sector partners. Only the scenarios for the 12th Five Year Plan for India were initiated and developed by its Planning Commission in collaboration with national research institutes.

5.4.2.2. Conceptions of the future, implications for actions and ultimate aims

The CCAFS participatory foresight process for the 7th Five Year Plan in Bangladesh used a combination of regional, participatory, qualitative plausibility-focused participatory scenarios created for South Asia, supported by the IPCC's climate and socio-economic scenarios; quantified agricultural economic modelling, and national impact studies. These scenarios were downscaled to create qualitative scenarios specifically for Bangladesh help support workshop participants (the Bangladesh Planning Commission) in their testing of the core elements of the 7th Five Year Plan (Vervoort et al., 2014), as associated with approach 2.

The anticipation process for the 12th Five Year Plan for India quantified participatory scenario narratives with a system dynamics model to 'add quantitative rigor' to the narratives. The aim was to understand the major challenges India faces in the future and to ensure more democratic and inclusive outcomes that took voices of all the different regions and societal groups into consideration. The scenario recommendations helped prioritize infrastructure and human capital investments for the aim of successfully reaping its 'demographic dividend' (approach 2 with elements of 1 and 4).

The Bangladesh Delta Plan 2100 used two different scenario processes to develop a robust, adaptive, integrated planning strategy for water secure, flood safe, climate resilient and prosperous delta. First, Dutch research consultants developed four scenario narratives of hypothetical futures including a wide range of drivers (approach 2). Thereafter the General Economic Division invited a team of Ecosystem Services consultants who proposed to validate and extend scenarios drivers through integrated modelling. While the first team disagreed because the scenarios were purely intended as test beds of plausible uncertain futures, two out of four scenarios were developed into policy scenarios and placed in a macroeconomic context that were easily communicable to policymakers and more suitable in the context of development (approach 1) (Hasan et al., 2020). The initial set of four future scenario narratives ended up in the annex. These examples also illustrate hybrid approaches of 1 and 2, combined with elements of 4. In addition, they demonstrate how anticipation can provide openings for opening up to different frames of the future but are enforced to close down in the formulation of possibilities for actions in the present.

5.4.2.3. Opening up/closing down

The CCAFS project followed approach 2 but was used for more linear policy planning in some respects; although the result of the approach 2-based analysis of the 7th 5-year plan did also focus on adding elements that focused on building general resilience. The 12th Year Plan opened a plausiblistic process (approach 2) up to give agency to diverse

societal groups (approach 4) but closed down into two macro-economic scenario's that fitted current policy frames (approach 1). The Delta Plan 2100 used approaches 1 and 2 in parallel, which started to compete, and the two macro-economic and policy relevant scenarios won from the four testbed scenarios– illustrating how policy relevancy delimits futures possibilities.

Discussions with participants highlighted that the government of Bangladesh takes a very technocratic and expert-analytic stance on climate change anticipation, funding primarily simulation modeling of flood risks for technical solutions to control floods and other disasters. These presumptions about what anticipatory governance is for shapes the types of processes that are funded and the space available for critical dialogue. It was also said that participatory processes were often less inclusive than initially aimed for, with 'usual suspects' such as government officials and researchers joining while local community voices, marginalized perspectives (e.g., women and youth groups) and other groups whose futures are at stake were excluded. The CCAFS process was said to have introduced uncertainty and plausibility to the Planning Commission which felt uncomfortable to them initially but was considered to have added value in the end. In the final policy, this also resulted in a focus on resilience and flexibility in the policy changes (around infrastructure and education). However, it remained a relatively closed process in terms of participation, particularly in terms of the voices included and political agendas that shaped the process – policy uptake was prioritized instead.

5.4.3. Anticipatory governance processes in Southeast Asia
5.4.3.1. Anticipation processes
In Southeast Asia, there is a growing concern for increasing awareness and reflexivity about future impacts of climate change and strategically work towards more resilient societies. As a result, climate legislation multiplied over the last years and there are numerous new stakeholders and agencies to support and test future-oriented policy formulation. Almost all national policies use some form of anticipation process to inform climate change decision-making and clearly report on their approach (see appendix 5.3 for a full list of anticipation processes analyzed). A variety of anticipatory processes are used, predominantly quantitative climate scenarios, but also visioning, horizon scanning, environmental assessments, and participatory foresight. Each policy is nationally endorsed and there is quite a strong political will to implement action. Some anticipation processes are expert driven but others seek to develop a common future and involve a wider range of stakeholders. Financial support and technical input come from international organizations such as the European Union, the United Nations Development Program and the World Bank, and donor organizations such as the Swedish International Development cooperation Agency and GIZ.

5.4.3.2. Conceptions of the future, implications for actions and ultimate aims

The Association of the Southeast Asian Nations (ASEAN) formulated the Climate Action for ASEAN Agriculture Resilient Societies 2020 based on climate forecasts and foresight expertise within international organizations, horizon scanning and visioning in a participatory process, and embedded the ASEAN member countries' Nationally Determined Contributions in plausible future scenarios. Participants were encouraged to share a future they want in the participatory process. The aim was to realize future societal resilience. The normative futures visions in the ASEAN process were complemented by strategies and technologies that allow for achieving its consolidated vision, followed by a timeline for implementing and prioritizing interventions (approach 2 with elements of 1 and 3). The roadmap that resulted from the process still provides the reference framework for several policy processes.

The Ministry of Natural Resources and the Environment Vietnam Institute of Meteorology, Hydrology and Climate Change developed climate change and sea level rises scenarios for a three-year frequency in an approach 1 probabilistic process, with the aim to understand climate risks and its impact on development.

For the Lower Basin Mekong Development Strategy 2016-2020 developed its Mekong River Commission nine climate change scenarios using qualitative and quantitative methods. The scenarios present diverse projections of the magnitude of climate change under low to high carbon emissions, and seasonal precipitation patterns, for four different time horizons. The impacts of these scenarios on the economy and environment, amongst others, were discussed in a two-year participatory process. The Lower Basin Mekong scenarios followed a process of determining long-term objectives as part of its Development Strategy (combining approaches 1 and 2).

5.4.3.3. Opening up/closing down

The ASEAN processes followed largely approach 2 - a plausiblistic process to increase residence - with approach 1 prediction-oriented anticipation and approach 3 pluralistic elements. The openings were closed down into linear planning in terms of the timeline and roadmap. The Vietnam scenarios followed approach 1 in a closed from of anticipatory governance. The Lower Basin Mekong Development scenarios combined approaches 1 and 2. Despite this participatory process, stakeholders were invited to discuss the future within the confines of the scenarios developed – delimiting future possibilities.

The ASEAN process took a more agentic perspective to anticipation and attempted to open up to include pluralistic futures (approach 3). The co-created desired future visions

were first considered impossibly optimistic and naïve by ASEAN members, but they saw its mobilizing potential when the NDC roadmap that resulted from the scenarios was used as the backbone for a joint statement by all ASEAN member countries for resilient agriculture. This example illustrates both a potential and struggle for opening up anticipatory governance.

Participants described the Vietnam scenarios as a strongly centralized and top-down process with high policy impact – it never opened up to divergent worldviews or contestations and provided strong policy enforcement because the process was directly under the order of the government who ensured policy uptake. The Vietnam Community party reviewed and integrated the scenarios into national and external policy processes as the baseline for all climate decision-making, including several policies, UNFCCC communication, national and subnational communications campaigns. These examples illustrate hybrids approaches of 1, 2 and 3 and highlight several dynamics of the closing down of opened up futures in the formulation of actions in the present.

5.4.4. Anticipatory governance processes in Central America
5.4.4.1. Anticipation processes

The anticipation processes reviewed in the Central American context were similar to those in the other regions (see appendix 5.4 for a full list of anticipation processes analyzed). Most anticipatory processes are assessments of climate impacts, risks and sectoral vulnerabilities and quantitative climate scenarios. These processes explore current and future impacts of climate change on the environment (biodiversity), health (water availability), development and the economy (agriculture and tourism). Policy documents also report primarily on model-based climate scenarios and climate impacts on e.g., yields, as well as climate impact risks and vulnerability assessments to legitimize decisions. A few used participatory and qualitative foresight methods such as Delphi methods and participatory scenarios development, but always in combination with quantitative climate scenarios and vulnerability assessments.

Most processes were initiated as independent processes that aim to guide decision making and governments also relied on independently designed processes. Nevertheless, some of these independent processes were complemented with foresight in the service of policy formulation. Processes were designed by national and international organization such as the IPCC and the National Institute of Seismology, Volcanology, Meteorology and Hydrology of Guatemala (INSIVUMEH). International organizations provide funding, such as the German Federal Ministry for Economic Cooperation and Development (BMZ) and the Nordic Development Fund (NDF) in Europe, and the Inter-American

Development Bank in the region. Policy documents often lack clear descriptions of the method used and how outcomes informed actions.

5.4.4.2. Conceptions of the future, implications for actions and ultimate aims

The National Climate Change Adaptation Strategy for the Agri-Food Sector of Honduras (2015-2024) explored plausible climate change, agriculture and food security futures for which it combined IPCC climate scenarios, impact studies of climate change on agriculture and food security, and four participatory workshops to validate the policy (Argeñal, 2010; USAID, Tetra Tech ARD, 2014). One of these four participatory workshops was organized by CCAFS and invited critical perspectives from farmers as a marginalized group and bring them into dialogue with national and regional policymakers, farmers´ associations, NGOs, teachers, and students. It was initially framed within a more technocratic stance to diversify crops and improve seeds in the face of climate change but ended up increasing awareness for the need to prepare for and build capacities to navigate diverse uncertain futures (approach 2).

The Sustainable Tourism Master Plan in Belize used more conventional methods to increase resilience to sea level rise and flooding, such as SWOT analysis, environmental assessments, and land use scenarios (approach 1). The aim of the project was to understand future risks and opportunities and invite public and private stakeholders to imagine the city they want to live in (approaches 1 and 3). The visions were used to prioritize environmental, social, economic and financial measures in the Sustainable Tourism Plan and the Belize City Master Plan and was also seen to have resulted a paradigm shift that collective action is needed between policymakers and citizens to live in harmony with water.

The government of Costa Rica started a collaboration with CCAFS in 2015 to make the Intended Nationally Determined Contribution (INDC) process more ambitious. The government first strengthened its institutional capacity to anticipate climate change and then used open access models to run thousands of climate, energy, land and water scenarios to assess which actions will probably have highest benefits to public health, the economy, climate reliance and mitigation (approach 1). Several qualitative scenario processes followed to collectively imagine alternative futures for more ambitious emission reduction than the models were able to show (combining approaches 2 and 3). One of the participatory scenario processes in 2020 involved 350 stakeholders from different sectors to explore diverse futures and test if policies are robust to scenario conditions. Actions focused on building capacities to anticipate change in a socially just and equitable way (approach 2 with element of 4).

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5.4.4.3. Opening up/closing down

Anticipatory governance processes are more open in this context with more transformative outcomes – in the sense of more radically different and deliberate action. Focus group participants pointed to a culture of participatory approaches in Central American countries. An example is the Ministry of Agriculture in Guatemala who receives quite a large number of anticipation studies, and rejects those not formulated in a participatory manner or including the government at an early state. The Honduras scenarios illustrates how critical futures dialogues (associated with approach 4) can be part of approach 2; diverse perspectives were seen to contribute to navigating diverse futures (approach 2), not to interrogate the performative power of anticipation (approach 4). Here, small-scale farmers were included to make sure the policy would be relevant to them. The futures opened up to include perspectives on plausible drivers of change, not necessarily on political contingencies – but still it aimed to include voices whose futures were at stake. The Honduras' National Climate Change Adaptation Strategy committee invited critical feedback from regional stakeholders to ensure that the policy would meet the local needs of farmers in an approach 2 through and pluralistic futures work. The Belize visions combined approaches 1 and 3 by aiming to reduce risks in pluralistic futures work. It was said to have resulted in a paradigm shift – changing participants' mindset and awareness.

The Costa Rican scenarios moved from approach 1 to combine all approaches; combining pluralistic futures for radical transformation (approach 3) with policy robustness (approach 2) in an open deliberative process to examining alternative visions and blind spots that may further marginalize vulnerable groups. The futures dialogue was opened up to realize more radically transformative ambitions than the models were able to show, and current transcendental emission efforts are insufficient to stay below a 1,5-degree temperature rise. The Costa Rican government was committed to maintaining an open dialogue in 5-yearly iterative cycles. Like in the other regions, these examples illustrate similar forms of anticipation in hybrids of approaches of 1, 2, 3 and 4, but provided more opportunities for the opening up of anticipatory governance.

5.5. Discussion and conclusions: opening up or closing down anticipatory governance in the Global South

In this paper, we set out to conduct a cross-regional analysis, investigating how anticipation processes in the Global South open up or close down potential futures and possibilities for action in the present. Our analysis finds that climate futures are predominantly framed in terms of probability or (to a somewhat lesser extent) plausibility - what we refer to as approaches 1 and 2 in our framework. Only a few processes imagine diverse and plural future worlds or critically examine assumptions

underlying future visions on their political implications (approaches 3 and 4) and these are mainly concentrated in the Central American context.

The analysis shows that anticipation approaches in practice are typically hybrids of the four ideal types of anticipatory governance approaches – with approaches decreasing in dominance from 1 to 4. Approach 1 processes seem to provide policy recommendations that fit incumbent policy frames and are therefore typically favored in the translation of outcomes to policy. Approach 2 receives growing recognition for its engagement with the deep uncertainty of climate futures; but its implications are harder to connect to linear planning. Approach 3 elements are incorporated in the designs of governance actors who recognize the need for more radically transformative change. Approach 4 is considered the least, but its principles inform some designs, particularly of those who are concerned equitable and just climate futures.

Nevertheless, our research shows that the translation from anticipation to governance action, regardless of the methodological underpinnings of the anticipation process, often means inferring linear planning actions – which builds on the belief that futures can be objectified, quantified and managed (Maechler & Graz, 2020). Approach 1 seems to dominate because practitioners feel it adheres most to policy discourses on effective anticipatory actions that favor technocratic and consensus-based advice and expert-analytic solutions for risk mitigation (e.g., seed modifications and water management). This was particularly mentioned in the West African and South Asian contexts. In order to meet such technocratic standards of effectiveness, incumbent actors justify decisions based on technical recommendations – or use subjective outcomes under the guise of technical decision-making (Jasanoff, 1987).

This results in a process of reframing, and less transparent reporting of subjective processes. This also explains why there is some space to consider more uncertainty through plausibility-based futures, on the technical arguments of systems thinking and resilience. However, discordant ideas on the future are typically not translated. Even those processes that aimed to open up to pluralistic worldviews, neglected issues and alternative futures (mostly in Central American contexts and some in Southeast Asian and South Asian contexts) are therefore closed down to some degree in practice, even if greater participation and novel methods can still be said to lead to more inclusive policy making than if these processes would not have happened. In sum, the process of more open participation is seen to have added value, but the outcomes are valued less, or at least recognized less in official documentation.

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Several implications emerge from our analysis. Fuller (2017) has pointed to the ways in which probability-focused anticipation, and to some extent, plausibility-focused anticipation as well, can be used to calm anxiety about the unknown rather than accepting the future as inherently uncertain. This is because scenarios do not reflect uncertainties in the sense of unknowns, but a variety of interrelated change processes based on knowable parameters that can be predicted or at least explored. Anticipation, when conducted in this mode, often informs a continuation of the status quo, rather than making a radical turn (Fuller, 2017). This can be quite problematic when those who finance and design anticipation (largely Global Northern actors) intend to create more inclusive and democratic processes but are closing down future possibilities for strategic and implicit rationales. As these implicit predetermined futures can de facto steer anticipatory governance (Gupta & Möller, 2018) in ways that hinder the transformative potential of anticipation (Avelino, 2017).

We thus see a danger in the dominance of approach 1 in pushing for linear planning strategies of climate futures – by means of an expansion of a Global North-dominated foresight industry that closes futures down while pretending to open them up futures. Countries depend on the funds, expertise and consultants of western institutions. We see that this foresight industry has been very successful in guiding climate action across the globe. But it also reasserts their epistemic authority at the cost of national structures (Kothari, 2005) and can push back alternative options and worldviews (Dutta, 2020). It is important to be reflexive of these dynamics. Futures studies is rooted in western secular philosophies and produces Eurocentric designs of the future even those that explore non-Western alternative futures (Escobar, 2020). These visions can be incompatible with other ontologies, for example futures imaged by local residents often contrast with expert visions (Paprocki, 2019). Therefore, scholars have warned that these dominant 'global' futures can further marginalize non-Western futures and conquer and colonize new futures (Dutta, 2020; Sardar, 1993). Land grabbing is a prime example in which dystopian futures have forecasted future destruction and legitimized dispossession (Boamah, 2014; Paprocki, 2019). Particularly in post-colonial development contexts a lack of reflexive anticipation can create an imperative for disruption before it takes place (Paprocki, 2019). Some of the discussions in our cases pointed to this direction; future visions were excluded that did not fit development paradigms, and in another example was information from a futures project used to grab land from smallholders in Cambodia.

The contexts in which our research was done were highly diverse in terms of their social, cultural, and political contexts, and much futures work has pointed to the need to represent such diverse societies (Appadurai, 2013; Escobar, 2020). However,

these regional differences are not fully incorporated into the designs of anticipation processes but are mostly based on Global North-style approaches tailored to the context. Nevertheless, some processes pluralistic and critical elements to collectively imagine, critique, and transform futures with public and private partners. This we consider explicitly opening up anticipatory governance – and the Costa Rican example in particular provides important insights into how setting an ambitious climate future agenda can open up anticipatory governance. It thus seems important to give the two approaches that are most marginalized in practice a more prominent place; approach 3 for its opening up space to diverse future worlds and setting of more ambitious agendas, and approach 4 for its opening up space to discuss the role of power and setting of more equitable and just future agendas. An emergent research agenda focused on bottom-up futures processes provides alternative (and more positive) future images that challenge the status quo (Bennett et al., 2016; Pereira et al., 2021). Such bottom-up futures can be successful catalysts for stimulating transformative change, particularly in rural areas (Totin et al., 2018) and steer local governance choices in ways that speak to communities and tap into existing institutional structures (Appadurai, 2013).

Our research shows that the opening up or closing down of anticipatory governance are not mutually exclusive but that its dynamics are interwoven. It is important to become aware of these dynamics, also those that happen less consciously, because closing down under the guise of opening up can legitimize inequitable action in a seemingly open, participatory process. According to Stirling it is important to question if anticipation processes mobilize counternarratives to justify or critique findings (Stirling, 2008). Opening up anticipatory governance for more radical transformation means to actively challenge the status quo, and this can be scary to the political elite (Pereira et al., 2021) and go against the nature of imagining the future based on past experiences (Andersson, 2018). Our empirical research provides insights into global calls for anticipatory governance that is reflexive of radical uncertainties, indeterminacies and competing visions (Bellamy et al., 2013; Gupta, 2011; Gupta et al., 2020) including a growing awareness of the unequal power structures in futures work (Appadurai, 2013; Gram-Hanssen et al., 2022; Sardar, 1993). Connecting the framework on anticipatory governance with the notion of opening up and closing down helped to understand and explain these dominant dynamics in specific contexts across the globe.

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CHAPTER 6

Conclusions

I began this thesis by comparing anticipatory governance to *demarrages* in road cycling – both are efforts to proactively realize a more desirable future. This metaphor visualizes the impact of anticipation on present-day actions – and epitomizes the workings of imagination. This research has explored the power of such imaginations of futures in anticipation processes that guide sustainability transformations across the globe. The aim of this thesis has been to examine how conceptions of the future steer governance actions to be taken in the present, and their implications for realizing sustainability transformations. To achieve this aim, the following research question was formulated: '*How are conceptions of the future steering anticipatory governance actions in the present and with what implications for realizing sustainability transformations?*'. This question was subdivided into four sub-questions. The first question is: *''How do different approaches to anticipatory governance in the literature relate to practice?''* The second question is: '*Which approaches to anticipatory governance dominate and why?*' The third question is: 'W*hat are the implications of the prevalence of different approaches to anticipatory governance for realizing sustainability transformations?*' And the fourth question is: '*How do different approaches to anticipatory governance open up or close down future possibilities?*'

This final chapter first presents a summary of the research findings in chapter 6.1 before answering the four questions in a cross-cutting way in section 6.2. Section 6.3 then discusses the implications of the research findings for the wider literature and what future research is needed. The thesis ends by reflecting on the research design in section 6.4 and looking ahead toward future directions for anticipatory governance research in section 6.5.

6.1. Summary of findings

After the topic of research and its intended theoretical contributions have been introduced in chapter 1, **chapter 2** unpacks divergent explicit and implicit conceptualizations of anticipatory governance in the social science and sustainability science literatures. Four approaches to anticipatory governance are identified with (a) diverse conceptions of the future; (b) implications for actions to be taken in the present; and (c) the ultimate end to be realized through anticipatory governance. These are:

Approach 1 assesses probable (and improbable) futures in order to help inform strategic policy planning to reduce future risks.

Approach 2 explores plausible futures in order to build capacities and preparedness to reflexively navigate diverse uncertain futures.

Approach 3 focuses on the imagining of pluralistic futures in order to mobilize diverse societal actors to co-create new futures.

Approach 4 scrutinizes the performative power of future imaginaries in order to interrogate and shed light on their political implications in the present.

Methods and tools of anticipation are then mapped onto the four approaches which demonstrates that some methods and tools align with a given approach and others with multiple approaches (figure 2.2 in chapter 2). The chapter ends by explaining how the four approaches provide an analytical lens through which to assess ongoing practices of anticipatory governance in the climate and sustainability realm – and provides the foundation for the theory-driven case studies in the following three empirical chapters.

The framework on anticipatory governance is applied for the first time in **chapter 3** to analyze how these anticipatory governance approaches relate to practice in a climate-vulnerable context in the Global South. It is a single case study of anticipation processes that inform climate decision-making in West Africa and builds on document analysis and interviews. The study finds that in this context probabilistic and plausibilistic forms of anticipation dominate and tend to inform quite technocratic and prediction-oriented anticipatory governance actions and demonstrates how approach 2 often becomes subservient to approach 1. Epitomizing is the finding that much stakeholder deliberation uses expert-based futures to determine adaptation options rather than a more open exploration of diverse and more fundamentally uncertain future possibilities, as associated with approach 2. Furthermore, the widespread absence of approaches 3 and 4 demonstrates a lack of plural and critical futures dialogue to co-create more radically transformative futures and interrogation of the politics of anticipation. This points to missed opportunities for realizing global ambitions for more inclusive and democratic climate futures.

Chapter 4 goes on to study these dominant dynamics in a global network of food systems foresight practitioners (Foresight4Food). It connects the analytical framework on anticipatory governance to a framework on transformations (Feola, 2015) to analyze how anticipation steers actions for sustainability transformations. The perspectives of members within the network were examined in a case study design, building on a workshop, interviews, and a survey. The chapter finds that most foresight practitioners use hybrid approaches to anticipatory governance that connect fundamentally different conceptions of the future. Nevertheless, most anticipation processes still produce recommendations that follow more prediction-oriented forms of strategic planning in order to mitigate future risks. The connection to the framework on transformation helps

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to explain why approach 1 plays such a large role in these hybrids by illustrating how the language between approaches overlap, without embracing the principles fully of these approaches. Particularly, much anticipation for transformation talks about deep uncertainty and deliberative action without fully taking such consequences on board. This chapter offers new insights for theory and practice, by pointing out shortcomings in approaches to transform future food systems and to the need for further research to better connect and make explicit assumptions on how anticipation and transformation connect.

The final empirical chapter is **chapter 5**, which connects the analytical framework on anticipatory governance to the notion of opening up or closing down (Stirling, 2008) to further examine and explain what dominant dynamics in anticipatory governance mean for possibilities for action. It is a cross-regional comparative analysis of four regions of the Global South. These are: West Africa, South Asia, Southeast Asia, and Central America, and builds on document analysis, interviews, and focus group discussions. The chapter finds that across the four regions, many anticipation processes are designed in ways that intend to open up dialogue about inherent uncertainties and pluralistic actions but, by suggesting quite technocratic and linear planning actions in the present, the space of future possibilities is closed down. Some closing down occurs for strategic reasons, e.g., to tailor recommendations to existing policy frames, but others are more unconscious due to a lack of recognition of closing down dynamics. The chapter makes an important contribution by explaining that the implication of this closing down, particularly in largely donor-funded anticipation contexts, may be that the global futures industry diffuses visions that reassert the status quo and push out culturally, socially, and politically diverse future worldviews. By contrast, anticipation processes in the Central American context more often follow a different path by using pluralistic and transformative anticipation and provide an important example of how setting transformative ambitions (to stay below a 1.5-degree temperature rise) gives incentive to more pluralistic, reflexive, and transformative anticipatory governance.

6.2. Answering the research questions across the chapters

Having presented a summary of the findings of the conceptual and empirical chapters, I can now answer the four questions that have guided the research.

6.2.1. Research question 1: How do different approaches to anticipatory governance in the literature relate to practice?

The review of the social science and interdisciplinary sustainability science literatures on anticipation and anticipatory governance demonstrates four understandings of anticipatory governance with distinct conceptions of the future, implications for the

present and ultimate aims to engage in anticipatory governance. Figure 6.1 is repeated below from chapter 2 to visually present the four approaches mapped onto an axis with the conceptions of the future (horizontal axis) and the implications for actions in the present (vertical axis).

How is the future conceptualized?

	Probable and improbable	Plausible	Pluralistic	Performative

With what implications for the present?

Planning
Assessing probable and improbable futures in order to help inform strategic policy planning **to reduce future risks**

Building capacities
Exploring plausible futures in order to build adaptive capacities and preparedness **to reflexibely navigate diverse (uncertain) futures**

Mobilizing
Imagining pluralistic futures in order to mobilize diverse societal actors **to co-create new futures**

Interrogating
Scrutinizing the performative power of future imaginaries in order to interrogate **and shed light on their political implications in the present**

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Key: Red: what conception of/engagement with the future; blue: how these intersect with actions to be taken in the present; **black bold**: why/to what end: the desired ends of engaging in/with anticipatory governance

Figure 6.1. The analytical framework on anticipatory governance

These four narratives (see figure 6.1) are subsequently used as heuristics to examine how the approaches identified in the literature relate to practice. The empirical research relies on the triangulation of qualitatively analyzing academic articles, policy documents, reports, interviews, a workshop, and focus groups. First, I considered it important to identify who steers in anticipatory governance. Much of the anticipation processes analyzed are developed by research institutes and research and development organizations funded by (donor) governmental organizations to realize sustainability transformations in the Global South (chapters 3, 4, 5). Examples include AMMA-2050 and AgriTerra (chapters 3 and 5). Sometimes, national governments invite organizations to design a foresight exercise to guide policy formulation, such as the CCAFS' Futures Scenarios for Burkina Faso's Livestock Policy. Later in the thesis I refer to this as a

'global foresight industry' of mainly Global Northern researchers and consultants who operate in the Global South. Their anticipation processes are predominantly probabilistic and plausiblistic in nature. Such processes seek to engage with future uncertainty; the probable futures category tries to reduce scientific uncertainty to make prioritizations on the likelihood of future events and mitigate associated risks, and the plausible futures category sees futures as more uncertain and therefore withholds from ranking or prioritizing them; its purpose is to be prepared to navigate uncertain future trajectories as they emerge. This engagement with uncertainty is important as it tends to shape anticipatory governance actions (more on this below). A few practitioners and one government (Costa Rica, chapter 5) employ pluralistic futures work to break with incremental futures thinking and open up anticipation to more radically different interpretations of the world. None of the practitioners approached future images critically as performative, by using anticipation to deconstruct frames of the future on their political implications (approach 4). Interestingly, quite a few anticipation processes stated to use approach 4 in their interrogation of the implications of actions that follow from anticipation for the purpose of prioritizing policy actions. However, they do not necessarily scrutinize the politics of negotiating futures in the present and thus do not fully engage with approach 4.

Like the two dominant conceptions of the future described above (probabilistic and plausiblistic), the actions that are seen to follow from anticipation also align with approaches 1 and 2: strategic linear planning (1) and capacity building (2). Approach 1 and 2, as are identified in the framework, are however not neatly represented but appear in hybrid form. Returning to the previous examples helps to illustrate this hybridity. AMMA-2050 uses probabilistic anticipation to build its capacities for science-based planning to mitigate future risks; this is mainly approach 1 with some approach 2 action. CCAFS uses plausiblistic anticipation to make policies more robust to changing future conditions but was appreciated for providing expert technical advice to the government it was invited by; this is approach 2 that was appreciated as approach 1. In addition, the ultimate aims of anticipatory governance cover the entire spectrum for anticipation practitioners (chapter 4), whereas in policy contexts the ultimate aims align with approaches 1 and 2 (chapters 3 and 5). Practitioners thus create more hybridity by using approaches 1 and 2 for multiple integrated aims. In doing so, the 'approach 1 and 2 hybrid' is seen to realize more transformative outcomes (an approach 3 aim) but scrutinizing the political implications of anticipation (an approach 4 aim) is never an end in itself, but rather partially integrated through stakeholder participation.

6.2.2. Research question 2: Which approaches to anticipatory governance dominate and why?

As the previous section explained, the approaches to anticipatory governance as presented in the analytical framework do not occur that frequently in practice in their pure form, but as hybrids that complement and conflict. The framework helps to understand and explain dominant dynamics. A first dominant dynamic is that hybrids of approaches 1 and 2, sometimes with elements of 3, tend to formulate recommendations as more linear planning strategies. The interviews and group discussions help explain that Kahn's legacy of foresight as a strategic tool to think about and plan for the future (section 1.4.2) remains a dominant discourse in futures work and permeates the design and outcomes of foresight. However, such action embeds a belief that the future is somewhat predictable and can be planned for and thus contradicts the plausiblistic and pluralistic conceptions of the future of approaches 2 and 3 (chapters 3 and 5 mainly). Another dominant dynamic occurs with the anticipation processes that align with approach 2 in the design of the process, with its focus on deep future uncertainty and advancing institutional capacities for preparedness to navigate diverse possible futures, but see more subjective and deliberative ideas about the future being translated into more technocratic policy advice (chapters 3 and 5 in particular). A similar dynamic is the use of pluralistic futures work (chapter 4) or elements of pluralistic thinking in plausibilistic futures work (chapters 4 and 5) to help strategize more unidirectional and technocratic policy planning (chapters 4 and 5) instead of open-ended governance processes. The interviews and group discussions help explain that approach 3 - the mobilization of societal stakeholders in new configurations to co-create new futures - is not perceived as viable governance action.

A few examples of hybrids are:

> Probabilistic anticipation to inform strategic policy planning and capacities building for risk reduction, which is an approach 2 type of action embedded in approach 1.

> Plausibilistic anticipation to increase policy robustness in order to reduce future risks, which is approach 2 to achieve an approach 1 aim.

> A merger of pluralistic and plausibilistic anticipation to inform strategic policy planning and capacity building to increase climate resilience and realize more transformative futures, which is approach 2 integrating an approach 3 conception of the future and ultimate aim, and an approach 1 recommendation for action.

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Plausibilistic anticipation to interrogate political implications of actions, build capacities for preparedness and inform strategic policy planning to increase resilience to climate change, which is approach 2 with approaches 1 and 4 actions.

These hybrids were exemplifying in the sense that they prevailed quite often and demonstrate how the approaches in the framework relate to practice. The examples also demonstrate the working of the framework, by revealing what elements of approaches are used and shedding light on such hybridity.

6.2.3. Research question 3: What are the implications of the prevalence of different approaches for realizing sustainability transformations?

Connecting the framework with the framework on transformations (Feola, 2015, chapter 4) helps to explain what the dominant dynamics mean for the anticipatory governance of sustainability transformations. This integrated framework demonstrates that the epistemologies of approaches 2 and 3 seem reconcilable with approach 1 in understanding transformations, despite their conflicting conceptions of the future. The integrated framework is repeated below (figure 6.2) to illustrate how the language on anticipation and transformation connects.
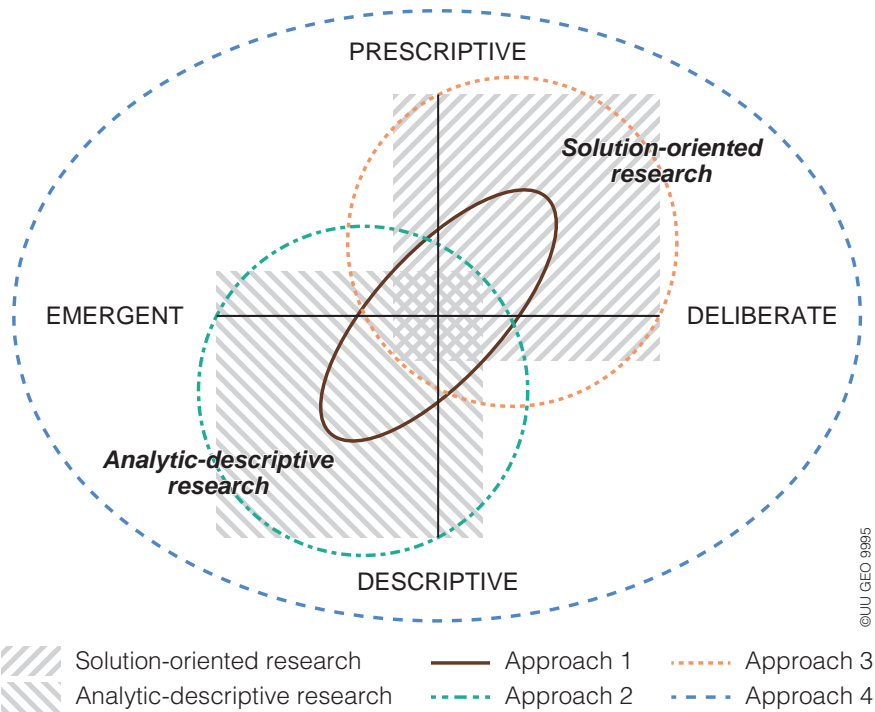
Figure 6.2. Connecting the frameworks on anticipatory governance and transformations

The figure helps to explain that approaches 1 (brown circle) and 2 (green circle) overlap by seeing change as emergent from larger societal processes. Nevertheless, the hybrid conflicts as approach 1 sees that the likelihood of such change can be predicted to some degree while approach 2 does not. Combining the approaches on this point thus means that this hybrid does not fully embrace deep irreducible uncertainty but proposes more conventional governance action. In addition, the integrated framework also illustrates that approaches 1 (brown circle) and 3 (orange circle) overlap in terms of seeing transformations as a deliberate process. However, the literature on anticipation helps explain that while approach 1 sees futures as something that can be partially controlled or managed, it does not focus on the political nature of deliberate change as approach 3 does. And thus, it can be concluded that the hybrid of approaches 1 and 3 also does not fully embrace the politics of anticipation and transformation. Indeed, the examples in this thesis (chapters 2 and 4 in particular) demonstrate a tendency to depoliticize futures by revealing scientific and normative contestations of governing sustainability transformations (Patterson et al., 2017). In sum, the integrated framework demonstrates that the hybrids of approaches 1, 2, and 3 may seem mutually reinforcing but a strong presence of approach 1 thinking may hinder the engagement with deep uncertainty and deliberate change towards transformations, and as such result in incremental tendencies, path dependencies, pragmatism, and lock-ins (Frantzeskaki et al., 2012; Sarkki et al., 2017). Examples in Senegal and Ghana illustrate how participatory scenarios informed participants (policymakers) with precooked scenarios about how climate change is likely to happen. However, farmers mostly sat at the table to discuss possible impacts given these scenarios, not to engage in an agentic co-creational process. Such closed-down anticipatory governance processes are unlikely to create radically transformative or ambitious trajectories but stay within the boundaries of current regimes. A strong reliance on approach 1 may thus hinder the transformative potential of anticipatory governance by aligning too much with and reenforcing the status quo rather than opening up to radically transformative future possibilities for action (chapters 4 and 5).

6.2.4. Research question 4: How do different approaches to anticipatory governance open up or close down future possibilities?

In trying to further understand what these dynamics mean for the opening up of anticipatory governance to future possibilities for action, I connected the framework to the notion of opening up and closing down (Stirling, 2008, chapter 5). Stirling explains that anticipation processes are often closed down by predetermined policy agendas that push for clear, authoritative and policy descriptive recommendations, whereas opening up means to interrogate whether future visions are created to justify or critique findings, alternative futures are taken into consideration, and marginalized perspectives

are valued. Figure 6.3. below is repeated from chapter 5 to demonstrate the integrated framework.

Closing down   **future possibilities**   **or opening up**

Probable and improbable futures	Plausible futures	Plural futures	Performative futures

Opening up possibilities for action or closing down

Opening up or closing down

Planning
1: Assessing probable and improbable futures in order to help inform strategic policy planning to reduce future risks

Building capacities
2: Exploring plausible futures in order to build adaptive capacities and preparedness to reflexibly navigate diverse (uncertain) futures

Mobilizing
3: Imagining pluralistic futures in order to mobilize diverse societal actors to co-create new futures

Interrogating
4: Scrutinizing the performative power of future imaginaries in order to interrogate and shed light on their political implications in the present

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Axes   Red arrow: the level of opening up futures to different framings and assumptions, blue arrow: the level of opening up possibilities for action or closing down towards existing policy frames; Boxes - purple: approach number; red: conception of the future; blue: actions to be taken in the present; **black**: the ultimate aims of anticipatory governance.

Figure 6.3. The opening up or closing down of anticipatory governance

The integrated framework helps to understand the implications of formulating governance actions as more technocratic forms of strategic planning and capacity building (chapters 3 and 4) for the possibilities for future action. The interviews and focus group discussions (chapters 3, 4, and 5) illustrate dominant policy discourses that tend to favor expert-analytic, consensual, and authoritative (rather than uncertain and contested) science, and as such are scientific and normative contestations inherent in climate science reframed to align with those policy requirements. In addition, there seem to be more implicit and explicit rationales for closing down. For example, the Bangladeshi Delta Commission scenarios are an example of more strategic closing down, where what is perceived as policy-relevant knowledge has shaped the outcomes of what should actually follow from the knowledge (Turnhout et al., 2016). Two groups

of consultants battled over who gets to portray the future of Bangladesh, with four participatory scenarios losing out to two policy-relevant scenarios placed in a macro-economic context. More unconscious closing down also seems to happen quite frequently when stakeholders are invited to create plausible future scenarios and interrogate policy effects for diverse societal groups, including marginalized groups, but (except for the Costa Rican case) such critical interrogation never informed open-ended governance commitments in which future images are frequently questioned and contestations are reflected upon (chapters 4 and 5). Sarkki (2017) has named this type of closing down the 'trap of the day', "a tendency of both users and producers of scenarios to use pre-existing policy agendas and scientific narratives as a pretext to promote their objectives instead of being open to transformation in science and policy"(p. 549). Such closing down while pretending to open up creates false expectations and is exclusion under the guise of inclusion. It can reassert the status quo and hinder the opening up to alternative future worlds that may be more sustainable or desirable. Identifying those dominant dynamics and what they mean is thus not an end in itself, but a way to bring issues of power and blind spots to light.

6.3. Implications for the wider literature and future research agenda
The conceptual and empirical knowledge gaps that have been addressed in this thesis can be of relevance to the research strands that are close to the topic of study.

6.3.1. Insights for anticipatory governance scholarship
This thesis has foremost furthered the conceptualization of the notion of anticipatory governance. It unpacked diverse understandings of anticipatory governance in the social science and interdisciplinary sustainability science in terms of their conceptions of the future, implication for actions in the present, and the ultimate aims intended to be realized. The research confirmed earlier research that anticipation processes steer futures in the present (Granjou et al., 2017; Gupta, 2001; Vervoort & Gupta, 2018) and demonstrated different approaches through which such ex-ante steering of the future takes place. In doing so, it revealed assumptions about the future that have remained implicit for a large set of anticipation processes in the sustainability domain across the globe. Once revealed, this thesis finds, the approaches have huge implications for steering sustainability transformations (see section 6.3.3). The theory-driven case studies illustrate that the four 'ideal-type' approaches are not neatly represented in practice (see figure 6.2). The first and second approaches are most common. The third and fourth are rarely used and appear only as elements merged into a more dominant approach. Moreover, the approaches appear in hybrid forms, and within these hybrids approach 1 is the dominant driver of action. These findings help further research on the politics of anticipation (section 6.3.4). The four approaches also serve as a boundary object for

cross-disciplinary learning (Shackley & Wynne, 1996) and highlight conceptual plurality on concepts such as probability and plausibility. This is an anything but settled field. Anticipation processes are often practiced by a consortium of international partners that conjoin the natural and social sciences. Disciplinary differences, such as ontological and epistemological views on the future, are not made explicit from the onset of a project (chapter 4). Conceptual plurality exists for example about probability in futures work – e.g., it is generally used as a synonym for a most likely future, but some see probability purely as a statistical measure that is wrongly used in futures studies while others see it as subjected to one's beliefs (chapter 5). The framework has thus proven to be a useful analytical tool for boundary work and can be expanded to other sustainability domains (beyond climate change and food systems), or even beyond sustainability.

The fourth approach, with its focus on performative futures and insights in the politics of anticipation, has offered a 'meta-perspective' to scrutinize any form of anticipation (including those covered by the other three approaches). It has shown how such implicit and different viewpoints about the future can create tensions once they surface in the process of formulating actions in the present – and how viewpoints that are attuned with incumbent views can become dominant in the process. These findings confirm research that points to the need for more reflexivity of the role of power in anticipation and thus bringing approach 4 to the fore (Granjou et al., 2017; Gupta, Möller, et al., 2020), but the empirical work illustrates that this is an aim rarely achieved. The framework helps to make such power imbalances explicit in the design of anticipation, as well in the translation of recommendations into policy guidance. Furthermore, the integration with the framework on transformations (Feola, 2015) and the connection with the notion of opening up and closing down (Stirling, 2008) are of added value to the further conceptualization of anticipation governance. It helped illustrate how more technocratic forms of anticipatory governance constrain the transformative potential of anticipatory governance and may close down possibilities for future action. As such, it confirms research in other contexts that anticipation processes prefer to delimit socio-political contingencies (Low & Schäfer, 2019; Sarkki et al., 2017) to which this research adds insights into the dynamics of strategic and unconscious forms of closing down, and their impact on framing future possibilities. The focus on Global North-Global South relations has been pivotal in this regard, placing these dominant dynamics and blind spots in a context of increasing awareness of the colonization of the future in sustainability contexts of the Global South (Bristow, 2017; Feola, 2019; Gram-Hanssen et al., 2022; Sardar, 1993). Pretending to include culturally, socially, and political diverse futures while in reality closing them down to existing policy frames may push out alternative worldviews and further donor dependencies. The technocratic approach to anticipation can be seen in light of the technocratic and tool-kit approach to

development which has exacerbated the depoliticization of development (Kothari, 2005). More research is needed to understand whose futures are preserved in the design of anticipation, but more urgently in the translation of anticipation to recommendations for action. Such geopolitical dimensions of global anticipatory governance need more prominent attention, as part of ongoing debates on the marginalization of the Global South in defining research and political agendas on how to govern sustainability futures (Biermann & Möller, 2019; Sénit & Biermann, 2021; Vervoort & Gupta, 2018).

6.3.2. Insights for futures studies and anticipation

The thesis also contributes to the wider field of futures studies and anticipation literatures, by examining the methods and tools brought forward as more implicit forms of anticipatory governance. Anticipation processes had not been comprehensively scrutinized before on their steering effects across the various disciplines and in the many diverse sustainability contexts of the world where they are proliferating. Futures studies is much appreciated for its methodological contribution to thinking openly and strategically about the future (Van Der Heijden, 2005), but it is recognized that not so much work has been done on its theoretical foundations (Bell, 2000; Poli, 2012), including how foresight practitioners are intervening in the governance contexts they engage with (Henrichs et al., 2010). By asking 'first order' governance questions to the field of futures studies, this research goes beyond the many valuable existing typologies on the methods and design of the processes (Bradfield et al., 2005; van Notten et al., 2003) that have pointed to conceptual debates on probability versus plausibility and explorative versus normative scenarios, or the ways to include stakeholders (Loveridge & Street, 2005). In her book 'Future of the World', Andersson (2018)distinguishes between probabilistic and economy-oriented futurology (futures as quantitative and economic objectives, guided through expert-based understandings of the future) and futures studies, which creates normative, desirable, and persuasive images of change. The four conceptions identified in this research relate to these forementioned typologies but complements them with notions of pluralistic and performative futures – which are generally considered niche practices (Vervoort et al., 2015). In addition, the work broadens the scope of what is considered anticipation, to include a range of methods with a future-orientation beyond foresight and scenarios specifically (Henrichs et al., 2010; van Notten et al., 2003). The work relates to research on the epistemological underpinnings of foresight and how it informs action (Wilkinson & Eidinow, 2008) but adds to this a more critical lens attained through the social science literatures (most prominently Science and Technology Studies).

The most important insights for futures studies and anticipation concern dominant dynamics and blind spots. Anticipation practitioners want to engage with deep

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uncertainty and alternative futures and worldviews, but there is a strong tendency to formulate action in a quite technocratic and unidirectional way. The interviews highlight that the closing down of future options is not always a conscious strategy to reconstruct findings (Sarkki et al., 2017), but more a way of doing, a perceived prerequisite to connect to the logic of policy environments (Turnhout et al., 2016). Further research is needed on how to improve the 'governance-literacy' of anticipation (Mangnus et al., 2021), including the unmaking of existing approaches (Feola, 2019). One area is how to build in mechanisms in anticipation processes for more reflexivity and pluralism, which "starts with being literate about what attitudes toward the future exist and what the power dynamics are, with being reflexive about one's attitude toward the future, and with being aware of what other attitudes toward the future might have to offer" (Mangnus et al., 2021, p. 3). Much foresight scholarship has developed practices to explore discomfort, but approaches in practice still move towards what is prominent in the present and observed in the past (Ramírez & Selin, 2014). These practices impede thinking beyond the status quo and create premature lock-ins (Vervoort, Mangnus, et al., 2022).

6.3.3. Insights for the literature on governing sustainability transformations

The research also presents important findings to the wider and interdisciplinary field of sustainability transformations, by examining what the diverse approaches to anticipatory governance mean for realizing sustainability transformations. This is urgent as futures work can be seen as part of the transformative turn in science (Blythe et al., 2018) in which the role of science for sustainability is increasingly aiming to advance transformations by acting as a catalyst for structural social change (van der Hel, 2020) yet research is needed as to how anticipation steers such transformations (Burch et al., 2019). This thesis explained that there are different approaches to which researchers and practitioners propose to anticipate and govern the needed sustainability transformations (Boyd et al., 2015; Burch et al., 2019). Although transformation is understood to mean different things (Feola, 2015) it is often associated with fundamentally different ways of doing things and imagining fundamentally different futures (Blythe et al., 2018). There are, however, differences in the types of transformation that is proposed (chapter 5). To some scholars is anticipatory governance a way to better manage uncertainty and adapt to emergent change (Quay, 2010), as a more incremental form of transformation. To others it is deliberate action needed to transform systems to a more desirable state (Pereira et al., 2019; Vervoort, Mangnus, et al., 2022).

Furthermore, the findings help explain that status-quo thinking often takes hold of its transformative potential. Anticipatory governance is ultimately about realizing transformations (Vervoort & Gupta, 2018), or even win the future (Fuerth & Faber, 2013), but mutually reinforcing interests, norms and power-structures indeed obstruct

more structural and radical reforms (Lahsen & Turnhout, 2021) and create path dependencies (Loorbach et al., 2017). As such, the thesis confirmed Frantzeskaki et al. (2012) who pointed to the tensions between the open-ended character of sustainability development agendas that is needed to adapt to future needs and local contexts, and regular implementation modes that follow linear, stepwise actions to meet objectives and targets. Their argument to develop arenas in which governance actors can experiment with transformational change in a structured yet open way could be a useful direction for future research. Pivotal contributions to this line of thinking are findings related to the need to place the role of power central. Not only is it important to examine who is invited into the arena of anticipatory governance, who has the power to set the agenda, and if dialogue is opening up or closing down existing policy frames (Avelino et al., 2019), but also who are currently outside of scope (but may still have something to win or lose in the future). Such a research agenda could look at how approaches 3 and 4 to anticipatory governance can help shift power from the incumbent system to niche practices to realize more transformative change (Avelino, 2017) deconstruct dominant imaginaries to make space for radical alternatives that are incompatible with unsustainable global systems (Feola, 2019) and disrupt the status quo (Rutting, accepted for publication). The Costa Rica example in chapter 4 provides important entry points in this direction for further research on if and how having transformative goals creates an imperative for more a more open dialogue about alternative futures and formulate more open-ended implementation modes, with frequent cycles instead of one-off events of critical reflection on current pathways and alternatives, possible lock-ins and dominant versus marginalized perspectives in anticipating change.

6.3.4. Insights for scholarship on the politics of anticipation

Finally, the empirical work in this thesis contributed to research that has examined how the object of what needs to be governed in the future gets framed and how such images create an imperative for certain governance actions (Gupta, Möller, et al., 2020; Gupta & Möller, 2018). The raison d'être of scenarios and other anticipation processes is often portrayed as providing some guidance in uncharted territory, however, the future is not an empty and neutral space but a negotiated space (Groves, 2017). Every anticipated future is made up of choices and prioritizations of expected or desired futures. Quantified futures are made up of trends that can be numerically reasoned (e.g., macroeconomic trends, yields, population growth). Plausibilistic futures work must set boundaries to drivers of change and interactions between them. Even pluralistic futures cannot mobilize all possible worldviews. Science for anticipating climate change is, like any science, a marketplace of ideas and instrument of power (Jasanoff, 2004). This thesis provides insights into the functioning of this marketplace. At the same time, although many anticipation processes include some form of reflexive element in their design to

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deliberate the political implications of certain anticipated futures, little critical and reflexive anticipation happens regarding this performative nature of anticipation, nor how recommendations that follow from anticipation are translated and negotiated, and what this means for whose futures are being represented or not.

The most fundamental insight into this 'marketplace' is the closing down of pluralistic and critical forms at the onset of anticipation processes. Scholars have advocated for a better representation of diverse worldviews in global images of future progress (Appadurai, 2013; Escobar, 2020; Jasanoff & Kim, 2015) but examples in this research have shown that anticipation relies heavily on the science, technologies and funding of external consults and donors – a global foresight industry that sometimes but not always 'trickles down' in terms of reinforcing local capacities. While many anticipatory governance scholars see stakeholder participation as a prerequisite for legitimately making decisions about future socioecological and sociotechnical change (Boyd et al., 2015; Guston, 2014), stakeholders too often lack agency to determine what their future may look like (chapters 3 and 5) and are involved in anticipation processes in ways that educate rather than empower. Anticipation indeed relies too heavily on expert advice at the expense of citizen views (Pickering, 2019). Through the lens of opening up or closing down, the research findings furthermore explain how frames of the future tend to dispose controversies, alternative visions and marginalized perspectives in a process of closing down towards existing policy frames (Stirling, 2008). An example in Burkina Faso demonstrated that what is considered subjective knowledge is communicated non-transparently and surpassed by quantified scenarios (chapter 3); and thus more research is needed on the role of transparency and what it means for the accountability and legitimacy of anticipatory governance (Gupta, Boas, et al., 2020). The conflict over the scenario sets in Bangladesh (chapter 5) furthermore illustrated how what is considered policy-relevant shapes the outcomes that should follow from knowledge (Turnhout et al., 2016). These examples explain how a process of translation and delimitation reduces future possibilities for action. Scholars argued that science for sustainability needs to be more just and inclusive (Lahsen & Turnhout, 2021), be clear on the functioning of scientific processes, abandon claims about truth and confirm to criteria beyond validity and reliability, such as social robustness, societal responsibility, effectiveness, and legitimacy of scientific knowledge (Leroy et al., 2010). But this thesis shows that incumbent actors prefer claims about a scientific 'truth', which gives incentive to a process of translation to reveal normativity. Many anticipation processes thus close futures down, even while pretending to open them up to diverse worldviews and alternative futures (chapter 5).

Processes of closing down of future possibilities for action can have negative material and discursive consequences (Nordmann, 2014; Paprocki, 2019). Actors have power to

shape or 'have a future' through exploring futures (Urry, 2016, p. 189), while others are being pushed into the 'slow lane' (ibid.). This means that by closing down while pretending to open up, anticipation processes may in fact further marginalize already less powerful views and groups (Escobar, 2020; Granjou & Salazar, 2016). Scholars argued for a downscaling of global environmental images to the local level by bringing places back in, along with the people who inhabit them, their communities, lifestyles, histories and memories, and their visions (Jasanoff, 2004) but this contradicts the observed closing down dynamics in anticipatory governance. The thesis furthermore points to the current Global South dependency in anticipatory governance of the Global North, which means that researchers and practitioners endanger representing a hegemony of Western science, donors and consultants who transfer their anticipatory knowledge to, or anticipate futures with incumbent national and local actors. Scholars have already pointed out that futures are being negotiated and may very well be colonized through anticipation (Feola, 2019; Sardar, 1993; Selin, 2011).

Quite a few practitioners are aware of that something needs to change, but little is done to forefront the politics of anticipation, and as such actions may veer away from global aims for more inclusive and democratic futures (Kashwan et al., 2020). An important question thus remains whose future is being imagined in order to preserve it? Such insights into Global North – Global South relations open up further research on what these anticipated futures mean for climate justice (Okereke & Schroeder, 2009) and intergenerational justice (Kashwan et al., 2020). More equitable futures means to redistribute impacts and vulnerabilities between the rich and the poor, between countries and within countries (Okereke & Schroeder, 2009), that the poor be seen as legitimate participants (Kashwan et al., 2020) and indispensable to legitimately formulating decisions about the future (Macnaghten, 2009; Gupta, 2011). Further research is thus needed on pro-poor anticipation processes, to analyze which groups are represented, if participants have an active or passive role in shaping policy debates (Taylor et al., 2014), if they are able to critique instead of justify findings (Stirling, 2008) and if the processes are designed to challenge stakeholder perceptions about futures and presents (Rutting et al., 2021). As a counterresponse, some foresight work explicitly focuses on niche practices that create bottom-up transformations of socio-ecological systems (Pereira et al., 2019, 2021; Bennett et al., 2016), worldmaking (Vervoort et al., 2015), and upstream engagement (Macnaghten, 2009). These initiatives towards more equitable futures, with agency for people whose futures are impacted, provide important starting points for a research agenda on more equitable and pluralistic anticipatory governance. Such research could look into how the object that needs to be governed in the futures is shaped by colonial notions of histories and presents and impacts what can be imagined as Global Southern futures.

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6.4. Reflections on the research design

The empirical focus in this thesis has been on the growing number of anticipation process that have been used to guide sustainability transformations in policy contexts around the world (Zougmoré et al., 2016; Sampson et al., 2016). The case studies analyze multi-actor and multi-level modes of environmental governance, by examining relationships between governments, public and private partners such as research institutes, civil society and the private sector (Driessen et al., 2012; Lemos & Agrawal, 2006). The anticipation practitioners are part of what has been named the science-policy interface; the acceleration of efforts in science to realize productive outcomes for society, including through policy interventions (Dinesh, 2022). I openly explored what anticipation processes emerged from a literature search and snowballing technique to comprehensively understand how approaches to anticipatory governance steer sustainability transformations. In chapters 3 and 4, I set the scope on anticipation processes that intended to inform decision-making. This choice influenced the analysis. Had I taken a targeted approach to include niche practices that are more innovative, experimental and radical - such as those analyzed as part of the Unmaking project (Feola et al., 2021), Seeds of Good Anthropocenes (Bennett et al., 2016), the Lighthouse Farm, and the work on games in project such as Anticiplay (Vervoort, Milkoreit, et al., 2022) - approaches 3 and 4 would have most likely be better represented. However, I consider the focus on science-policy interfaces pivotal to understanding dominant dynamics in more conventional governance arenas, to establish a foundation for future research.

Focusing the research on four regions in the Global South (particularly in chapters 3 and 5) is an important contribution to the current research focus on the Global North (Vervoort & Gupta, 2018). The knowledge imbalance was found to have shaped anticipatory governance across the globe, by perpetuating its science, technologies, and funding into the lesser researched areas. In addition to those more Global South-oriented chapters, chapter 4 gives insights into how the global foresight industry steers the future: by bringing forward the techniques of anticipation and shaping visions of the future through them. The empirical studies thus address an important knowledge gap in these four global regions, as well as insights into Global North – Global South dynamics and dependencies that shape visions of the future. Research already pointed to unevenly distributed climate impacts, coping mechanisms and knowledge to deal with the impacts of climate change (Yaro & Hesselberg, 2016), to which this research adds insights into the unevenly distributed power to envision and govern sustainability futures in the present.

The research was designed to advance the conceptualization and empirical contribution of anticipatory governance. Looking back, it was very helpful to start the thesis with a

conceptual chapter (chapter 2) and apply it to various case study contexts (chapters 3, 4, and 5). It not only added to the internal validity of the research, but also created an iterative discovery of research findings for the thesis as a whole; the findings of each chapter (e.g., the hybrids of chapter 3) were used to reflect on the framework and open up new research directions (e.g., the implications of hybrids for realizing sustainability transformations in chapter 4). As such, the framework was some sort of 'living tool' that organically merged with the framework on transformation (Feola, 2015) and the notion of opening up and closing down (Stirling, 2008). The framework also served as a tool to guide the team of researchers in doing their research in Central America, South Asia, and Southeast Asia (see chapter 5) and has been of use to other research projects on plausibilitic, pluralistic and performative futures work (e.g., Spijkers et al., 2021; Stripple et al., 2021; Wibeck et al., 2022). The cross-regional comparative analysis analyzed reports, policies, interviews and focus groups qualitatively and interpretatively for each region to which one researcher took the lead and I coordinated the work. The analysis was conducted in close cooperation between all team members, who sometimes had different interpretations of the elements in the framework (e.g., of what the different conceptions of the future meant or which one an anticipation process embedded). We tried to make such conceptual plurality and diverse interpretations explicit in the many research meetings we had during the 4-year research period. This triangulation of sources (reports, interviews, etc.) of methods (document review, interviews, focus groups) and of researchers going through the material in different phases helped to obtain a very detailed and holistic overview (Verschuren & Doorewaard, 2010). Furthermore, we invited participants to the workshops and interviewees to give feedback on the theoretical approach and we exchanged our findings multiple times – this iterative and bottom up approach to the research creates a more advanced understanding in a co-creational process (Flyvbjerg, 2006), which I enjoyed immensely. The framework grew on us, as it were, and it was rewarding to see how the other researchers in the team and the participants in the research project started to think in terms of 'the four approaches' and apply it in their work as foresight practitioners. It was unfortunate that I could not involve all the participants in writing the paper as the social sciences are much stricter on the number of co-authors to invite onto a paper; in the natural sciences, it is considered much more appropriate to invite workshop participants as co-authors a difference to which quite a few participants to the research related to.

6.5. Looking ahead
I concur with Urry (2016) who pointed out that the critical question for anticipation is to democratize the way the future is constructed and mobilized. This research has shown that it is time to pull futures studies out of the corporate and strategic world. Futures are too often made up of what can be numerically reasoned to tame anxiety about the unknown (Fuller, 2017) with an expert-based account of what can be calculated. With

this, the future is reduced to a technocratic account of what can be projected into the future. Climate futures are reduced to yield losses and economic decline. My point is not to argue that this is not important, but to argue that these types of practices dominate anticipatory governance while moving socially, culturally and politically diverse future images to the background. Plurality is morphed into consensus. Subjectivity into objectivity. The normative and political into technical ideas. This is not what all foresight stands for, but these are dominant dynamics that enforce the closing down of anticipatory governance. Futures are about negotiating what gets to stay in the future, who wins and who loses. Anticipation processes are the infrastructures through which these ideas about the future materialize. Anticipatory action is a key means through which life in contemporary democracies is secured, conducted, disciplined and normalized (Anderson, 2010, p. 197). It is assumed that anticipation processes allow for the opening up of future possibilities, but this research shows that this is false hope. At the very least, it should be made much more transparent and explicit what choices are being made and what gets prioritized and what is marginalized – and the marketplace made visible (Jasanoff, 2004). This is an appeal to decision-makers, but also to foresight practitioners to become aware that they are actively taking part in these closing down dynamics that have remained a blind spot to many. Anticipatory governance actors are not simply *demarraging* into the future but are deciding along the way who gets to stay on track and who will be supported.

With its export to different parts of the world, anticipation is becoming a geopolitical matter. Too often is it assumed that anticipation reduces future (climate) risks and brings prosperity and this assumption reflects the modernist and capitalist notions of development that have been criticized for decades (Escobar, 2011). Much more work is needed on how to de-universalize futures and better connect to the needs and desires of communities whose futures are to be imagined. The appeal to decolonize futures is not new (Abdulla et al., 2019; Sardar, 1993). Research could connect the framework to counter-movements such as the aforementioned in order to learn how to open up the anticipatory governance of sustainability transformations and open up space for alternative futures, such as those that go beyond growth-dominated future imaginaries of sustainability transformations (Feola, 2019; Feola et al., 2021). Many more efforts are needed to make science for sustainable futures more just and equitable (Lahsen & Turnhout, 2021). Such research could also question universal narratives of time (Mazé, 2019), how different notions of time (Granjou & Salazar, 2016) and time/space (Aradau & Van Munster, 2012) impact what can be imagined. Given my positionality as a researcher who was raised and educated in the West, I consider it important that such an agenda is designed by researchers from and in the different locations, to whom I would be happy to be of assistance.

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APPENDIXES

Appendix 1.1 Overview of units of analysis, methods and data collected for each chapter of the thesis

Chapter	Unit of analysis	Methodology	Data collected
2	Conceptualizations of anticipatory governance in the social science and sustainability science literatures	Narrative-style interpretative literature review	144 academic articles within journals in the social science and environmental sciences, including: – A first set of 47 articles via a SCOPUS search – Another set of 24 articles by scanning reference list and citations of the first set of 47 articles for various anticipatory governance topics such as anticipatory risk governance – A final and another 73 articles, by scanning the reference list of these 71 articles by looking for implicit notions of anticipatory governance such as 'anticipation' and 'foresight'
3	Anticipation methods and tools that have been used to anticipate climate futures in West-Africa and are intended to inform decision-making	Document-analysis and interviews in a qualitative case study analysis	– 11 papers academic articles on anticipation in the climate domain via a Scopus search – 3 anticipation process reports via snowballing – 16 national and sectoral policies that address climate change via snowballing – In-depth analysis of 3 anticipation processes based on 14 interviews with foresight practitioners (working e.g., for CCAFS and AMMA-2050), people working on the foresight-policy interface (e.g., working for IO's and donor organizations), and policymakers who were part of the design or were meant to do something with the outcomes
4	Viewpoint and experiences of foresight practitioners within the Foresight4Food initiative	Survey, workshop, and interviews in a qualitative case study analysis	– Online survey with 12 respondents – A two-day workshop in Oxford with 24 participants, which partially overlapped with survey respondents. The aim was to exchange on the key assumptions and elements in the framework. – 5 follow-up interviews with participants to the workshop and online communication with all participants to discuss the results
5	Anticipation methods and tools that have been used to anticipate climate futures in West Africa, South Asia, Southeast Asia and Central America and are intended to inform decision-making	Document analysis, interviews and focus groups in a qualitative case study analysis	– 17 papers academic articles on anticipation in the climate domain via a Scopus search – 31 anticipation process reports via snowballing – 55 national and sectoral policies that address climate change via snowballing – In-depth analysis of 12 anticipation processes based on 41 interviews with foresight practitioners (working e.g., for CCAFS and FAO), people working on the foresight-policy interface (working for IO's such as FAO and donor organizations such as GIZ), and policymakers who were part of the design or were meant to do something with the outcomes (such as the General Economics Division) – 6 focus groups in Niamey, Ouagadougou, Bangkok, Dhaka, Guatemala, and San Salvador with 10-20 participants. Participants were researchers, representatives from civil society and policymakers. Aim was to discuss in an open-ended manner their perspectives regarding opportunities and challenges for formulating actions in the present based on anticipation and conveying this to incumbent actors

Appendix 3.1 Document analysis of anticipation processes and their intended role in decision-making

Statements in anticipation process reports

Country	What type of anticipation process was held?	Who initiated and/or funded it?	How did the anticipation process inform policy?
Senegal	Climate models and policy fora that include changes in the production system in response to changes in the biophysical and economic environment until 2050 (Amma2050, n.d.; Future Climate for Africa, n.d.; Hartley et al., 2016)	Initiated under the Africa Monsoon Multidisciplinary Analysis Program. Funded by the UK Department for International Development (DFID) and Natural Environment Research Council (NERC) Future Climate for Africa (FCFA) program.	A forum was conducted with national and regional decision-makers in Dakar to inform adaptation plans and NDCs but not specified policy outcome formulated in the documents assessed
	Ordered probit model estimating the simultaneous probabilities of sustainable and unsustainable adaptation practices to capture how future adaptation planning depends on the way in which SMEs deal with climate stress (Crick et al., 2018)	London School of Economics, Kingston University and IED AFRIQUE-Innovation, Environnement, Développement en Afrique. Financial support from the UK Government's Department for International Development (DfID) and the International Development Research Centre (IDRC)	Policy recommendations were clearly listed, no explicit policy outcomes formulated in the document assessed
Ghana	Participatory scenarios workshop to address future climate uncertainty until 2050 with MoFA representatives, the Ghana Science-Policy Platform and CGIAR researchers, and stakeholders from the rural private sector and civil society of Ghana (*CCAFS Livestock Policy Report Ghana*, 2017)	Initiated by CCAFS based on a request of the Ministry of Food and Agriculture, funded by CCAFS	Scenario-guided recommendations were used to reformulate the National Livestock Policy of Ghana
	Downscaled climate change scenarios for the Wa District generated by the Model for the Assessment of Greenhouse-Gas Induced Climate Change (MAGICC) under IPCC A12 SRES. Scenarios were conducted by the Environmental Protection Agency (EPA) and the Ghana Meteorological Agency (GMet)	University of Cape Town, University Ghana, Environmental Protection Agency	Objective is to guide local medium-term development plans, no explicit policy outcome formulated in the document assessed

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Appendix 3.1 (Continued)

Statements in anticipation process reports

Country	What type of anticipation process was held?	Who initiated and/or funded it?	How did the anticipation process inform policy?
Burkina Faso	Climate projections and a workshop with national and local policymakers, researchers, and NGOs on climate information understanding and local needs using Participatory Impact Pathways Analysis (PIPA) from 4 to 50 years (Hartley et al., 2016; Karambiri et al., 2016)	Initiated under the Africa Monsoon Multidisciplinary Analysis Program. Funded by the UK Department for International Development (DFID) and Natural Environment Research Council (NERC) Future Climate for Africa (FCFA) program	Recommendations for local decision-making plans were formulated and presented to the Minister of Agriculture, Finance and Devolution and a policy brief was formulated. A workshop was held with national and local policymakers, no explicit policy outcomes are formulated in the documents assessed
	Participatory scenarios workshop with policymakers, researchers, few representatives from civil society and private sector to address short and mid-term challenges (CGIAR, 2015; Hebinck et al., 2018)	Initiated by the permanent secretariat for the Coordination of Sectoral Agricultural Policies and CCAFS, funded by CCAFS	Scenario-guided recommendations helped to formulate a renewed rural development policy, the PNSR II, particular focus on integrating long-term climate adaptation measures
	Practical consensual tool that assesses vulnerability and identifies responses to climate risks, followed by assessing future impacts using three quantitative scenarios and finally the development of an adaptation framework (Gahi et al., 2015)	Developed by the Institut d'Application et de Vulgarisation en Sciences in Ouagadougou Research, funded by the West Africa Economic and Monetary Union (UEMOA)	The tool is designed to guide climate adaptation policy processes, no explicit policy outcomes are formulated in the document assessed

Appendix 3.1 (Continued)

Statements in anticipation process reports

Country	What type of anticipation process was held?	Who initiated and/or funded it?	How did the anticipation process inform policy?
Niger (see regional below)	-	-	-
Mali	Cost-benefit analysis training with private sector, Small and medium sized enterprises (SMEs) using an interactive online tool that supports enterprises in analyzing climate change risks and developing individualized climate change adaptation strategies (Adelphi, n.d.)	Facilitated by Adelphi Consultants. Funded through the GIZ project Private Sector Adaptation to Climate Change (PSACC)	Local case studies highlight diverse ways of implementation of measures
	Participatory foresight to explore long term changes in an irrigation scheme using exploratory scenarios with different stakeholders based on interest and power: scientist, engineers, policymakers, local civil society representatives, private sector (Hertzog et al., 2017)	French center for international cooperation in agricultural research for development (CIRAD) UMR, IRD, IER ESPGRN (France, Mali & Senegal). Funded by CIRAD and the French development agency (AFD)	Provides policy recommendations, close collaboration with the Malian Institute of Rural Economy (IER), the Office du Niger operator and the Malian authorities, integration was abrupted by the Malian civil war
Regional	Population scenarios and climate scenarios to test the effect of population policies and population control on water stress under climate change horizon 2085 (Gunasekara et al., 2013)	Initiated by Tohoku University, University of Bristol and University of Tokyo. Funded by Environment Research and Technology Development Fund (S-8) of the Ministry of Environment, Japan	Provides policy recommendations, no explicit policy outcomes formulated in the document assessed

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Appendix 3.1 (Continued)

Statements in anticipation process reports

Country	What type of anticipation process was held?	Who initiated and/or funded it?	How did the anticipation process inform policy?
	Error correction model to explore long-run equilibrium relationships and short-run dynamics to understand the effect of policy integration on agriculture and climate adaptation in ECOWAS (Tinta, 2017)	Initiated by the University of Ghana, not clear who funded the project	Provides policy recommendations, yet no explicit policy outcomes are formulated
	Process-based crop model SARRA-H calibrated to assess climate change impacts on sorghum and millet yields in the Sudanian and Sahelian savannas of West Africa (Sultan et al., 2013)	LOCEAN/IPSL, CIRED/CNRS, AGRHYME (institution of CILSS in Niamey), CIRAD, UMR AGAP & CIRAD, UMR TETIS (2 CIRAD departments). Funded by REGYNA (GIS–CES), the French National Research Agency (ANR) through the ESCAPE project (ANR–10–CEPL–005) and the R2DS network	No clear policy implications are formulated in the document assessed
	Times series of climatic events in the Sahel Researchers and engineers. Long term monitoring focused on documenting the simultaneous variability of rainfall, continental surface conditions and WAM dynamics (Lebel et al., 2009)	Initiated under the Africa Monsoon Multidisciplinary Analysis CATCH Program. Involvement of LTHE University Grenoble, Hydrosciences Montpellier, Colorado State University, CESBIO, National Center for Atmospheric Research, School of Civil Engineering and Environmental Science. Funded by IRD, INSU and the French Ministry of Research	Provides policy recommendations, no clear policy outcomes are formulated in the document assessed, yet successor AMMA-2050 projects have focused more strongly on policy integration
	Capacity building workshop on climate and vulnerability data, gaps in existing data, and exploration of capacity for future planning with participants from government-affiliated institutions and organizations	Initiated under the West Africa Biodiversity and Climate Change program. Funded by USAID	Policy recommendations and a roadmap were developed to inform internal policy, as well as ongoing exploration of follow up activities, no explicit policy outcomes are formulated in the document assessed

Appendix 3.2 Document analysis of the employment of anticipation processes in policy development

Statements in policy documents

Country	National policies for climate adaptation (approval year)	Who initiated the policy?	What anticipation methods and tools were used?	Who initiated, developed and funded the anticipation process?	How did the anticipation processes inform policy?
Senegal	#3. Emerging Senegal Plan 2014-2035, implemented through Plans of Action (Republic of Senegal, 2014a, 2014b)	Government of Senegal with technical and financial support from partners and PPPs	A vision for the future in the ESP, and three macroeconomic scenarios as guidance for the PAP - trend, optimistic and pessimistic - based on a iterative prioritization method integrating the impacts on both economic and social factors	The government of Senegal, supported by the IMF	The vision guides short terms strategies and implementation choices. The Plan of Action (2014) builds on the optimistic scenario, prioritizing projects and investments that that increase economic growth and reduce vulnerabilities
	#2. National Adaptation Plan for the Fisheries and Aquaculture Sector in the Face of Climate Change Horizon 2035 (2016)	Ministry of Environment and Sustainable Development initiated the policy, technical support from the United Nations' Least Developed Countries Expert Group and financial support from USAID/ COMFISH	IPCC 5th assessment report scenarios RCP 4.5 and RCP 8.5 on temperature rise were used in two global models (MPI-ESM-LR and HadGEM2-ES) to calculate future climate variability (2031-2040) compared to the reference period (1967-2005), then downscaled to three regional models with finer spatial resolution (50 km), followed by risk and vulnerability analysis of sectors	The government of Senegal, led by the Ministry of Environment and Sustainable Development	Regional consultations with local stakeholders as well as prioritizing workshops with several ministries, NGOs, research institutes and farmer organizations were held to identify short-term, medium-term and long-term adaptation measures, policy priorities and budgets, which in turn formed the backbone of the policy (2035)

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Appendix 3.2 (Cotinued)

Statements in policy documents

	Policy document	Implementing body	Description	Developed by	Statement
	#2. Program of Acceleration of the Cadence of Senegalese Agriculture (Republic of Senegal, 2014c)	Ministry of Agriculture and Rural Equipment	Policy visioning based on guidelines of the Horizon 2035 which stems from the Emerging Senegal Plan	The government of Senegal	Integrating adaptation and mitigation measures in the agricultural sector
	#3. Prospective Study 2035	Ministry of Economy and Finance	Participatory scenario analysis quantified in policy simulation tool Threshold 21	Developed by the Millennium Institute	Providing medium-term and long-term trajectories for sustainable and inclusive economic development
Ghana	#1. National Climate Adaptation Master Plan (2015) (successor of the national Climate Change Adaptation Strategy (2012) and the National Climate Change Policy (2013))	Ministry of Environment, Science, Technology and Innovation, supported by donor countries, EU and UNDP	Scenarios on changing weather pattern, building on the scenarios	Developed under the UNFCCC Country Studies Project	Policies are seen to be robust to withstand different scenarios, decision must be based on hard evidence
	#3. Shared Growth and Development Agenda II (GSGDA II, 2014) (successor of GSGDA I)	The government of Ghana	Volume I: Vision 2020 - middle-income country in 25 years – as the guiding vision. Plus two scenarios of GDP growth dependent of oil production. Volume II operationalizes policy proposals	The government of Ghana	Long-term vision translated into medium-term development objectives and priorities, goals and values
	#3. Coordinated Program of Economic and Social Development Policies (CPESDP) 2017-2024 (successor of the CPESDP 2014 – 2020)	The President based on vision of the political party during elections. Funded by the Government of Ghana	Medium-term vision of the New Patriotic Party	The government of Ghana	Medium-term visions are translated into objectives, priorities and action

Appendix 3.2 (Cotninued)

Statements in policy documents

Burkina Faso	#1. National Climate Adaptation Plan (2015)(*Mali Plan D' Action S National Pour La Mise En Place Du Cadre National Pour Les Services Climatiques*, 2016)	The Ministry of Environment & Sustainable Development through the Permanent Secretariat of the National Council for the Environment and Sustainable Development (PS/CONEDD)	Climate projection scenarios by the Mathematical Equation Analysis Laboratory (LAME) of the University of Ouagadougou, five regional climate models (CRCMs) from AMMA and nine global climate models (GCMs) by University of Cape Town. Followed by vulnerability assessment of sectors and participatory stakeholder consultations	Financial support scenario processes from NAPA-BKF-UNDP/Japan. Technical support from LAME, Cape Town and AMMA	Short-, medium- and long-term adaptation measured were established in detail per sector, a five-year plan, and the cost of adaptation measures over a period of between 1-15 years
	#2. National Rural Development Plan II (PNSRII) (2018)	Several Ministries	Visioning process aligned with other policies and international treaties, socio-economic impact analysis by FAO, ECOWAS and CCAFS, discounted and disaggregated social accounting matrix Involvement of policymakers, researchers, smaller number representatives from civil society and private sector	CCAFS and FAO in two individual processes	Integration of climate impacts on several sectors and coherence between policies

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Appendix 3.2 (Cotninued)

Statements in policy documents

Niger	#2. Nigeriens Nourish the Nigerian Initiative (3N) (2012)	Initiated by the Government of Niger. Funded by UN and since 2014 also PAM, FAO and UNICEF	A shared vision for the country's economy and food security, in line with the broader institutional framework Development Plan for Agriculture in Africa and the Millennium Development, in frequent dialogue with regional and local government officials, civil society, private sector, producer organizations and development partners	The Nigerian government, directed by a High Commissioner appointed for the 3N	The shared vision has been divided in five objectives and guides five strategic programs, and provides a framework for measures and investments in the short- and medium and long-term
	#2. The Strategic Framework for Sustainable Land Management 2015-2019 (SLM) (2014)	Initiated by the Government of Niger, funded by UNDP, WB, TerrAfrica, The Global Mechanism, NEPAD, IFAD	A participatory visioning process resulted in a vision for sustainable land management, horizon 2029, which was amended during the GS-Sustainable Land Management validation workshop	The government of Niger	The vision served as guidance for the making strategic policy choices, and serves as a reference framework for policies SDDCI, PDES, and 3N
	#3. Sustainable Development and Inclusive Growth Strategy (SDDCI or 2035 Vision) (2016)	Initiated by the Government, all ministries and institutions are involved	Retrospective and prospective analysis, development scenarios Horizon 2035, and long-term strategic visions and directions	The government of Niger	The vision 2035 lays out a medium-term development strategy for Niger and serves as a reference framework for the SLM, 3N and Economic and Social Development Plan (PDES 2015, the first of a series 5-year plans) with shorter timeframes

Appendix 3.2 (Cotrinued)

Statements in policy documents

Mali				
#1. The National Climate Plan of Action (PANC) (successor of the National Strategy for Climate Change (SNCC) (2011) and the National Policy for Climate Change (PNCC) (2011))	Funded by the Norwegian government (embassy), technical support from Gesellschaft für Internationale Zusammenarbeit (GIZ), consulting services from EcoSecurities (a carbon offset company). Coordinated by l'Agence de l'Environnement et du Développement Durable (AEDD)	EIDOS strategizing tool (setting priorities and testing policies on their robustness) based on strategic policy priorities set in the PNCC	GIZ	EIDOS helped determine policy objectives in SNCC and PANC
#1. National Climate Adaptation Plan (2016)	Main funders seem to be the United Nations Development Program and GIZ	Several initiatives focusing on climate services capacities of meteorological institutions, projections and local information services	United Nations Development Program, GIZ, French Development Agency, African Development Bank, Institute for Research and Development	Assessment of climate service capacities and gaps
#2. National Agricultural Investment Program (PNISA) (2015-2025) (2014)	Ministry of Rural Development	Macroeconomic model calculations horizon 2025 based on a comparison of production under the PRSP versus PNISA	MME model was used by the National Direction for Development Planning	Projections help determine policy priorities for the agricultural sector a consultative process was part of the institutional design of the policy, including NGOs, regional agricultural chambers, local governmental officials

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Appendix 4.1 Data Generation Tool
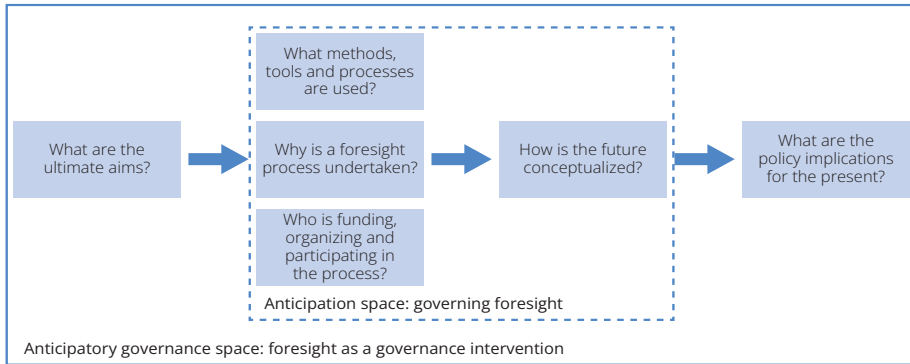
Source: developed by the authors

Appendix 4.2 Survey questions

1. Which of the following methods did you use to develop forward looking information to explore the future of food systems? Please describe your most recent process (In case you want to describe another process, please use the option at the end of this form):
    · Simulation model
    · Participatory scenario development
    · Horizon scanning
    · Visioning and back casting
    · Story-and-simulation
    · Megatrends analysis
    · Delphi survey
    · Simulation gaming * e.g. to experiment with future food systems, governance systems, etc.
    · Role play * e.g. to explore future interests and negotiations
    · Citizen jury * e.g. to critically reflect on assumptions embedded in frames of the future
    · Vulnerability pathway mapping * e.g. to explore factors contributing to future vulnerabilities
    · Prefer not to say
    · Other:

2. Did you combine the above method with another method? (e.g. risk-, vulnerability- or impact assessments, scenario narratives). Please note which one(s):

3. Can you let us know the name of the process/exercise/project/process? Please also use this space to share any relevant weblinks. If you would like to share an informative document on this, please email

4. Which organizations, institutes, companies etc funded the process?

5. Could you briefly describe the process, what steps you followed and how in a few sentences? Please also use this space to share any relevant weblinks. If you would like to share an informative document on this, please email us

6. Which organizations, companies, etc. were involved in designing the practice?

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7. Can you briefly describe what interaction you had with your clients? (The people in the governance space that ask you to do the foresight process)

8. Were the stakeholders (e.g. policymakers) consulted in the design and/or the content of the process?
   - Yes
   - No

9. Please describe how they were involved or co-designed the process (e.g. help with formulating or framing the issue, or identifying, developing or implementing policy measures, or assessing its impact)

10. Who were the stakeholders that participated in the foresight process? Were these participants from:
    - Research institutes/Universities
    - National government
    - Research & Development institutes
    - Local government
    - International governmental organizations
    - Civil society
    - Large enterprises
    - Small and medium-sized enterprises
    - Community representatives
    - Farmers groups
    - Prefer not to say
    - Other:

11. As a designer/co-designer of the process can you describe how the future was/ futures were seen and engaged with in your process? For example: *
    - A most probable future can be approximated
    - Multiple futures are plausible as the future holds fundamental uncertainties
    - Futures are plural - shaped and co-created by those who imagine them
    - Future are performative - assumptions embedded in frames of the future exert power over the present
    - Prefer not to say
    - Other:

12. Did this conception of the future influence any of the following steps in the design of the foresight process?
    - Which method was chosen
    - Which stakeholders participated
    - How engagement with policymakers was undertaken
    - How engagement with other clients took place
    - The outcomes of the foresight process
    - The (policy)recommendations
    - Prefer not to say
    - Other:

13. What time horizon was set? *
    - 0-5 years
    - 5-10
    - 10-20
    - 20-50
    - >50
    - 20

14. Why was this time horizon chosen?

15. What was the geographic scale of the process? *
    - International
    - National
    - Local
    - Other:

16. Why was this scale chosen?

17. What were the key issues addressed in the exercise?
    - Land use change
    - Food system development
    - Agricultural development
    - Diet and nutrition outcomes
    - Climate change or environmental changes
    - Livelihood Issues (related to agriculture and food)
    - Other:

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18. According to you, what was the purpose of the foresight process? Why was this foresight process undertaken? For example:
    - To scientifically explore future uncertainty
    - To educate and raise awareness for future risks and opportunities
    - To support decision making
    - To deliberate and mediate conflict
    - To analyse future trade-offs
    - Prefer not to say
    - Other:

19. If you supported decision making processes, please briefly state why and how:

20. What do you think was the ultimate societal aim of the foresight process in whichever governance or decision-making process you supported? For example, the foresight processes was undertaken to aim to:
    - Reduce and manage future risks involved in food systems
    - Increase reflexivity within food policy instruments, plans, trajectories, institutions
    - Transform food system towards a more sustainable or desirable state
    - Have dialogue about the direction of food system change and political contestation involved in such change processes, e.g. discussing who benefits, who's excluded
    - Prefer not to say
    - Other:

21. Did you aim to influence any of the following steps in the policy process? *
    - Identify the issue/problem with stakeholders/decision-makers
    - Frame the issue/problem with stakeholders/decision-makers
    - Identify which policy measures are needed and ex-ante impact assessment
    - Developing or adopting certain policy measures
    - Implementing certain policy measures
    - Supporting the effectiveness of certain policy measures and ex-post impact assessment
    - Prefer not to say
    - None of the above
    - Other:

22. Do you know if and how the foresight exercise indeed influenced any of these steps of the policy process? Please describe this impact:

23. Can we approach you for a further discussion of your answers? If yes, please enter your email address below: *

End of Survey. Many thanks for your input.

Do you want to describe another process? Please click 'Submit Another Response' on the page once you select Submit below.

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Appendix 5.1 Overview of documents, interviews, and focus groups for each region

West Africa

	Anticipation process workshop reports and articles	Policy documents	Interviewees and personal communication	Focus group discussants Niger	Focus group discussants Burkina Faso
1.	Senegal: Amma2050 climate models and serious games	Senegal: Emerging Senegal Plan 2014-2035, implemented through Plans of Action (2014)	Climate Change Impacts and Adaptation Expert - PAS-PNA – Senegal for AMMA2050, 26 April 2019	Institut National de Recherche Agronomique du Niger, Département de gestion des ressources naturelles	Professor Centre National de Recherche Scientifique et Technologique	CNRST
2.	Senegal: Ordered probit model of how SMEs respond to climate risks	Senegal: National Adaptation Plan for the Fisheries and Aquaculture Sector in the Face of Climate Change Horizon 2035 (2016)	Head of Agence Régionale de Développement (ARD) of Fatick for AMMA2050, 18 April 2019	Regional Coordinator, Mercy Corps	Student Centre National de Recherche Scientifique et Technologique	CNRST
3.	Ghana: CCAFS participatory scenarios workshop to guide formulation of the Livestock Policy	Senegal: Program of Acceleration of the Cadence of Senegalese Agriculture (2014)	Scientific Project Manager & Knowledge exchange officer, Centre for Ecology and Hydrology for AMMA2050, January-March 2019	SP/CNRA	Secrétariat Permanent en charge de la gestion des crises et vulnérabilités en élevage
4.	Ghana: EPA & MET downscaled climate change scenarios for the Wa District by the Model for the Assessment of Greenhouse-Gas Induced Climate Change	Senegal: Prospective Study 2035	Scenarios and Policy researcher Utrecht University for CCAFS, 3 October 2018	CILLS	CNRST/IRSAT/DTA
5.	Ghana: Amma2050 climate projections and Participatory impact Pathway Analysis	Ghana: National Climate Adaptation Master Plan (2015)	Africa Program leader CCAFS, 4 October 2018	President of Science-Policy Platform, CNRS/MESRI/ Bangoula	Secrétaire Permanent / Confédération Paysanne du Faso
6.	Burkina Faso: CCAFS participatory scenarios workshop to guide reformulation of the PNSRII	Ghana: Shared Growth and Development Agenda II (2014)	International scientist for the Center for International Forestry Research for CCAFS, January 2019	Director, INRAN	Center for International Forestry Research
7.	Burkina Faso: Practical consensual tool using the ClimProspect Model and a participatory approach to monitor and evaluate Water Policy in response to climate risks	Ghana: Coordinated Program of Economic and Social Development Policies (CPESDP) 2017-2024	Flagship leader International Livestock Research Institute for CCAFS, August-October 2018	Director, DPER/M. Energy	Confédération Paysanne du Faso

West Africa

	Anticipation process workshop reports and articles	Policy documents	Interviewees and personal communication	Focus group discussants Niger	Focus group discussants Burkina Faso
8.	Mali: CIRAD participatory foresight to address long-term challenges in an irrigation scheme	Burkina Faso: National Climate Adaptation Plan (2015)	Head of Rural Sector Prospects and Policies Department at SP-CPSA, Ouagadougou, Burkina Faso for CCAFS, 29 April 2019	International Crops Research Institute for the Semi-Arid Tropics	Institute International d'Ingénierie de l'Eau et d'Environnement – Fondation 2iE
9.	Mali: cost-benefit analysis private sector and SMEs to analyze climate risks and develop adaptation strategies	Burkina Faso: National Rural Development Plan II (2018)	Chief of Party WABiCC, 08 October 2018	National council of environment and sustainability, SE/CNEDD	ICRAF
10.	Regional: Process-based crop model SARRA-H to assess climate change impacts on yields in the Sudanian and Sahelian savannas	Niger: The Strategic Framework for Sustainable Land Management 2015-2019 (2014)	PI WABiCC, Center for International Earth Science Information Network (CIESIN), Columbia University, 8 October 2018	Direction Générale de l'Environnement et du Développement Durable/ Ministère de l'Environnement et du Développement Durable	CPF/Confédération Paysanne du Burkina Faso
11.	Regional: Error correction model to understand the effect of policy integration on agriculture and climate adaptation in ECOWAS	Niger: Nigeriens Nourish the Nigerian Initiative (2012)	Senior Researcher, Center for International Earth Science Information Network (CIESIN), Columbia University for WABiCC, 19 March 2019	Directeur Général Adjoint des Eaux et Forêts République, Ministry of Environment and Développement Durable	Chef de Service suivi des politiques (MCEM CC)
12.	Regional: Times series of climatic events in the Sahel	Niger: Sustainable Development and Inclusive Growth Strategy (2016)	Chief of Party WABiCC, September 2018	Platforme Paysanne du Niger	Scenarios and Policy researcher UU, CCAFS
13.	Regional: WABiCC capacity building workshop on climate and vulnerability data	Mali: The National Climate Plan of Action (2011))	Senior Climate Resilience Expert IRRP for WABiCC, February 2019	Collectif des Associations Pastorales du Niger (CAPAN)	
14.		Mali: National Climate Adaptation Plan (2016)	Senior Climate Resilience Expert IRRP for WABiCC, February 2019	Scenarios and Policy researcher UU, CCAFS	
15.		Mali: National Agricultural Investment Program (PNISA) (2015-2025) (2014)			

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South Asia

#	Anticipation process workshop reports and articles	Policy documents	Interviewees and personal communication	Focus group discussants Bangladesh	
1.	Bangladesh: DECCMA Scenarios	Bangladesh: 7th Five Year Plan (7FYP) [CCAFS Scenarios]	General Economics Division	Director ICCCAD	Assistant Chief/PS to Member General Economics Division
2.	Bangladesh: Participatory Scenario Development (PSD) Approaches for Identifying Pro-Poor Adaptation Options - Economics of Adaptation to Climate Change (2010)	Bangladesh: Delta Plan 2100	General Economics Division	Senior Secretary General Economics Division	Senior Assistant Chief General Economics Division
3.	Bangladesh: Climate change adaptation and migration scenarios in BGD	Pakistan: National climate change policy (2012)	General Economics Division	Deputy Chief General Economics Division	Senior Assistant Chief General Economics Division
4.	Pakistan: The UNEP Country Studies on Climate Change	Pakistan: Framework for economic growth (2011)	Planning Commission	Deputy Chief General Economics Division	Joint Chief General Economics Division
5.	Pakistan: Impacts and Adaptations Assessment (2000)	Pakistan: Framework for implementation of climate change policy (2014 - 2030)	ICCCAD	Deputy Chief General Economics Division	ICCCAD
6.	India: TERI socio economic scenarios for climate change impacts	Pakistan: Vision 2025	CCAFS	Deputy Chief General Economics Division	ICCCAD
7.	India: A scenario framework to explore migration and adaptation in deltas: A multi scale participatory approach	India: 12th Five Year Plan (Scenarios for India), Planning Commission	CCAFS	Senior Assistant Chief General Economics Division	ICCCAD
8.	India: WRI participatory scenarios development: A tool for effective planning	Nepal: Climate Change Policy (2011)	IFPRI	Assistant Chief General Economics Division	IUB

South Asia

	Anticipation process workshop reports and articles	Policy documents	Interviewees and personal communication	Focus group discussants Bangladesh
9.	India: Engaging stakeholders in developing food security scenarios in Kerala	Nepal: National Adaptation Plan Process (2018)	ICCCAD	Joint Chief General Economics Division; GED
10.	Sri Lanka: CDKN CCD Scenarios for Sri Lanka	Nepal's National Adaptation Plan of Action (NAPA) (2010)	ICCCAD	Chief (Attached) General Economics Division
11.		Nepal: National Climate Change Health Adaptation		Assistant Chief General Economics Division
12.		National Framework on Local Adaptation Plans of Action (LAPA) 2011		Program Manager IFPRI
13.		Sri Lanka: Mahinda Chintana: Vision for the future 2010		Assistant Secretary General Economics Division
14.		Sri Lanka: National Adaptation Plan for Climate Change Impacts 2016 - 2025		Research Officer General Economics Division
15.		Sri Lanka: National Climate Change Adaptation Strategy (NCCAS) (2011 - 2016)		Senior Assistant Chief General Economics Division
16.		Sri Lanka: National Framework on Local Adaptation Plans for Action		Assistant Chief Programming Division
17.		Regional: DECCMA (Deltas, Vulnerability & Climate Change: Migration & Adaptation) project is part of the Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA)		Senior Assistant Chief General Economics Division

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Southeast Asia

	Policy documents	Interviewees and personal communication	Focus group discussants from the region
1.	Vietnam: Resolution 24/NQ-TW: Active response to climate change, improvement of natural resource management and environmental protection	Senior Advisor Forest and Climate Change (FOR-CC) under the ASEAN-German Program on Response to Climate Change, GAP-CC Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) GmbH Based in Jakarta and Philippines	Agriculture Sector Expert, National Environmental Protection Agency (NEPA) Afghanistan	Deputy Administrator, Vietnam Meteorological and Hydrological Administration, Ministry of Natural Resources and Environment Vietnam
2.	Vietnam: Decision No. 543/ QD-BNN-KHCN: Action Plan on Climate Change Response of Agriculture and Rural Development Sector in the Period 2011-2015 and vision to 2050	Natural Resources Officer- Climate Change (FAO – RAP) Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific Based in Bangkok	TNA Project Specialist/Climate Change Advisor, National Environmental Protection Agency (NEPA) Afghanistan	Deputy Director General, Vietnam Institute of Meteorology, Hydrology and Climate change (IMHEN)
3.	Vietnam: The National Climate Change Strategy and the No: 2139/ QD-TTg Decision on Approval of the National Climate Change Strategy	Senior Officer Agriculture Industries & Natural Resources Division Finance, Industry & Infrastructure Directorate ASEAN Economic Community (AEC) Department	Assistant Chief, Ministry of Agriculture Bangladesh	Official, Department of Science, Technology and Environment, Ministry of Agriculture and Rural Development Vietnam
4.	Vietnam: Decision No. 158/2008/ QD-TTg on the Approval of the National Target Program to Respond to Climate Change	DDG for international Cooperation Department of MARD Based in Vietnam	Professional Assistant, Department of Meteorology Bangladesh	Principal Spatial Analyst NSW Department of Planning, Industry & Environment Australia
5.	Decision No. 2730/QH-BNN-KHCN: Decision on Promulgation of the Climate Change Adaptation Framework Action	Senior Offical Ministry of Agriculture and Rural Development (MARD), Department of Natural Resources and Environmental Economics (IPSARD)	Director, Department of Agriculture, Ministry of Agriculture and Forests Bhutan	CCAFS South East Asia Regional Scenarios Coordinator and Policy Researcher Utrecht University- Copernicus Institute of Sustainable Development, CGIAR CRP7- Climate Change, Agriculture and Food Security (CCAFS) Cambodia

Southeast Asia

	Policy documents	Interviewees and personal communication	Focus group discussants from the region
6.	Philippines: Executive Orders no. 43 and no. 24 , Cabinet Cluster on Climate Change Adaptation and Mitigation"	Water Management Specialist Investment Center Division - Asia and the Pacific Service (DPIB) Food and Agriculture Organization of the United Nations (FAO)	Head, Climate, Research & Analysis Services, Weather & Climate Services Division, National Center for Hydrology & Meteorology Bhutan	Project Advisor, Remote Sensing-Based Information & Insurance for Crops in Emerging Economies (RIICE), Environment, Climate Change and Natural Resource Management Program (GIZ) India
7.	Philippines: National Climate Change Action Plan	Senior Official Ministry of Agriculture and Rural Development (MARD), Department of Natural Resources and Environmental Economics (IPSARD)	SAO, Agriculture Research and Extension Division, Department of Agriculture, Ministry of Agriculture and Forests Bhutan	Agro-meteorology Division Researcher, Institute for Agro-Environmental Sciences, National Agriculture and Food Research Organization (NARO) Japan
8.	Philippines: Framework Strategy on Climate Change		Deputy Director, Plant Protection Sanitary and Phytosanitary Department, General Directorate of Agriculture, MAFF Cambodia	Research Fellow, Prediction Research Department, APEC Climate Center (APCC) Republic of Korea
9.	Philippines: Disaster Reduction and Management Act (RA 10121)		Deputy Director, Department of Meteorology, Ministry Of Water Resources And Meteorology Cambodia	Administration Department, APEC Climate Center (APCC) Republic of Korea
10.	Philippines: Strategy on Climate Change Adaptation		Head, Applied Climate Information Service Unit, Meteorological, Climatology and Geophysics Bureau (BMKG) Indonesia	Climate System and Analysis Group, Environmental and Geographical Science Department, University of Cape Town, South Africa
11.	Cambodia: Climate Change Strategic Plan		Researcher, Research Institute for Agro-Climate and Hydrology, Research and Development Agency, Ministry of Agriculture Indonesia	Associate Professor, Chair, Department of Applied Mathematics, University of Cantabria Spain

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Southeast Asia

	Policy documents	Interviewees and personal communication	Focus group discussants from the region
12.	Cambodia: Green Growth Policy		Researcher Institute of Agricultural Technology North Sumatra (AIAT), Ministry of Agriculture Indonesia	Climate Data Analyst/ Project Officer (SERVIR-Mekong), Asian Disaster Preparedness Center (ADPC) Thailand
13.	Indonesia: National Medium-Term Development Plan 2015-2019 (RPJMN 2015-2019)		Climate Information and Analysis Sub-unit, Center of Climate Change Information, Meteorological, Climatology and Geophysics Bureau (BMKG) Indonesia	Senior Project Manager - Climate Risk Management (SERVIR Mekong), Asian Disaster Preparedness Center (ADPC) Thailand
14.	Indonesia: Law 31/2009 Concerning Meteorology, Climatology and Geophysics		Researcher, Research Institute for Agro-Climate and Hydrology, Research and Development Agency, Ministry of Agriculture Indonesia	Team Leader (RS/GIS), Geoinformatics Center (GIC), Asian Institute of Technology (AIT) Thailand
15.	Indonesia: Law 32/2009 Environmental Protection and Management		Head of RS & GIS Center, Ministry of Agriculture Jihad Iran	Dean, School of Environment, Resources & Development, Asian Institute of Technology (AIT) Thailand
16.	Lao PDR: Strategy on Climate Change of the Lao PDR		Deputy of Information & Communication Technology Center, Ministry of Agriculture Jihad Iran	Project Advisor, Remote Sensing-Based Information & Insurance for Crops in Emerging Economies (RIICE), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH Thailand
17.	Lao PDR: Environmental Protection Law (2013 version)		Head of the GIS Unit, Department of Agricultural Land Management, Ministry of Agriculture and Forestry Lao PDR	Visiting Professor GeoData, Geography and Environmental Sciences, University of Southampton United Kingdom
18.	Lao PDR: Natural Resources and environment Strategy, 2016-2025		Modelling and Data Analysis, Department of Agricultural Land Management, Ministry of Agriculture and Forestry LAO PDR	Climate-Change Scientist World Agroforestry Centre (ICRAF) Vietnam

Southeast Asia

	Policy documents	Interviewees and personal communication	Focus group discussants from the region
19.			Database Management, Department of Agricultural Land Management, Ministry of Agriculture and Forestry Lao PDR	National Field Manager, FAO Afghanistan
20.		Mapping and Data Management, Department of Agricultural Land Management, Ministry of Agriculture and Forestry Lao PDR	NPC cum Technical Advisor, FAO Bangladesh
21.		Deputy Head of Climate and Agro-meteorological Division, Department of Meteorolgy and Hydrology, Ministry Of Natural Resources and Environment Lao PDR	Assistant FAOR (Program), FAO Cambodia
22.		Technical Staff of Climate and Agro-meteorological Division, Department of Meteorolgy and Hydrology, Ministry Of Natural Resources and Environment Lao PDR	Programme and Monitoring Specialist, FAO Cambodia
23.		Deputy Director, Department of Agriculture, Ministry of Agriculture, Livestock and Irrigation Myanmar	Project Coordinator, FAO Laos
24.		Assistant Director Department of Meteorology and Hydrology, Ministry of Transport and Communication Myanmar	Disaster Risk Reduction/Climate Change Specialist, FAO Myanmar

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Southeast Asia

	Policy documents	Interviewees and personal communication	Focus group discussants from the region	
25.			Joint Secretary Ministry of Agriculture and Livestock Development Nepal	Programme Officer, FAO Nepal
26.			Senior Meteorologist Department of Hydrology and Meteorology, Ministry of Energy, Water Resources and Irrigation Nepal	National Technical Coordinator & Project Manager, FAO Nepal
27.			Senior Scientist, Nepal Agricultural Research Council (NARC)	GIS Assistant, FAO Pakistan
28.			Principal Scientific Officer/Head Global Change Impact Studies Centre (GCISC), Ministry of Climate Change Pakistan	Monitoring and Reporting Assistant, FAO Sri Lanka
29.			Principal Horticulturist, Department of Agriculture & Livestock Papua New Guinea	Senior Environment Officer, Head of Geospatial Unit, CBDS
30.			Climatologist National Weather Service Papua New Guinea	Natural Resources Officer, CBC
31.			Weather Services Chief, Climatology and Agrometeorology Division (CAD), Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)	Climate Impact and Adaptation Consultant, CBC

Southeast Asia

Policy documents	Interviewees and personal communication	Focus group discussants from the region
32.	Engineer II, Agro-Hydrology and Rain Stimulation Section, Water Resources Management Division, Bureau of Soils and Water Management. Department of Agriculture Philippines	National Technical Advisor, FAO Papua New Guinea
33.	Agriculturist II, Field Programs Operational Planning Division, Department of Agriculture Philippines	Technical Advisor, FAO Solomon Islands
34.	Policy Officer, Policy, Planning & Communication Division, Ministry of Agriculture and Fisheries Samoa	Senior Resilience Officer, FAO RAP
35.	Principal Scientist Natural Resources Management Center, Department of Agriculture Sri Lanka	Natural Resources Officer, FAO RAP
36.	Meteorologist, Climate Change and Research Division, Department of Meteorology Sri Lanka	Natural Resources Officer, FAO RAP
37.	Professor Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka	Junior Professional Offficer (Climate Change), FAO RAP
38.	Geo-informatics Officer Geo-Informatics and Space Technology Development Agency (GISTDA) Thailand	Forestry Officer, UN-REDD Programme

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Southeast Asia

Policy documents	Interviewees and personal communication	Focus group discussants from the region
39.		Geo-informatics officer Geo-Informatics and Space Technology Development Agency (GISTDA) Thailand	83. Abu Mahmood
40/		Chief of Land Use Planning And Policy Group, Land Development Department, Ministry of Agriculture and Cooperatives Thailand	Remote Sensing and Land Cover Assessment Expert, UN-REDD Programme
41.		Environmentalist, Practitioner Level, Policy and Strategy Section Climate Change Management and Coordination Division, Office of Natural Resources and Planning (ONEP) Thailand	Technology and Innovation Consultant, FAO RAP
42.		Senior Policy and Plan Specialist, Planning and Technical Division, Department of Agriculture Thailand	GIS Consultant for AGRI-MAP design, FAO RAP
43.		Policy and Plan Specialist, Planning and Technical Division, Department of Agriculture Thailand	

Central America

	Anticipation process workshop reports and articles	Policy documents	Interviewees and personal communication	Focus group discussants El Salvador	Focus group discussants Guatemala
1.	Belize: Urban development scenarios for Belize City 2010-2030	Belize: National Climate Resilience Investment Plan (2013)	Policymaker of SAG team in charge of development of the policy, 24 July 2019	MAG	Universidad de San Carlos - USAC
2.	El Salvador: effects of climate change on agriculture	Belize: National Biodiversity Strategy and Action Plan, Ministry of Agriculture, Fisheries, Forestry, the Environment, Sustainable Development & Immigration (2016)	Coordinator of SAG team in charge of development of the policy, 17 July 2019	MARN	Instituto Privado de Investigación sobre Cambio Climático - ICC
3.	Guatemala: Climate change and Biodiversity; Elements to analyze their interactions in Guatemala with an ecosystem approach	Belize: National Climate Change Policy, Strategy and Action Plan to address Climate Change (2014)	Consultant contracted by GIZ to support SAG in development of the policy, 30 July 2019	MARN	Instituto Interamericano de Cooperación para la Agricultura - IICA
4.	Guatemala: First report evaluating knowledge about climate change in Guatemala	El Salvador: National Climate Change Plan (2015)	Project leader on behalf of PADECO, 25 September 2019	PROTECCIÓN CIVIL	Universidad Rafael Landivar de Guatemala - IARNA
5.	Guatemala: The economics of climate change in Guatemala	El Salvador: National strategy for hydrographic basins of El Salvador (2017)	Ministry of Tourism, Civil Aviation and Culture of Belize - Project Liaison Officer, 15 October 2020	CONASAN	Programa de las Naciones Unidas para el Desarrollo - PNUD
6.	Guatemala: Final Report Climate Impacts for Guatemala: Preliminary Results of Regional and Global Climate Models IPCC AR5	Guatemala: National action plan on climate change (2016)	Project leader on behalf of IADB, 15 January 2021	CONASAN	Ministerio de Agricultura, Ganadería y Alimentación - MAGA

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Central America

	Anticipation process workshop reports and articles	Policy documents	Interviewees and personal communication	Focus group discussants El Salvador	Focus group discussants Guatemala
7.	Honduras: Environmental Assessment and Climate Change For the preparation of IFAD's 2012-2016 National Strategic Opportunities Program	Guatemala: Institutional Climate Change Agenda 2013-2016 of the National Forest Institute (2013)	Climate Change Focal Point and Head of the Agricultural Development Unit at ECLAC (CEPAL), 15 October 2019	PNUD	Instituto Nacional de Sismología, Vulcanología e Hidrología - INSIVUMEH
8.	Honduras: Using expert judgments to inform economic evaluation of ecosystem-based adaptation decisions: watershed management for enhancing water supply for Tegucigalpa, Honduras	Guatemala: K'atun National Development Plan: our Guatemala 2032 (2014).	Author of several ECLAC (CEPAL) studies on the economy of climate change, 14 January 2021	FIDA	Instituto Nacional de Sismología, Vulcanología e Hidrología - INSIVUMEH
9.	Nicaragua: Mainstreaming of climate change in Nicaragua: Evaluation of risks and opportunities	Nicaragua: Adaptation Plan to Variability and Climate Change in the Agricultural, Forestry and Fisheries Sector, Ministerio Agropecuario y Forestal (2013)	Policymaker and former executive secretary of the Central American Board on Agriculture and Livestock (CAC), 9 January 2020	PROINTER	Instituto Nacional de Sismología, Vulcanología e Hidrología - INSIVUMEH
10.	Nicaragua: Climate Smart Agriculture in Nicaragua	SICA region: Climate Smart Agriculture strategy for the SICA region 2018-2030 (2017)	Viceminister of Environment when Guatemala's Climate Change Action Plan was developed, 19 Octobrer 2018	PRISMA	Ministerio de Ambiente y Recursos Naturales - MARN
11.	Costa Rica: INDC process		Consultant and author of the study 'Avances a nivel politico y estratégico en la adaptacion al cambio climatico' (Global water Partnership), 10 January 2019	FAO	Ministerio de Ambiente y Recursos Naturales - MARN
12.	Regional: Climate Change in Central America: Potential Impacts and Public Policy Options			MAG	Universidad del Valle de Guatemala - UVG

Central America

	Anticipation process workshop reports and articles	Policy documents	Interviewees and personal communication	Focus group discussants El Salvador	Focus group discussants Guatemala
13.	Regional: Impacts of Climate Change on Agriculture in Central America, mitigation and adaptation strategies			MAG	Consejo Nacional de Áreas Protegidas - CONAP
14.	Regional: Climate change and challenges for the tourism sector in Central America			MARN	Consejo Nacional de Áreas Protegidas - CONAP
15.				FAO	Rainforest Alliance - RA
16.				MARN	Fondo de las Naciones Unidas para la Alimentación y la Agricultura - FAO
17.				CONASAN	Ministerio de Agricultura, Ganadería y Alimentación - MAGA
18.				PNUD	Ministerio de Agricultura, Ganadería y Alimentación - MAGA
19.				FONAES	CCAFS - Universidad para la Cooperación Internacional – UCI / CCAFS
20.				MAG	Universidad para la Cooperación Internacional - UCI
21.				CRS	
22.				UCI	
23.				UCI/CCAFS	

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SUMMARY

The anticipatory governance of sustainable futures

In times of accelerating earth system transformations and their potentially disruptive societal consequences, imagining and governing the future is now a core challenge for sustainability research and practice. Anticipation processes have become a key governance mechanism to imagine uncertain climate futures and guide actions in the present. Anticipation processes include foresight practices, such as scenarios, visioning processes, and games. In addition, methods that are not normally labeled as foresight can also be used to explore the future, such as impact assessments and cost-benefit analyses. These methods and tools have become popular methods for imagining uncertain futures in the present and informing decision-making. They have spread throughout different disciplines and prominent norm-setting institutions such as the Intergovernmental Panel on Climate Change and the United Nations Environment Program's Global Environmental Outlook. Many social science scholars have argued for understanding anticipation as a site of political negotiation, where images of the future are made sense of, and shape how we understand the future and act on it in the present. There is, however, a lack of scrutiny of how the future is conceptualized in anticipation processes, and how these conceptions steer sustainability actions in the present. Therefore, the aim of this thesis is to examine how conceptions of the future steer actions in the present and what their implications are for realizing sustainability transformations. I analyze anticipation processes in various sustainability domains and global contexts through the lens of anticipatory governance, which can be broadly defined as 'steering uncertain futures in the present'.

The thesis examines the following question:

'How are conceptions of the future steering anticipatory governance actions in the present and with what implications for realizing sustainability transformations?'

After the topic of research and its intended theoretical contributions have been introduced in chapter 1, chapter 2 unpacks divergent explicit and implicit conceptualizations of anticipatory governance in the social science and sustainability science literatures. As chapter 2 shows, there are various (often implicit) conceptions of the future embedded in these understandings of anticipatory governance, in terms of the extent to which the future can be known and steered in the present. And these conceptions each have different implications for actions to be taken in the present, and also pursue diverse ultimate aims to be realized. The chapter reviews perspectives in disciplines such as public administration, futures studies, socio-ecological system theories, environmental governance, transition studies, science and technology studies, and responsible research and innovation studies. All these perspectives engage explicitly or implicitly with the

notion of anticipatory governance, yet from distinct ontological and epistemological starting points. Four approaches to anticipatory governance are identified:

1. Approach 1 assesses probable (and improbable) futures in order to help inform strategic policy planning to reduce future risks.
2. Approach 2 explores plausible futures in order to build capacities and preparedness to reflexively navigate diverse uncertain futures.
3. Approach 3 focuses on the imagining of pluralistic futures in order to mobilize diverse societal actors to co-create new futures.
4. Approach 4 scrutinizes the performative power of future imaginaries in order to interrogate and shed light on their political implications in the present.

These four approaches are presented in a figure that serves as an analytical framework for the rest of the thesis. The co-authors and I map a diverse set of methods and tools of anticipation onto the framework, illustrating that some methods and tools align more with a given approach, while others are used through multiple approaches. The analytical framework is thus a useful analytical lens to assess how the four approaches identified in the literature relate to practice in diverse sustainability contexts across the globe. This is done in empirical chapters 3, 4, and 5.

Chapter 3 applies the analytical framework to a highly climate-vulnerable area - West Africa. In a case study analysis, I analyze through document analysis of reports and policy documents, and interviews with foresight practitioners and policymakers how anticipation processes have been used to inform climate change decision-making in Burkina Faso, Senegal, Ghana, Mali, and Niger. The study finds that the probable and plausible futures approaches (approaches 1 and 2) are dominant. They appear in various hybrid forms, but all take on a fairly technocratic interpretation, especially when actions in the present are determined. Moreover, approach 2 often becomes subservient to approach 1, which is more linear and planned in nature and therefore assumes a more predictable future. This is reflected, for example, in the way in which stakeholder participation takes shape. While many processes are participatory in nature, they often revolve around a transfer of knowledge from experts to stakeholders rather than a real exchange between a variety of people to open up dialogue on what and whose futures to engage with. Moreover, for practical reasons, it seems difficult to recruit beyond the expert. An important point is therefore that in these participatory processes the participants, but also the population (whose future, after all, participatory processes aim to visualize), have too little agency to be able to give their own vision of the future and to contribute to designing it. Furthermore, too little attention is paid to the power relations that determine the shaping of the future and thus steer actions in the present.

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In particular, international organizations (Western knowledge institutions and donor agencies) dominate such processes. Such organizations have much influence on the representation of the future with their funding, knowledge, and technology, but at the same time deny this power by presenting their interference as apolitical and their activities as technical support for policymakers. The chapter thus argues that more plural and critical dialogue is needed in which stakeholders have the agency to shape futures and address power imbalances, particularly in contexts where anticipation relies on Western funding and science.

In chapter 4, this analytical framework is then combined with Feola's (2015) transformation analytical framework to better understand the implications of the dominant approaches for realizing sustainability transformations. In this chapter, I examine with the coauthors the perspectives within a global network of experts in foresight (Foresight4Food) to analyze their perspectives on how anticipatory governance can steer action in the present to transform food systems. The research is based on an online survey, a two-day workshop, and interviews. The study shows that most foresight practitioners in the network use a hybrid approach in their work that integrates fundamentally different conceptions of the future (mainly probable, plausible, and plural). Despite this diversity of conceptualizations, and with it the recognition of more fundamental uncertainty about the future, recommendations for action are formulated in a way that is more based on a planned approach to the future. Much anticipation for transformation thus uses the language of deep uncertainty and deliberative action without fully taking its consequences on board. In other words, foresight practitioners use language that assume an inherently uncertain (and therefore unplanned) future and the need for a more critical participatory process. But they also tend to express their outcomes in technical and strategic terms, in line with prevailing policy discourse, partly because they feel that this is what policymakers want and this is the way to make sure that recommendations land. This points to a missed opportunity because a proactive transformation of future food systems requires an explicit dialogue about the political considerations. The combined framework offers new insights for theory and practice by helping researchers and practitioners to be more reflexive of how assumptions about key human systems such as food system futures shape what is prioritized/marginalized and included/excluded in actions to transform such systems.

In the final empirical chapter, chapter 5, I examine what these dominant dynamics mean for the opening or closing of possible futures and contemporary actions to arrive at those futures. To this end, the analytical framework is combined with Stirling's (2008) notion of opening up and closing down. The integrated analytical framework is then applied to anticipation processes in national and sectoral climate policy (in

sectors such as agriculture, tourism and water) in four regions of the global South: West Africa, South Asia, Southeast Asia and Central America. The research is based on document analysis, focus groups, and interviews. In these four regions, the co-authors and I find that the majority of the anticipation processes aim to initiate an open dialogue about the scientific uncertainty of climate change and, to a large extent, also focus on the plurality of visions of the future. At the same time, the outcomes of almost all anticipation processes are used to formulate strategic and linearly designed actions in the present that (build capacity to) reduce future risks. It is important here that capacity building is not so much about navigating different possible futures (in line with the plausibility approach), but a capacity for making risk estimates (in line with the probability approach). Such formulation closes down the space for more pluralistic and critical approaches, such as jointly creating a more radically transformative future and questioning power relations in future images. This is partly done for strategic reasons, for example, to adapt the recommendations to existing policy frameworks. Existing policy frameworks are often leading for imagining the future, while it should be the other way around: the knowledge from anticipation processes should shape the policy frameworks. Partly, the closing down of possibilities occurs unconsciously, due to a lack of recognition of these closing-down dynamics, for example in the design of participatory processes. For instance, participants are often asked to imagine their (pluriform) visions of the future and to contribute ideas about the policy consequences, but their input is adapted to policy frameworks without putting such frameworks into question. As such, it seems that anticipation processes are opening up dialogue about the future, but in fact they remain closed. It creates false expectations and does not lead to transforming policies. Furthermore, the co-authors and I observe that in Central America there has been an exceptionally greater effort to approach futures openly and also to question policy frameworks, in particular by formulating ambitions that are more transformative in nature (as in their Intended Nationally Determined Contributions), and to emphasize the need for pluralistic visions of the future. The chapter, therefore, ends with a plea for a revision of the dominant approach to anticipatory governance because this reduces future developments to a technical interpretation and may close down culturally, socially and politically diverse and regionally relevant future worldviews.

In the concluding chapter, chapter 6, I answer the research question and reflect on the empirical and conceptual contribution of the research to the literature on anticipatory governance and related fields. The chapter summarizes that the thesis first outlines different approaches to anticipatory governance based on the literature, then empirically examines the dominant dynamics in practice through a large number of anticipation processes in global sustainability contexts, and questions their implications for realizing sustainability transformations. The case studies show that at the four 'ideal-type'

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approaches are not neatly represented in practice but occur in hybrid forms in which some approaches become dominant, and others subordinate in the translation to actions for the present. The first approach dominates, the second often occurs in combination with the first, the third is sometimes combined with the first two approaches, and the fourth approach is rare. The dominance of the first approach means that sustainability transformations are often guided on the basis of a technically proposed and apolitical future, in which politically conflicting interests are hardly debated. Actions in the present are preferably determined on the basis of expert analysis and consensus-based forms of knowledge. In addition, scientific uncertainty is reduced in the translation of the outcomes of anticipation processes into actions for the present and normative uncertainty is revealed. In general, conceptions of the future are rarely culturally, socially, and political diverse, while what is desirable for one person may be undesirable for another. Such closing down seems does not only seem to be the preference of policymakers, but also experts in foresight practice often think that outcomes should fit into existing policy frameworks in order to be implemented.

Finally, it can be concluded that a wide range of future possibilities are closed down in this dominant approach to anticipatory governance that could have potentially led to a more sustainable, democratic, or equitable future. Scholars have advocated for a better representation of diverse worldviews in global images of future progress but many examples in this thesis have illustrated that anticipation relies heavily on the science, technologies and funding of external consults and donors – a global foresight industry that sometimes but not always 'trickles down' in terms of reinforcing local capacities. There is a tendency of both users and producers of anticipation to use pre-existing policy agendas and scientific narratives as a pretext to promote their objectives instead of being open to transformation and alternative worldviews in science and policy. The fourth approach, with its focus on performative futures and insights into the politics of anticipation, has offered a 'meta-perspective' to make power relations explicit in the design of anticipation processes, but the research shows that this approach is used the least. At a minimum, it should be made much more transparent and explicit what choices are being made and what gets prioritized and what is marginalized.

My research also places these findings in an important context, namely the dominance of the Global North over the Global South. More and more attention is being paid to how knowledge, institutions, and norms perpetuate this dependency relationship, and it is precisely in this light that it is important to make power imbalances and political negotiations about the future explicit. This research contributes to that discussion by revealing that many anticipation processes pretend to open the future and make it more radically transformative, democratic, and equitable, but in fact close down the

future prematurely along existing policy frameworks that are often dominated by donor agendas (by means of their knowledge, financial instruments, and technology). More research is needed to understand how to democratize ongoing anticipatory governance processes in a way that better represents the needs and desires of communities whose futures are being imagined.

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SAMENVATTING

De anticiperende governance
van duurzame toekomsten

In de huidige tijden van toenemende transformatie van de aarde door klimaatverandering en haar potentieel ontwrichtende maatschappelijke consequenties heeft het verbeelden en sturen van de toekomst een centrale plek gekregen in duurzaamheidsonderzoek en in de praktijk. Toekomstverkenningen, zoals scenario's, *visioning*-processen en *simulation gaming* zijn populaire methoden geworden om onzekere toekomsten te verbeelden in het heden en bij te dragen aan beleid. Maar ook andere methoden en instrumenten, die normaal niet als toekomstverkenningen bestempeld worden, kunnen gebruikt worden om de toekomst te verkennen en acties in het heden te onderbouwen, zoals *impact assessments* en kostenbatenanalyses. Dit brede pallet aan toekomstverkenningen wordt steeds toonaangevender in verschillende academische vakgebieden en internationale organisaties die de mondiale norm bepalen, zoals het *Intergovernmental Panel on Climate Change* en de *Global Environmental Outlook* van de Verenigde Naties. Er is alleen een gebrek aan kennis over hoe de toekomst geconceptualiseerd wordt in deze toekomstverkenningen, en hoe zulke conceptualisaties acties in het heden sturen om duurzaamheidstransformaties te realiseren. Sociaalwetenschappers hebben betoogd dat toekomstverkenningen gezien moeten worden als een vorm van politieke onderhandeling, waarin men de toekomst duidt en op basis hiervan een handelingsperspectief bepaalt. Maar hier is nog weinig onderzoek naar gedaan, met name in het mondiale Zuiden. Daarom onderzoekt dit proefschrift hoe concepties van de toekomst acties in het heden sturen en wat de implicaties hiervan zijn voor duurzaamheidstransformaties. Hierbij worden verschillende vormen van toekomstverkenningen onderzocht, met toepassingen in twee duurzaamheidsdomeinen (klimaat en voedselsystemen) en in verschillende regio's in de wereld. Ik analyseer deze toekomstverkenningen door de lens van *anticipatory governance*, wat breed omschreven kan worden als 'het sturen van onzekere toekomsten in het heden'.

De centrale vraagstelling is:

> *'Hoe sturen conceptualiseringen over de toekomst anticipatory governance acties in het heden en wat zijn de gevolgen hiervan voor het realiseren van duurzaamheids-transformaties?'*

Na deze vraagstelling en de context verder te hebben uitgelegd in hoofdstuk 1, worden in hoofdstuk 2 de impliciete en expliciete definities van het begrip *anticipatory governance* gedeconstrueerd in verschillende sociaalwetenschappelijke vakgebieden. Zoals blijkt uit hoofdstuk 2, zijn er verschillende (veelal impliciete) aannames over de mate waarin de toekomst te kennen en te sturen is in het heden, en deze aannames hebben elk verschillende gevolgen voor het bepalen van acties in het heden en hebben daarnaast verschillende doelstellingen. In dit hoofdstuk wordt onderzocht hoe hiertegen

aangekeken wordt in de disciplines zoals (in het Engels) *public administration*, *futures studies*, *socio-ecological system theories*, *environmental governance*, *transition studies*, *science and technology studies*, en *responsible research and innovation studies*. Al deze vakgebieden gebruiken de term *anticipatory governance* expliciet of impliciet, maar benaderen het onderwerp vanuit verschillende ontologische en epistemologische beginselen en dat heeft gevolgen voor hoe *anticipatory governance* begrepen wordt. Aan de hand van het literatuuronderzoek worden vier benaderingen geïdentificeerd:

1. In de eerste benadering wordt een inschatting van *probable futures* gemaakt, ofwel waarschijnlijke (en onwaarschijnlijke) toekomsten, om strategisch beleidsontwikkling te onderbouwen en toekomstige risico's te verkleinen.
2. In de tweede benadering worden *plausible futures* verkend, ofwel mogelijke toekomsten, om de bereidheid en institutionele capaciteit te vergroten om te navigeren door diverse onzekere toekomsten die zich kunnen aandienen.
3. In de derde benadering worden *plural futures* verbeeld, ofwel pluriforme toekomsten, om verschillende maatschappelijke groepen te mobiliseren tot het co-creëren van een reeks radicaal andere toekomsten.
4. In de vierde benadering worden *performative futures* onderzocht, gericht op de performatieve macht van toekomstbeelden, om hun politieke implicaties voor het heden onder de loep te nemen.

Deze vier benaderingen worden vervolgens weergegeven in een figuur die als analytisch kader fungeert voor de rest van het proefschrift. De co-auteurs en ik plaatsen ook een aantal veelvoorkomende toekomstverkenningen op dit analytisch kader, wat laat zien dat sommige methoden vooral gebruikt worden vanuit één bepaalde benadering terwijl andere vanuit meerdere benaderingen kunnen worden toegepast. Het analytisch kader is dus een handig instrument voor empirisch onderzoek naar welke *anticipatory governance*-benaderingen dominant zijn in verschillende mondiale duurzaamheidscontexten en wat de gevolgen daarvan zijn. Daar gaan de vervolghoofdstukken over.

Hoofdstuk 3 past het analytisch kader toe in een voor klimaatverandering zeer kwetsbare regio: West-Afrika. In een casusonderzoek analyseer ik door middel van documentanalyse van rapporten en beleidsstukken, en interviews met *foresight practitioners* en beleidsmakers hoe toekomstverkenningen zijn toegepast om klimaatbeleid te onderbouwen. Het gaat om toekomstverkenningen in nationaal en sectoraal klimaatbeleid in Burkina Faso, Senegal, Ghana, Mali en Niger. Het onderzoek toont aan dat de *probable* en *plausible futures*-benaderingen (de eerste en tweede benadering zoals hierboven toegelicht) dominant zijn. Ze komen in verschillende hybride vormen voor, maar krijgen allemaal een vrij technocratische invulling, met name

wanneer de acties in het heden worden bepaald. Bovendien wordt de tweede benadering veelal ondergeschikt aan de eerste benadering. Die is namelijk meer lineair en planmatig van aard en gaat daarmee uit van een meer voorspelbare toekomst. Dit is bijvoorbeeld terug te zien in de manier waarop stakeholderparticipatie vorm krijgt. Hoewel veel processen participatief van aard zijn, draait het vaak om een kennisoverdracht van experts naar stakeholders in plaats van een echte kennisuitwisseling tussen een verscheidenheid aan mensen uit allerlei lagen van de samenleving over wat als een ideale of mogelijke toekomst wordt gezien. Bovendien is het om praktische redenen lastig om voorbij de expert te werven. Een belangrijk punt is dus dat in deze participatieve processen de deelnemers, maar ook de bevolking (wiens toekomst immers beoogd wordt te verbeelden in participatieve processen), te weinig eigenaarschap hebben om hun eigen visie op de toekomst te kunnen geven en bij te dragen aan het ontwerpen ervan. Bovendien is er is te weinig aandacht voor de machtsverhoudingen die bepalend zijn voor het vormgeven van de toekomst en daarmee acties in het heden sturen. Dominant zijn met name internationale organisaties (westerse kennisinstellingen en donoragentschappen) die met hun financiering, kennis en technologie veel invloed hebben op de weergave van de toekomst, maar tegelijkertijd deze macht ontkennen door hun inmenging als apolitiek en hun werkzaamheden als technische ondersteuning van beleidsmakers te presenteren.

In hoofdstuk 4 wordt dit analytisch kader vervolgens samengevoegd met het analytisch kader over transformatie van Feola (2015) om beter te begrijpen wat de gevolgen zijn van de dominante benaderingen voor het bereiken van duurzaamheidstransformaties. In dit hoofdstuk onderzoek ik de perspectieven binnen een mondiaal netwerk van *foresight practitioners* (Foresight4Food) om erachter te komen hoe zij denken dat *anticipatory governance* actie in het heden kan sturen om voedselsystemen te transformeren. Het onderzoek is gebaseerd op een enquête, een workshop en interviews. De studie laat zien dat de meeste *foresight practitioners* in het netwerk een hybride benadering gebruiken in hun werk waarin fundamenteel verschillende opvattingen over de toekomst worden geïntegreerd (*probable, plausible en plural*). Ondanks deze diversiteit van conceptualiseringen, en daarmee de erkenning van meer fundamenteel onzekerheid over de toekomst, worden aanbevelingen voor actie geformuleerd op een manier die meer uitgaat van een planmatige aanpak ten aanzien van de toekomst. Er worden weliswaar termen gebruikt, in de gesprekken en projectrapporten, die uitgaan van een inherente onzekere (en dus niet planmatige) toekomst en een meer kritisch participatief proces, maar de consequenties van dit soort termen worden niet in acht genomen in de formulering van acties in het heden. *Foresight practitioners* hebben de neiging om hun uitkomsten in technische en strategische termen uit te drukken, passend bij de heersende beleidsdiscoursen, deels omdat ze het idee hebben dat beleidsmakers dit

willen en het de manier is om aanbevelingen te laten landen. Dit wijst op een gemiste kans, want een proactieve transformatie van toekomstige voedselsystemen vraagt om een expliciete dialoog over de politieke afwegingen.

In het laatste empirische hoofdstuk, hoofdstuk 5, onderzoek ik wat deze dominante dynamieken betekenen voor het openen of afsluiten van mogelijke toekomsten en hedendaagse acties om tot die toekomsten te komen. Daartoe wordt het analytisch kader samengevoegd met de notie van *opening up and closing down* van Stirling (2008). Het geïntegreerde analytisch kader wordt vervolgens toegepast op toekomstverkenningen in nationaal en sectoraal klimaatbeleid (onder andere landbouw, toerisme, water) in vier regio's van het mondiale Zuiden: West-Afrika, Zuid-Azië, Zuidoost-Azië en Centraal-Amerika op basis van documentanalyse, focusgroepen en interviews. In deze vier regio's komen de coauteurs en ik tot de conclusie dat het merendeel van de toekomstverkenningen een open dialoog beogen te starten over de wetenschappelijke onzekerheid van klimaatverandering en een groot deel ook de pluriformiteit van visies op de toekomst centraal stellen. Tegelijkertijd worden de uitkomsten van bijna alle toekomstverkenningen gebruikt om strategische en lineair vormgegeven acties in het heden op te stellen die (capaciteit opbouwen om) toekomstige risico's te verkleinen. Belangrijk hierbij is dat die capiciteitsopbouw niet zozeer gaat over het navigeren van verschillende mogelijke toekomsten (in lijn met de *plausibility*-benadering), maar capaciteit voor het doen van risicoschattingen (in lijn met de *probability*-benadering). Daarmee worden de openingen voor meer pluriforme en kritische benaderingen, zoals het gezamenlijk creëren van een meer radicaal transformatieve toekomst en het bevragen van machtsverhoudingen in toekomstverkenningen, weer gedicht. Dit gebeurt ten dele om strategische redenen, bijvoorbeeld om de aanbevelingen passend te maken aan bestaande beleidskaders. Vaak zijn de beleidskaders leidend voor het verbeelden van de toekomst, terwijl juist de kennis uit toekomstverkenningen de beleidskaders zou moeten vormgeven. Deels gebeurt het afsluiten van mogelijkheden onbewust, door een gebrek aan herkenning van deze *closing down* dynamieken, bijvoorbeeld in het vormgeven van participatieve processen. Bijvoorbeeld wanneer deelnemers worden gevraagd om hun (pluriforme) toekomstbeelden te verbeelden en mee te denken over de beleidsconsequenties daarvan, maar hun input wordt passend gemaakt aan beleidskaders zonder deze ter discussie te stellen. Op deze manier wordt gedaan alsof er *opening up* plaatsvindt, maar in feite blijven ze gesloten. Dit noemden de coauteurs en ik '*closing down while pretending to open up*'. Het creëert valse verwachtingen en transformeert geen beleid. Verder observeren de coauteurs en ik dat in Centraal-Amerika uitzonderlijk meer gepoogd wordt om toekomsten open te benaderen en beleidskaders ook ter discussie te stellen, met name door ambities te formuleren die meer transformatief van aard zijn (zoals in hun *Intended Nationally Determined*

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Contributions), en nadruk te leggen op de noodzaak van pluriforme toekomstbeelden. Het hoofdstuk eindigt daarom met een pleidooi voor het herzien van de dominante benadering van *anticipatory governance* omdat dit voortijdig toekomstige ontwikkelingen reduceert tot een technische invulling en de culturele, sociale en politieke diversiteit van toekomstbeelden dichtgooit. De effecten hiervan zijn mogelijk groter in die delen van de wereld die afhankelijk zijn van de invulling van een westerse *foresight*-industrie.

In het concluderende hoofdstuk, hoofdstuk 6, beantwoord ik vervolgens de onderzoeksvraag en reflecteer ik op de empirische en conceptuele bijdrage van het onderzoek aan de literatuur over *anticipatory governance* en aanverwante vakgebieden. Het hoofdstuk vat samen dat het proefschrift allereerst verschillende benaderingen van *anticipatory governance* uiteenzet op basis van de literatuur, en vervolgens de dominante dynamieken in de praktijk empirisch onderzoekt aan de hand van een groot aantal toekomstverkenningen in mondiale duurzaamheidscontexten en de implicaties daarvan bevraagt voor het realiseren van duurzaamheidstransformaties. De casussen laten zien dat de vier benaderingen zoals die geïdentificeerd zijn in de literatuur niet één-op-één overeenkomen met de praktijk, maar dat zij in hybride vorm voorkomen waarin sommige benaderingen domineren en andere benaderingen ondergeschikt raken in de vertaalslag naar acties voor het heden om deze toekomst te realiseren. De eerste benadering domineert, de tweede komt veel voor in combinatie met de eerste, de derde komt soms voor in combinatie met de twee voorafgaande benaderingen, en de vierde benadering komt niet of nauwelijks voor. De dominantie van de eerste benadering leidt ertoe dat duurzaamheidstransformaties, in bijvoorbeeld de landbouwsector, vaak worden gestuurd op basis van een technisch voorgestelde en apolitieke toekomst, waarin politiek tegenstrijdige belangen weinig ruimte krijgen. Dit is belangrijk omdat het inzicht geeft in de manieren waarop informatie en besluitvorming bepaalt welke sectoren, beroepen, groepen, interventies enzovoort geprioriteerd en gefinancierd worden andere gemarginaliseerd. Bovendien is er heel weinig ruimte voor de culturele, sociale en politieke diversiteit in toekomstbeelden die gebruikt worden om duurzaamheidstransformaties te sturen, terwijl wat wenselijk is voor de één maar wellicht onwenselijk voor de ander. Acties in het heden worden bij voorkeur bepaald op basis van expert-analyse en op consensus gebaseerde vormen van kennis waarbinnen wetenschappelijke onzekerheid weinig plek heeft en normatieve onzekerheid helemaal geen plek heeft. Dit lijkt niet alleen de voorkeur van beleidsmakers te zijn, maar ook denken *foresight practitioners* dat uitkomsten moeten passen in de huidige beleidskaders om opgepikt te worden.

Tot slot valt te concluderen dat een breed scala aan toekomstige mogelijkheden worden afgesloten door de huidige manier waarop toekomstverkenningen worden ingezet die

mogelijkerwijs tot een meer duurzame, democratische of gelijkwaardigere toekomst zouden kunnen leiden. De huidige manier waarop toekomstverkenningen gebruikt worden draagt niet voldoende bij aan de radicale, democratische en gelijkwaardige duurzaamheidstransformaties die nodig zijn om de klimaatdoelstellingen te halen en dienen daarom aangepast te worden. Het is bijvoorbeeld belangrijk om in het ontwerp van toekomstverkenningen machtsverhoudingen expliciet te maken en te bevragen hoe zij bepalend zijn voor het vormgeven en sturen van de toekomst. De vierde benadering biedt handvatten voor zulke reflecties, maar het onderzoek laat zien dat deze benadering juist het minst gebruikt wordt. Het onderzoek plaatst deze bevindingen bovendien in een belangrijke context, namelijk de dominantie van het mondiale Noorden op mondiale Zuiden. Er is steeds meer aandacht voor hoe kennis, instituties en normen deze afhankelijkheidsrelatie bestendigen en het is in dit licht juist belangrijk om de politieke onderhandeling over de toekomst expliciet te maken. Dit onderzoek draagt bij aan die discussie door aan het licht te brengen dat veel toekomstverkenningen pretenderen de toekomst te openen en deze democratischer en gelijkwaardiger te maken, maar in feite de toekomst voortijdig afsluiten langs bestaande beleidskaders die veelal door donoragenda's gedomineerd worden (door middel van hun kennis, financiële instrumenten en technologie). Meer onderzoek is nodig om te begrijpen welke toekomsten verbeeld en verdedigd worden en wiens toekomst daarmee beschermd wordt, zowel in het ontwerp van toekomstverkenningen als in de vertaalslag naar hedendaagse actie.

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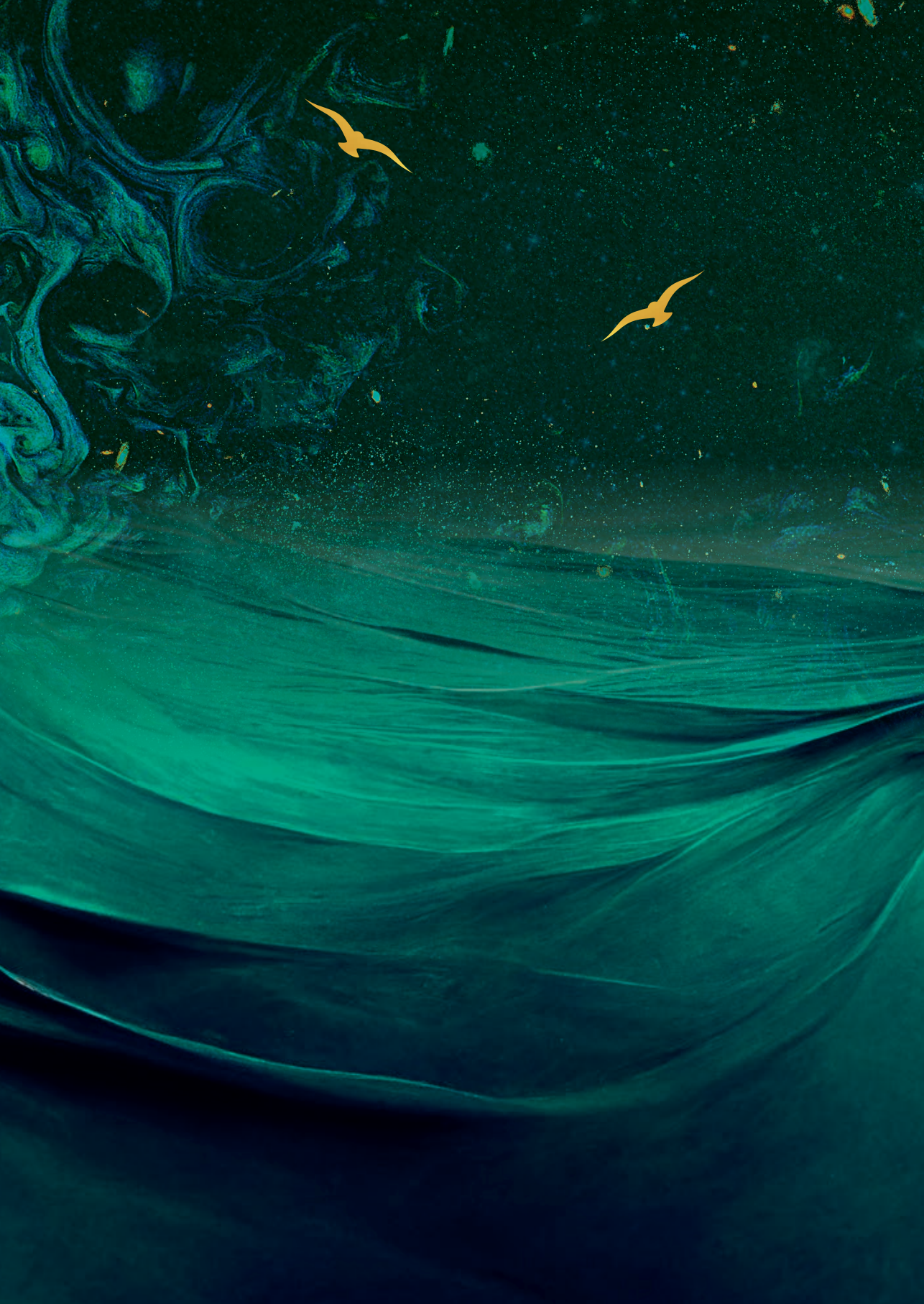
Curriculum Vitae

CURRICULUM VITAE

Academic positions

2017 – 2022   PhD researcher, Utrecht University

2018 – 2020   PhD researcher, Wageningen University & Research, Environmental Policy Group

Education

2011 – 2012   Master of Arts in Journalism, University of South-Wales

2009 – 2010   Master of Science in International Development Studies, University of Amsterdam

2005 – 2009   Bachelor of Science in Development Studies, Radboud University

Scholarship

2011   Scholarship for studying abroad, VSB fund

Presentations at conferences

Earth System Governance Conferences (2017 Lund, 2018 Utrecht, 2020 virtual, 2021 Bratislava and 2022 Toronto), Global Conference on Food Security (2017, Cape Town), Anticipation Conference (2017, London).

Teaching

Lecturer in the courses Politics of the Earth and Global Integration Project, guest lecturer in the course Research Design, and supervisor of two bachelor students and a master student (all Utrecht University). Guest lecturer in the courses Environmental Policy and International Environmental Politics (Wageningen University) and Global Environmental Governance (Rijksuniversiteit Groningen).

Short course training

Winterschool Earth System Governance (Earth System Governance Project) and courses on Research ethics and scientific integrity, Academic writing, and Academic presenting (all Graduate School, Utrecht University). Courses on Theory in Environmental Governance and Qualitative methods and mixed methods (both Wageningen University). Furthermore, I followed several French language courses (Volksuniversiteit and ILE International) and security training for working in fragile states.

Science-policy work
Public talks include a presentation on World Environment Day at BNP Paribas (London), several presentations on anticipatory governance for CCAFS, and a panel on West Africa at the Balie (Amsterdam). I moderated a panel at the Africa Day event of the Royal Tropical Institute (Amsterdam) and an event on local governance for D66 (Zoetermeer). I was also a member of a think tank of the Wiardi Beckman Stichting (the Hague).

Publications
Peer reviewed
- **Muiderman, K.,** Zurek, M., Hasnain, S., Vervoort, J., Gupta, A., Driessen, P. (2022) Anticipatory governance of sustainability transformations, *Global Environmental Change.*
- **Muiderman, K.,** Gupta, A., Vervoort, J.M. & Biermann, F. (2020) Four approaches to anticipatory governance: varying conceptions of the future and their implications for the present, (2022) *WIREs Climate Change.*
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- Rutting, L., Vervoort, J., Mees, H., Pereira, L., Veeger, M., **Muiderman, K.,** Mangnus, A., Winkler, K., Bottega Pergher, V., Olsson, P., Lane, R., Hichert, T., Christiaens, L., Bansal, N., Hendriks, A. & Driessen, P. (In press) Disruptive seeds: a scenarios approach to explore power shifts in sustainability transformations.

Book chapters
- Pereira, L., Vrettos, C., Cramer, L., Drimie, S., **Muiderman, K.,** Schapendonk, F., Stringer, L., Veeger, M., Vervoort, J. & Wamukoya, G. (2022) Policies and design processes to enable transformation. In: B. Campbell, P. Thornton, A.M. Loboguerrero, D. Dinesh & A. Nowak (eds.). *Transforming Food Systems Under Climate Change, Cambridge University Press.*
- **Muiderman, K.** (2017). De 'gelukszoekers': migranten uit West-Afrika. De zoektocht naar duurzaam migratiebeleid in mondiaal tijdperk. In: M. Sie Dhian Ho, R. Cuperus & A. Pilon (eds.). Over de Grens: de vluchtelingen crisis als reality test, 1st ed. Amsterdam: van Gennep.
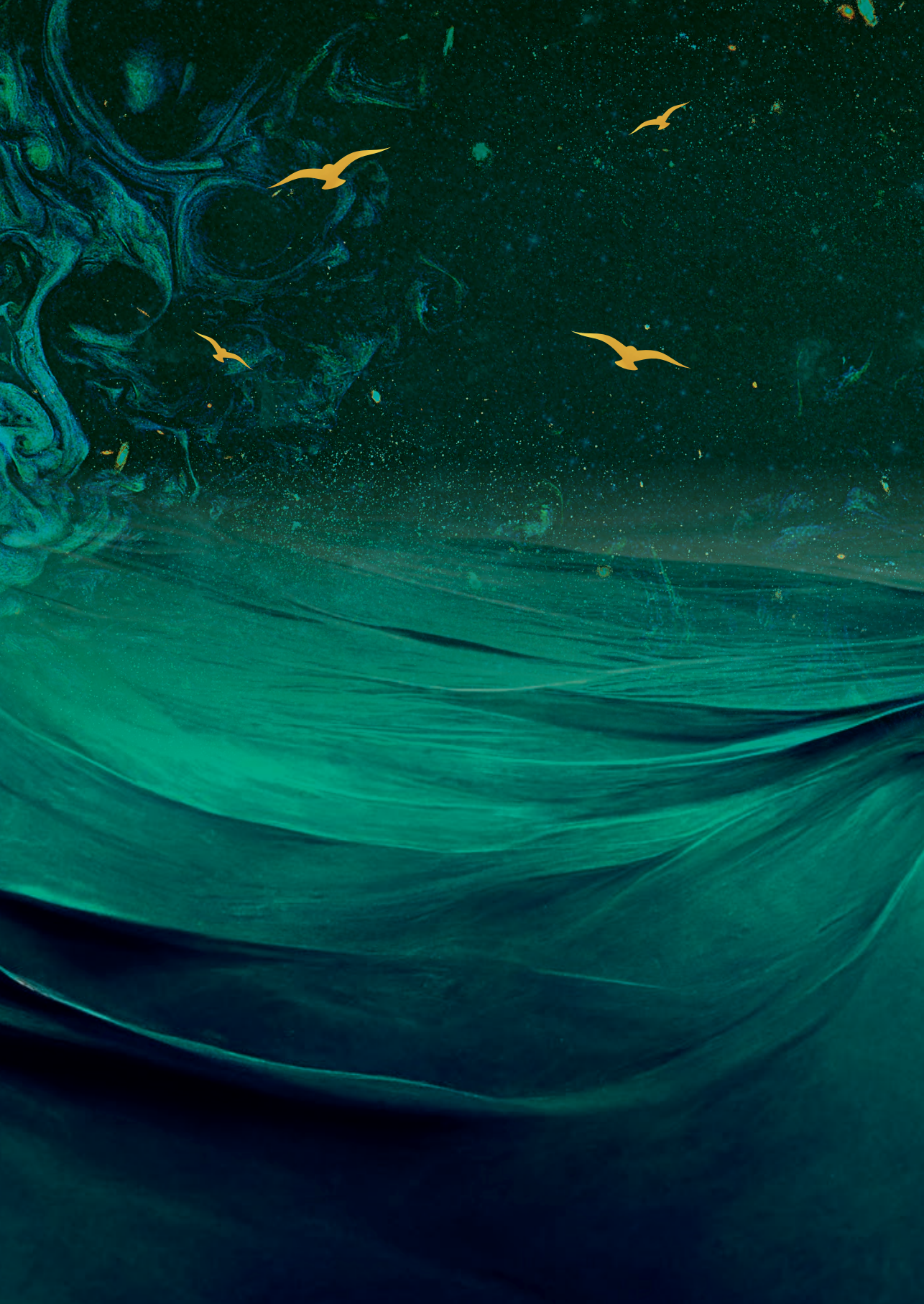
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The Copernicus Institute was a warm and inspiring place to conduct research and teach. I highly enjoyed the academic discussions within my own Environmental Governance group and the Innovation Studies group. Many colleagues also became friends. First, my paranymphs and roommates Astrid and Lucas. Lucas, thank you for kickstarting the adventure. Your jokes always made me laugh and lifted the mood. I still feel the Bern. Astrid, for our long talks, when we were too busy to chat. We connected on many levels, and I feel privileged that we were offered to take up a new job together and develop a critical futures project there. Copernicus road cycling buddies Robert, Floor, Frank, and Jarno, you were my first within-UU interdisciplinary activity. Writing this acknowledgment in the Vosges brings back memories of the 175 km Gran Fondo. It was great nearly dying there with you in the horrific weather. Floor, we had a baby around the same time which gave us another topic to chat about. Your incredible balance of academic work, a baby, two other kids, sports, and social life has been mind-blowing. Sandra, thank you for introducing me to the Earth System Governance early career network (where I met wonderful people like Carole-Anne, Karsten, Ina, Jennifer, and many more). This was an excellent platform to exchange ideas on research and research life. Lisette, Jeroen, Abe, and Irene, I very much enjoyed our futures book club meetings and discussing a set of books at length, it has enriched my research. Carole-Anne, thank you for your friendship et merci pour ton aide avec pratiquer mon français. Iris, for joining our little beer club to Jan Primus, we instantly connected. Kieran, for never believing how old I am and for reading parts of my work. And everyone who passed our little glass house in room 7.42 for a chat: Charlotte, Marjanneke, James, Abbie, Rak, and everyone else. Harmina and Ineke, thank you for answering all of my questions and helping me organize meetings in the busy agendas of my supervisors.

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embarking on a post PhD adventure. Pim and Ilana, for implanting this picture of your southern France swimming pool towards the end – I hope to visit you soon again.

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Many different approaches are used today to anticipate possible futures and to guide policies, strategies and actions in the present. But how is the future conceptualized in these anticipation processes, what are the impacts of this conceptualization on governance actions in the present, and what are the implications for realizing sustainability transformations? This thesis answers these questions by investigating the use of anticipation in diverse sustainability contexts across the globe through a new theoretical perspective.

The research finds that most foresight practitioners use hybrid approaches to anticipatory governance that connect probabilistic, plausibilistic and pluralistic conceptions of the future. However, despite this diversity of conceptions of the future, the resulting policies and strategies are formulated in a rather technocratic and prediction-oriented way. As such, ideas about a more fundamentally uncertain and contested future become subordinate to an anticipatory governance approach that seeks to plan the future and reduce risks. When foresight practitioners and policymakers ask participants to engage in a dialogue about the future, their visions are often fitted into existing policy frameworks without putting these frameworks as such into question. The effect of these dynamics is that fundamentally different futures are overlooked.

The thesis concludes that this closing down of the future may hinder the search for more radical transformations and may reassert the status quo. Furthermore, the global dominance of the technical approach to anticipation, often relying on western science, technologies, and funding, may push out culturally, socially, and politically diverse future worldviews.