

CLIMATE ADAPTATION AND PREPAREDNESS IN NORWAY: THIRD ORDER EFFECTS, SMALL-SCALE WICKEDNESS AND GOVERNANCE CAPACITY

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ABSTRACT

Referring to challenges of a global nature, climate change may well be a super-wicked problem. Climate change nevertheless poses local and regional challenges that public authorities must handle on a much smaller scale. In this article, the wicked characteristics of local climate adaptation and preparedness for climate-related events and the challenges posed for governance capacity are in focus. The analyses build on data about the activities of and interactions between municipalities and state agencies in adaptation and preparedness work in western Norway. The main findings are that a) public actors, through their actions and interactions, perspectives and experiences across sectors and governance levels, influence the degree to which climate adaptation and preparedness comes across as wicked. Thus, b) the presence and degree of a certain small-scale wickedness is potentially amplified by the involved actors, which in turn c) does pose challenges for governance capacity. The wicked characteristics of climate adaptation and preparedness, and the nature of capacity challenges, have properties of variability across temporal distinctions, spatial scales and governance levels that are contingent on organizational action and choice.

Keywords: *climate adaptation, governance capacity, preparedness, wicked problems*

INTRODUCTION

The climate in Norway is changing, leading to pronounced changes in climatic patterns (e.g. the amount and intensity of precipitation) and in the hazards posed by climate-related events, such as floods, severe storms, avalanches and landslides (Hanssen-Bauer et al. 2015). Climate-related events, anteceded by alterations in global climate dynamics, require organizational responses by public authorities. Such societal responses can be labelled *third order effects* of climate change. These effects are different from, but relate to, first order effects, understood as climate dynamics and variability (including anthropogenic influences). Second order effects refers to events influenced by the climate dynamics, e.g. floods, landslides. The societal measures taken to prepare for and adapt to

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such restricted climatic events remain spatial and specific but take place within larger policy frameworks that demand complex interaction between a diverse set of public organizations. National policies concerning climate adaptation in Norway have been modest in terms of strength and coherence (Dannevig and Aall 2015). Preparedness and societal security policies – which overlap adaptation policies – have been more specific and powerful in governing local actors (Rykkja 2017). Local authorities meet quite different demands when they interact with these two strings of policies.

Some consider climate change an archetypical case of wicked problems (Pollitt 2016). Its wickedness connects to how the physical characteristics of climate change intertwine with policy issues across scales and levels. Climate issues tend to lack a well-structured policy domain, knowledge is uncertain and sometimes contested (Termeer, Dewulf, and Breeman 2013). Thus, an important part of dealing with the effects of climate change has been for natural scientists to develop knowledge that caters to specific needs. These approaches often fail to incorporate the organizational and political specifics of climate adaptation and preparedness in concerns of governance, however (Kolstad et al. 2019).

Societal security, preparedness and crisis response have received considerable attention from public administration scholars, following disasters such as hurricane Katrina, the 2004 south-east Asian tsunami, numerous terrorist attacks and events of a more spatially restricted nature (Lægreid and Rykkja 2018; Rykkja 2017). One important theme is how crises are dealt with before, during and after they occur (Boin, t'Hart, Stern, and Sundelius 2005). Another is that crises are often transboundary: Crisis management crosses sectors and governance levels (Ansell, Boin and Keller 2010). In terms of climate-related research, public administration scholars were not among the first contributors (Pollitt 2015, 2016; Rykkja, Neby and Hope 2014). Likewise, organization theorists, political scientists and management researchers were also rather slow in responding to climate change issues (Goodall 2008; Winn, Kirchgeorg, Griffiths, Linnenluecke and Günther 2011). Reviewing the climate adaptation governance literature, Vink, Dewulf and Termeer (2013) state that “a large part of the CCAG¹ literature conceptualizes long-term policy making predominantly as a matter of ‘getting the system right,’ instead of understanding the interplaying processes of organizing knowledge and organizing support within those systems over time.” A merit of public administration is the supply of approaches for descriptive governance analyses, and the analyses contributes within such a framework.

This article focuses on how Norwegian public actors’ deal with climate adaptation and preparedness. Within the Norwegian policy framework, the municipalities have pivotal tasks but also interact with a number of state agencies, consultancy firms, research institutions and others to meet their responsibilities. An important question is whether these actors add complexity, uncertainty, divergence and fragmentation (Head 2008) to the mix, increasing the wickedness of climate adaptation. If this is the case, we need to look deeper into the challenges for handling the problem – in other words, whether

¹ CCAG: Climate change adaptation governance.

increased wickedness raises concerns for governance capacity. Thus, the article departs from the following two main questions:

1. Do local-level efforts to organize for climate adaptation and preparedness represent increased *small-scale wickedness* as a third order effect?
2. If so, and in the context of such wickedness, what are the issues raised for *governance capacity*?

The article reports from an aggregated set of six case studies of municipalities located in the heart of western Norway. I argue that there is indeed a presence of wickedness in the context of local climate adaptation and preparedness, but that this wickedness intertwines with factors relating to organizational actions, interactions and the rationales underpinning these. The degree of interconnectivity across levels and actors sometimes contributes to an ‘amplification’ of the wicked characteristics of local climate adaptation and preparedness issues. Although parts of this wickedness rests with the physical aspects of climate change, a third order effect is wickedness stemming from social and organizational influences on complexity, fragmentation, uncertainty and divergence. Wickedness poses barriers to establishing, sustaining and increasing governance capacity, contingent on variations in perceptions of and emphasis on different aspects of capacity among the involved actors.

The article’s structure is as follows: The next section outlines the analytical framework, followed by an account of the methodological approach and the data underpinning the study. Third, there is a presentation of the contextual specifics of the western Norwegian case. An introduction to the larger system of governance and the involved organizations marks the transition to the findings section. The findings section, fourth, presents and analyzes observations along a set of analytical expectations. Finally, a discussion section revisits the research questions, followed by a short conclusion.

ANALYTICAL FRAMEWORK: A THREE-STEP APPROACH

The analytical framework caters to three specific analytical needs. The first is to establish connections between the natural and societal phenomena under investigation by explicating the term third order effects. The second is to specify the wicked problems approach in order to assess the possible presence of a certain small-scale wickedness. The final is specifying an approach to governance capacity and suggesting a set of expectations.

Connecting nature and society: Third order effects

This study introduces the concept of *third order effects*, referring to how society functions in the face of climate change, and what happens when it does. These effects are distinguishable from first and second order effects. First order effects are the observable changes in the climate itself. They occur naturally, but anthropogenic factors influences climate dynamics considerably (IPCC 2014). Second order effects are specific climate-related hazards posed to society through the natural environment. Examples are floods, landslides, avalanches, sea-level rise and drought; i.e. climate-related *events* of varying

spatial scale and temporal pace. While the extent to which communities need to adapt relates to first order (anthropogenic) climate change and second order hazards (Klein, Schipper and Dessai 2005), actors experience, reflect, decide and act upon climate variations in societal contexts and through social constructs: organizational responses are essential. Perceptions of climate and climatic variability are parts of such constructs (Hulme, Dessai, Lorenzoni and Nelson 2009). The term third order effect thus connects the natural and physical consequences of climate change with the societal responses to them. Introducing the term is a response to calls in the literature for differentiating between nature and society while appreciating the complexity of their interrelation (Trickett 2019; Winn et al. 2011). In the natural climate sciences, the term is sometimes used to describe complex, non-linear and chaotic physical dynamics that depend on antecedent climatic conditions, e.g. by Lee, Hall and Meadowcroft (2001) and Burkett (2011).

Seeing political-administrative action for climate adaptation and preparedness helps delineating the intersection between physical and social phenomena: how the physical aspects of climate change, deliberately or more tacitly, becomes part of rationales for action. However, it also relates to the framing of climate issues as wicked, since such framing would indeed also be a third order effect. The following discussion of the possibility of a certain *small-scale wickedness* reflects these distinctions.

Describing the problem: Wickedness

Climate adaptation and preparedness center on societal planning, aligning well with Rittel and Webber's (1973) original focus on social policy planning. Some planning problems, they claimed, are harder to formulate and define than others, are not resolved, and are typically symptoms of other problems. Although the literature assesses the concept differently (Peters 2017), the contention is that wicked problems cause complex, incomplete, contradictory and dynamically interdependent problem-solving situations. Problem-solvers are in a squeeze between having to find solutions, and not being able to do so. Climate change as a policy field has been dubbed a 'super wicked issue' and even 'the ultimate wicked issue' (Pollitt 2016). Climate adaptation and preparedness is local, tangible and concrete, in some contrast to general policies for handling global first order climate change. That suggests a spatial and structural hierarchy to understanding climate-related wickedness, which influences the connection between actors and problems. As a problem manifests in spatial terms, so do levels of governance: when the problem is physically identifiable, actor participation and actions become more tangible.

Peters (2017) show how there is a difference between wicked issues and issues that are merely more difficult than others are. In real-life decision-making, even local climate issues are hard to classify based on notions of linear rationality (Sun and Yang 2016). This raises the question about how to observe small-scale wickedness. The distinction between complexity, divergence, fragmentation and uncertainty (Head 2008; Head and Alford 2015) as characteristics of wickedness is useful, since these terms do not presuppose a spatial scale or governance level *per se*. These terms explicitly connect to situations with multiple stakeholders, interests and values, institutional complexity and scientific uncertainty.

Complexity concerns the differences and interdependencies between actors' decisions and the consequences of these. Decision-making domains overlap and intersect, compete and diverge. Organizational actors are interconnected and mutually dependent: in some situations, no one actor has sole jurisdiction, knowledge, authority or resources to resolve problems. The actors thus rely on collaborators and competitors alike. Complexity reflects the systemic character of the field, e.g. the inter-dependencies of processes and structures, or perceived incommensurability of risks and tradeoffs. Head (2014) argues that complexity increases when the scales of proposed problems, solutions, and impacts are diverse. *Divergence* refers to whether the mandates distributed across the governance system are distending. Tasks and roles may be incoherent, conflicting or even contradictory. This causes tensions, differences in perspective, rationale or mode of operation. Based on different types of expertise, regulatory frameworks or other factors, problem definitions may diverge. This suggests overlap between complexity and divergence (Head and Alford 2015), in the sense that problem perceptions are likely to influence the choice of solution (Heifetz 1994). This study emphasizes identifying a) intersecting and/or mutually dependent decision domains, knowledge bases and resource pools, and b) differences in formal, expressed and perceived mandates associated with the involved institutional actors as indications of complexity and divergence, respectively.

Uncertainty refers to inaccuracies and insecurities concerning the effects of policies and policy measures and to variability in demands placed on the actors, whether substantive, strategic or institutional (Koppenjan and Klijn 2004). Uncertainty may characterize both the involved actors' assessments of policy challenges and the problem as such. It is difficult to know how to adapt to and prepare for the effects of a changing climate, as is the specification of first and second order effects. Uncertainty also characterizes decision-making: consensus, negotiations, prioritizations, participation etc. influence the nature and outcome of decision-making. As March (1994) claims, decision-making presumes the use of knowledge, but knowledge is a social construction subject to decision. Assessing uncertainty as a component of small-scale wickedness, the analysis looks for a) uncertainties in the scientific understanding of the involved actors' dilemmas, and for b) uncertainties in the decision-making for adaptation and preparedness.

Fragmentation refers to incoherence in the relationship between policy fields and their subdivisions, reflected in ambiguous delineations between organizations and between policy actions. For instance, although climate adaptation is a specific subset of climate policy, the definition of the term adaptation varies. Adaptation connects to preparedness, which crosses over to societal security. Using knowledge about local climate impacts relates to science. All of these relate to regulation and planning efforts stemming from both local and state level actors. Such variations of interconnected fragmentation accompany organizational solutions for handling them. Here, a) tensions between policy priorities and actors, identifiable by b) expressed concerns, overlapping or underlapping accountabilities and silo-oriented measures, indicate fragmentation.

Challenges: Governance capacity

A point made in thematic climate research is that a way out of the ‘mess’ of climate policies may be to establish long-term governance trajectories (beyond the salient political agenda) to restrict our future selves (Levin, Cashore, Bernstein and Auld 2012). A central concern is thus to grasp the interplay between organizational actors involved in establishing, working, developing and sustaining policy choices and implementation (Lodge and Wegrich 2014; Peters and Pierre 1998). Concepts of multi-level governance are important as organizations from different levels of governance directly and indirectly take part in local adaptation and preparedness efforts.

Governance capacity refers to whether single actors or a system can ‘get things done’ by enabling the rules of the game, connect and interlink discourses and provide necessary resources (Dang, Visseren-Hamakers and Arts 2016). Lodge and Wegrich (2014) distinguish between four main types of governance capacity. *Delivery capacity* refers to the provisions made to ensure delivery of services: allocations of resources, definitions of tasks and functions, allowing bureaucratic discretion, selecting ‘the tools for the job’, but also provisions of backup solutions and relieving the system from stressors that influence its ability to deliver services. *Regulatory capacity* refers to the ability to exercise control over the system and its parts, e.g. through monitoring, audits and accountability arrangements. Third, *coordination capacity* refers to the ability to bring different bodies together and align their efforts to achieve ends that extend beyond those of single actors in the system. This can involve both procedural and structural components, typically giving rise to secondary processes and structures that cut across the main organizational distinctions between the governance system’s constituent parts. Fourth, *analytical capacity* is about the involved actors’ abilities to develop, gather, assess and utilize knowledge and information relevant for their activities and mandates, including the organizational choices made to facilitate this.

Connecting wicked problems and governance capacity in a joint framework for discussing enables an interpretive scheme (Table 1). This forms the basis for the findings and discussion sections below.

Table 1: Interpretive framework – wickedness and governance capacity.

| | | Governance capacity dimensions | | | |
|--------------------------------------|---------------|--------------------------------|------------|--------------|------------|
| | | Delivery | Regulation | Coordination | Analytical |
| Dimensions of small-scale wickedness | Complexity | | | | |
| | Divergence | | | | |
| | Fragmentation | | | | |
| | Uncertainty | | | | |

The fusion of the two approaches allows the formulation of a set of expectations that guide the following the analysis:

- The degree of complexity is likely to influence delivery capacity, as complexity concerns the ability to handle interconnectivity and incommensurability when defining challenges, measures and desired outcomes.
- The degree of divergence is likely to influence regulation capacity, reflecting that the ability to delineate and shape mandates, value conflicts, and perceptions of such reflect the ability to regulate and distribute authority, accountability and competencies.
- The degree of fragmentation is likely to influence coordination capacity, since adaptation and preparedness sorts under a variety of different policy fields and institutional domains.
- The degree of uncertainty is likely to influence analytical capacities, reflecting variation in measures taken to ensure access to, existence and use of knowledge.

METHODS AND RESEARCH DESIGN

The empirical material that underpins this article stems from, firstly, a portfolio of research projects that focus on local climate adaptation and, secondly, from a project that examines coordination and capacity issues at the central level.² The former projects include six case studies of climate adaptation and preparedness issues in western Norwegian municipalities located within the geographical boundaries of the Hordaland County. The case studies were explorative, covering a range of decision-making issues. A premise for the studies was to grasp the phenomena of interest in the contexts that they occur, aiming for depth and richness in documenting actors' experiences of climate adaptation and preparedness, as well as how they view the relationships and interactions between different actors in the field. The forthcoming analysis report, illustrate and exemplify analytical points from the aggregated set of cases. It does not follow event-based descriptions or certain timelines: the study's design and, consequently, the article's structure centers on the analytical framework.

Background data consists of documents gathered from all relevant governance levels (plans, strategies, white and green papers, minutes, reports, etc.). The article also draws on a mapping of the complete Norwegian climate governance structure, based on the Norwegian state administration database, public documents, laws and regulation, as well as information from websites etc. The main empirical basis is a set of saturated

² Project and funding information: HordaKlim 2015-2018 funded by Regional Research Fund West (RFF Vest), project no. 245403, HordaPlan 2017-2018, funded by RFF Vest, project no. 260037, R3: Relevant, reliable and robust local-scale climate projections for Norway, funded by the Research Council of Norway (RCN) under the program KLIMAFORSK, project no. 255397, and COCAL: Coordination, capacity and legitimacy: organizing for climate, immigration and the police, funded by RCN under the program DEMOS, project no. 255359.

conversational data that originates from both single informant and group interviews, workshops and field level observations. Informants come from the six municipalities, the county, the county governor's office, and three state agencies. In all, the dataset contains rich and various, open and semi-structured qualitative data from 52 informants. The study also uses data collected through workshop sessions and on-site field visits. Field notes served as documentation of these. Data collection took place from 2015 to 2018. The benefits of collecting data over such an extended period include securing information about different decision-making processes across the municipalities. A temporally small window of observation would restrict our insight in the interplay between actors and into the different challenges that municipalities face, e.g. as rotation of plans and the political agenda varies between them.

Finally, the article exploits a dataset collected as part of an experimental approach that set local adaptation decision-makers, knowledge providers and other actors together to suggest solutions to simulated adaptation challenges through group work, over two full working days (klimathon2018). Twelve groups with 4-6 participants submitted their working notes and a summary, a final presentation, and a short survey after the two-day session. A description of the klimathon method and a summary of the results from the 2018 event is available in an open access report (Kvamsås and Stiller-Reeve 2018). The interviews, fieldwork and group discussions took place between fall 2015 and spring 2018, the experimental workshop in January 2018.

CLIMATE ADAPTATION AND PREPAREDNESS IN WESTERN NORWAY

Compared to the standard normal period (1961-1990), average annual precipitation in western Norway is now around 14% higher (Hanssen-Bauer et al., 2015). The number and patterns of rain floods, unseasonable snowmelt, wastewater challenges, landslides and other water-related events are changing (Lawrence 2016; Vormoor, Lawrence, Schlichting, Wilson and Wong 2016). Local geographic variations within Hordaland County greatly influence the municipalities' adaptation challenges: large fjord systems penetrate the entire area; high mountains and glacial terrain leave relatively small areas for inhabitation in some areas. Elsewhere there are lower-altitude forested areas, wider valleys, and river systems of varying complexity. The mountainous areas between the coast and the eastern valleys receive almost twice as much precipitation as the eastern- and westernmost areas. The municipalities included range from small and medium-sized inland municipalities (between appr. 8,000 and 15,000 inhabitants) to a larger coastal city (280,000 inhabitants).

Climate adaptation and preparedness are mainly local responsibilities, although implemented in a multi-level governance setting. The system has two autonomous democratic tiers: the national state level, and the regional/municipal level. Central policies cut across these levels as well as across regulatory domains and administrative silos. Several state agencies are involved in climate adaptation and preparedness (see Table 2).

Here, focus is set on four state-level actors, based on the municipal actors' descriptions of their interaction with them: the Directorate for Societal Security and Preparedness' (DSB) is responsible for risk assessments and regulations for crisis management. DSB sorts under the Ministry of Justice and Public Security, and administers the Civil Protection Act. An important part of the DSB's work is ensuring that municipalities utilize vulnerability assessments (VAs).

Table 2: Governance level, actor, actions and roles

| Level | Type | Actor | Typical actions | Typical role |
|---------------|------------------|--|---|--|
| State | Ministries | Ministry of climate and the environment, Ministry of local government and modernization, Ministry of oil and energy, Ministry of justice and public security | Policy formulation, financing, task specifications | Political, regulative, executive |
| | Agencies | The Environment Agency (Miljødir), The Water Resources and Energy Directorate (NVE), The Directorate for Civil Protection (DSB), The Building Authority (DiBK), The Mapping Authority (Statkart), The Geological Survey (NGU), The Meteorological Institute (Met), Food Safety Authority (Mattilsynet) | Specific regulation, advice, knowledge provision, specific grants | Regulative, professional |
| | County governors | Fylkesmannen i Hordaland | Audit, advice, facilitator | Regulative |
| Region | Counties | Hordaland fylke | Advice, facilitator, regional planning | Mid-level facilitator, regional services |
| Local | Municipalities | Voss, Odda, Osterøy, Kvam, Kvinnherad, Bergen | Local policies, planning, service production, adaptation decisions, Actual measures | Democratic, administrative, executive, service provision |

The Norwegian Water Resources and Energy Directorate (NVE) provides knowledge and regulations connected to hydroelectricity, waterways, floods, slides and avalanches, and engages in funding, regulation, advisory activities, and research. NVE also contributes to field-level operational work, and sorts under the Ministry of Petroleum and Energy. The Norwegian Environment Agency (Miljødir), sorting under the Ministry of Climate and the Environment, has central policy tasks for climate adaptation. Miljødir has the central coordination responsibility for the policy field. The County governor is the state's regional representative, has audit and appeal responsibilities towards local authorities and provides a link between governance levels.

In addition, the County government is also important. It is the regional democratic governance level, and has autonomous policy-making capabilities. The county, in this case Hordaland, produces decisions within its own jurisdiction, but also works as a facilitator for municipalities to share experiences, develop joint contributions to regional development, to improve quality and capacity in planning issues.

The interface between concerns of adaptation and preparedness is difficult to delineate. For instance, the Planning and Building Code and the Civil Protection Act are the foremost regulative frameworks for climate adaptation and preparedness, respectively. The first emphasizes spatial and societal planning, whereas the second establishes local preparedness as a formal municipal duty. Although Norwegian municipalities are rather autonomous, they rely on national level support and guidance, regulation, resources and policy priorities through the state agencies. The four principles for handling preparedness issues, stated explicitly in steering documents, are important (Christensen, Lægred and Rykkja 2013; Rykkja 2017). The liability principle states that responsibilities resting with a public entity under normal circumstances should remain in the event of a crisis. The decentralization principle entails crisis management at the lowest possible operational level. The conformity principle demands that organizational solutions during crises should resemble the 'standard organization' as much as possible. Finally, a principle of collaboration require involved authorities to facilitate collaborative efforts.

Small-scale wickedness and governance capacity

The six municipalities and the involved agencies examined in this study take their climate adaptation and preparedness work seriously, which the data clearly indicate. However, they do this in different ways, with different perspectives and knowledge, and across a range of challenges, mandates and interactions.

Complexity and delivery capacity

Much adaptation and preparedness work is quite technical, tackling physical phenomena in concrete and tangible ways, involving engineering-type solutions, countering the original wicked problem approach from Rittel and Webber (1973). Examples are regulating the water flow in rivers, upgrading infrastructure, or regulating construction in hazardous locations. Such efforts connect to overall plans, however, and to the framing and understanding of the problem. For instance, both Odda and Voss experienced major

floods during the fall of 2014. In Odda, the river Opo ripped through central parts of the town, leaving neighborhoods and infrastructure severely damaged. In Voss, the lake Vangsvatnet flooded well above the 200-year flood estimate. In retrospect, the NVE adjusted the 200-year flood thresholds for Vangsvatnet, with direct consequences for local planning and construction permits. In the two municipalities, references to climate adaptation and preparedness were quite different. For Voss, an important discussion centered on previous assessments of the lake's potential for flooding and how climate risk was included in past analyses provided by the NVE. The discussion partly focused on the problem of not being able to specify solutions for a problem of unknown magnitude. In Odda, the discussion turned towards securing the river and repairing the damages, with little reference to climate change. Rather, the focus was technical and one-off: finding technical solutions and financing them. The local Odda actors highlighted the NVE's role for funding, but less so for climate scenario-based assessments of water flow and upstream basin capacities. It seems that the actors involved in Voss more readily viewed the problem as a 'climate problem' than in Odda, where it was framed as a security and preparedness issue.

In Osterøy, the personal engagement in climate issues of a small group of planners was important for a more holistic approach to climate change with direct references to general planning. The planners actively searched for avenues to increase their knowledge of climate change and its impacts (first and second order effects), for instance considering how extreme precipitation events could cause landslides threatening infrastructure and fish farming facilities, in turn influencing the natural biological diversity of the local fjord system, and so on. These issues embed in a holistic, ecosystem-oriented approach to municipal planning.

In all these examples, a recurring theme was local climatic variation. Difficulties with predicting how precipitation patterns (first order) influences climate-related events (second order) was important in all three municipalities. However, as the framing of climate hazards differed between them, both the process of finding solutions and the final options differed: for Odda, the problem was to deliver technical solutions to a preparedness problem, for which it relied on the NVE. For Voss, the problem was to delineate what floods could be under future climate variability, which implied revisiting the estimates, mapping and scenarios used for previous decisions. That also means interacting with a more diverse set of actors – researchers, consultants, agencies. For Osterøy, climate adaptation was part of a larger adaptive, continuous process. In contrast to Osterøy and Voss, Odda at this time did *not* have a thematic municipal plan for climate issues, indicating that climate issues were not particularly salient.

The examples show that choices, as much as the problem, influences wickedness. When the problem is 'boxed in' and narrowed down, as in the Odda case, solutions appear more available to decision-makers. Opening the box, however, creates uncertainties about what the problem is, how to assess and resolve it. The Osterøy case shows that in spite of competent actors and knowledge-intensive processes, the 'climate problem' *per se* may come across as ambiguous and vague. This is also visible in the actors' 'deliverables': in Odda, deliverables were of physical character, in Voss it concerned the analytical quality of local regulations, and the Osterøy reflected perceptions of climate issues as integral

parts of societal planning. The relative wickedness in terms of complexity seems marked by a tension between an event-based preparedness logic and a more ambiguous discourse about climate dynamics and variability. While it may be possible to reduce complexity as a matter of choice, the trade-off is that blind spots may occur. There are demands for delivery capacity to cover these blind spots as well.

Divergence and regulation capacity

A different issue is whether attempts to secure governance capacity challenge the principles supposed to underpin the field of preparedness – the principles of liability, decentralization, conformity and coordination. These principles can be interpreted as guidelines for dealing with wickedness as they state responsibilities according to existing organizational boundaries (liability), proximity to the problem at hand (decentralization), adherence to existing and well-known procedures (conformity) and stressing joint efforts (coordination).

An issue with these principles is temporality. They focus on organizing for events of limited duration, and less towards long-term planning, developing knowledge, and working the governance system. Over time, the uncertainty associated with climate variability may create more room to deviate or navigate away from these principles. A consistent impression from all six cases is that the municipalities would like ‘more’ from the state agencies. Apart from resources, this revolves around two issues. The first is managing differences in how the state agencies approach municipal responsibilities. For instance, in Kvam, a municipal employee working with water supply vented concerns about the quality of drinking water as precipitation patterns change. Part of that frustration was not having a knowledge provider that could help establish connections between climate-related dynamics and drinking water quality. The state agency involved, Mattilsynet, is primarily an audit agency, which means that the municipality itself would develop much of the actual measures to secure water supply under a changing climate. From the DSB’s point of view, this is a matter to be included in VAs. From the NVE’s side, drinking water supply is a less central concern, in spite other responsibilities for waterways and water management. For the Kvam water manager’s perspective, the concern was that he experienced a long-term need to consult an external agency while remaining loyal to agency-specific regulations and policies of shorter duration. His responsibilities fell between distending agency mandates and temporal limitations, in part because of a fragmented administrative system. Asking for advice became difficult, as the approaches represented by the agencies did not really match his needs.

Secondly, and related to this, as adaptation and preparedness responsibilities spread out across agencies, accountabilities become ambiguous. Whereas municipal responsibilities are relatively clear, and agencies generally can emphasize municipal accountability in a top-down manner, the direction of accountability does not move as easily from the bottom and up. Agency responsibilities are often more general and abstract, causing an asymmetric distribution of mandates and perceptions of these. This is clearly an issue of divergence: it seems that a lack of holistic approaches manifests in the pluralistic and polycentric character of climate adaptation and preparedness governance in Norway. The difficulties some municipal actors experience in navigating the landscape of state

agencies may be an indication of a regulatory challenge stemming from the national level, manifesting in local settings. An effect of this may be that climate adaptation becomes characterized by what Dannevig and Aall (2015) defines as boundary work: navigating and mediating mandates and expectations by seeking common ground and clear distinctions, where these are lacking.

Fragmentation and coordination capacity

An increasingly important aspect of climate adaptation is dialogue. A current buzzword is ‘co-production’, based on the premise that climate-related challenges are too complex for one actor or one sector to solve on their own (Bremer and Meisch 2017). Administrative actors can provide input to scientific communities and agencies can adopt their practices to the needs of local actors: competence and capacity supposedly increases through sharing of insight, and clarifying the role distribution and contents of the larger governance system. Local considerations, whether stemming from confined climatic issues or from access to competence, resources or politics, are seldom part of the deliberations. Westskog, Hovelsrud and Sundqvist (2017) argue that national agencies do not fully recognize such issues, and therefore do not understand municipal needs. Considerations made by one actor to safeguard, develop or sustain its own governance capacity may directly intervene with another’s attempt to do the same. This relates to fragmentation, in the sense that particularized policy concerns become the domains of individual actors. Seen from the local level, this creates competing concerns and ambiguous governance relations that counters the relative clarity of policy instruments such as VAs.

To illustrate, the DSB focuses on format and procedural demands in their preparedness policies towards municipalities. In contrast, the NVE contributes more actively to the substantial contents of adaptation deliberations. Municipalities have knowledge needs that neither agency can provide, however. In turn, science communities and regional actors engage in developing knowledge and attempting to increase its usability – often through networked arrangements. Science communities have lacked an understanding of what it takes to make knowledge usable, municipalities have lacked insight into what is scientifically possible, and the regional actors have lacked a clear mandate and jurisdiction (Kolstad et al. 2019). Adding to this, local politicians may interfere with planning processes, as they mediate interests and prioritize within and across sectors that influence adaptation progress. A finding based on the klimathon, is that difficulties in attracting and sustaining political interest in adaptation and preparedness issues was a reoccurring theme among the participants (Kvamsås and Stiller-Reeve 2018).

This often results in the establishment of secondary structures that cut across formal policy aims and organizational distinctions. Networks of different kinds is the typical solution: Bergen, for instance, has a highly competent and large group of people working with water management. They actively take part in and initiate large-scale projects (e.g. EU research and innovation projects) that increase fragmentation by adding coordination issues to the municipal agenda. The efforts taken by the Hordaland County to gather municipalities, knowledge producers and agencies in networked collaborations also reflect this. Typically, as these collaborations are relatively informal, actors with

resources and competencies – such as the Bergen water departments, regional-level planners and researchers – play an important role for agenda setting and focus. Hence, in spite of a general willingness to participate, certain conflicts comes to show: scientific advice sometimes counter state policies, regional priorities do not always match local needs, small municipalities are under some circumstances less able to contribute than the larger ones, and so on. In one meeting, a planner from a small municipality explicitly stated that in her situation, networks disturbed the working routine and altered the agenda, and complicated relationships to agencies and regional actors simply by providing too much information. However, most participants in these networked arrangements report that these are useful, highlighting the development of actionable knowledge and system navigation skills.

Uncertainty and analytical capacity

These collaborative efforts directly relate to the intersection between analytical and delivery capacity: when the complexity of either analytical tasks or service production increases, one is likely to influence the other. The Plan and Building Code require municipalities to plan based on knowledge. Knowledge, however, comes in a variety of types and from a diverse set of actors. It is not always evident for the municipalities whether researchers produce applicable knowledge, and even less evident how such knowledge could be made actionable. A reason is regulatory demands for certain types of information to come from specific actors. By example, the NVE delivers authoritative information about hydrological models, water flow estimates, calculations of flood lines and flood size. This information is geographically oriented and plotted in maps used for planning purposes. How a changing climate may influence these calculations, even in the near future, is seldom a topic of deliberation in interaction with local actors, however. This may lead local actors to view first order climate change as a peripheral factor, driving uncertainty. As a senior wastewater manager in Bergen stressed several times: “We’re even having trouble adapting to the current climate.” The implication is that including trajectories for future climate change increases the uncertainty involved in planning for an already complex problem – notwithstanding a very distant temporal horizon for their planning efforts (for some infrastructure aspects, a century).

Another problematic issue is risk and vulnerability assessments (VAs). Municipalities use VAs in a variety of settings, from overall assessments to risk handling in single measures taken in specific locations. VAs are important for identifying and analyzing preparedness needs, and the DSB emphasize them heavily. This comes with a cost. From the municipal actors’ point of view, the DSB comes across as a regulatory agency (in the hierarchical sense). That suggests – as explicitly stated by DSB representatives on several observed occasions – that if municipal actors follow the right, standardized VA guidelines, the municipality have met the requirements and “all systems are go”. A concern, thus, is uncertainty related to the connection between first order climate change and, ultimately, third order societal response. For instance, global models of precipitation patterns have a very coarse resolution, leading to inaccuracy in modelling of future precipitation in regional and local settings. Actors in western Norway know from experience and observation that such patterns vary greatly over short distances. By example, the entire

Hordaland County, including all six municipalities from this study, is effectively a single grid in global models. Within the county, however, annual precipitation varies from around 1200 mm along the coast and in the eastern valleys, to over 3500 mm in some of the semi-coastal, mountainous areas. At the same time, the NVE recommends adding a standard margin of 20-40 % to calculations for shorter periods with intense precipitation. This has direct consequences for spatial planning at the local level: it means more land becomes restricted for societal development, and that a larger portion of existing infrastructure is included in high-risk areas. All this feed into VA processes. The use of VAs thus becomes a procedural formatting of knowledge, which implies mediation and translation of knowledge into premises for local decisions. VA processes also involve dialogue with subsets of actors, including agencies. The agencies NVE and DSB differ: where the DSB stresses the formal procedural aspects of VAs, the NVE to a larger extent deals with knowledge content. For the municipalities, this contributes to a dilemma between satisfying regulatory demands and emphasizing (development of) knowledge. This illustrates how regulatory concerns stemming from principal agencies influence local approaches to analytical capacity, simultaneously reflecting complexity and uncertainty.

In some contrast, VAs are also instruments to reduce wickedness: they provide templates for procedure, content and action. They establish rules or guidelines for municipal considerations of the what, how and why of climate adaptation and preparedness. That means VAs may provide the baseline for strategies, but do not resolve the problems as such. Different from the DSB and the NVE, the county and the county governor often focus on bringing actors together to increase the quality of decision-making. They emphasize coordination capacity by stimulating network solutions and cross-level discourse. In fact, all relevant actors state that different types of collaboration are positive assets for adaptation and preparedness.

DISCUSSION: SMALL-SCALE WICKEDNESS, CAPACITY PROBLEMS, OR BOTH?

The empirical section of the article shows that the two research questions are interrelated. In adaptation processes that include state, regional and local public actors, issues of governance capacity indeed arise from situations characterized by *some degree* of wickedness. The observations from the municipalities suggest two things: one element of wickedness is about the natural phenomena in question – the first and second order effects – and achieving operational certainty about the likelihood of specific developments, scenarios or events. A different element of wickedness is about how actors themselves attempt to handle climate adaptation and preparedness – the third order effect. This relative wickedness is less predictable: in some situations (as experienced by local actors), decisions to interpret, frame and delineate the challenges in particular ways reduce wickedness. In other situations, the same actors' reported experiences suggest that complexity, divergence, fragmentation and uncertainty pose significant challenges.

Arguably, small-scale wickedness thus straddles a) the problems of first and second order effects, and b) working out the societal response to these. In the experience of the involved actors, third order effects do not necessarily reflect wickedness just because capacity

challenges are present. These challenges may just as well associate with difficulties in establishing and sustaining governance capacity. Based on Lodge and Wegrich's (2014) distinctions, there are challenges concerning all four types of capacity – analysis, delivery, regulation, and coordination. The challenges do not distribute evenly across the cases, however. Also, capacity challenges may come in variants that are not discussed here, resembling scholarly discussions about the nature of governance capacity: quality (Rothstein and Teorell 2008), bureaucratic organization (Evans and Rauch 1999), or the power needed to produce effective decisions (Fukuyama 2013).

There is considerable uncertainty associated with climate knowledge. Current scientific approaches have difficulties with providing actionable knowledge for decision-makers. This is in part due to local variations that are hard to predict and model, and in part due to expectations to the level of precision provided by analyses of climate change in local settings. An observation is that municipal actors tend to look for quantifiable knowledge. A problem with striving for such measurability is that it strains the format of the involved actors' work: deliberative processes and networked arrangements are 'fuzzier' than the measurability the actor's desire. How actors frame and delineate challenges is thus important to understand the relative degree of wickedness associated with third order effects. This, however, is an area where many actors see a workable way towards improvements. By engaging in co-production processes that involve a relatively complex and fragmented set of actors with diverging mandates, the actors increase their analytical capacity, but also contribute to the wicked problem.

The organizational landscape is complex, diverging and fragmented, even when the level of analyses is restricted to local climate adaptation and preparedness. The degree of wickedness seems contingent on the coupling of problems, actors, solutions and decision-making opportunities. These are dimensions highlighted by Cohen, March and Olsen (1972), describing an organized anarchy of decision-making in their 'garbage can model'. The relevant analogy here is that participants have a certain influence over how chaotic climate adaptation and preparedness is. By that, I suggest that although local climate adaptation and preparedness involves problems of complexity, divergence, fragmentation and uncertainty, the degree to which this represents a particular small-scale wickedness varies with organizational choices. Although the problems stemming from first and second order effects of climate variability may be wicked, conclusions of whether wickedness is a third order effect depends on the involved actors: if we ask the actors in the field, their answers vary with approaches and perceptions of the very issue of climate change. The social aspects of wickedness add on to this, and have a potential to "amplify" complexity, divergence, fragmentation and uncertainty. Such amplifications, moreover, are likely to raise issues of governance capacity.

Importantly, the actors do not make these choices to influence the degree of wickedness, but rather to ensure governance capacity. As with wickedness, however, there is a tendency that the involved actors frame and perceive governance capacity challenges differently. This is visible in e.g. the 'technification' of adaptation and preparedness issues in some municipalities, or in how different state agencies emphasize their own deliverables over issues that require a broader perspective. An underlying aspect is also that the salience of adaptation and preparedness varies with experience: by example, large

floods elevates climate adaptation issues on the political-administrative agenda, as audits and inspections of local actors' preparedness work may also do. Thus, capacity issues are subject to a shifting temporality and spatiality: what is important at one point in time comes across as less central at other times; what is important for one actor is less central to another.

The municipalities that were part of this study stress loyalty towards formal tasks and responsibilities, in the sense that they see regulatory demands as important to their efforts. While this is promising in terms of securing instrumental capacity from the perspectives of principal agencies, the principals seldom take into consideration that capacity problems come in a variety of types. This may cloud some of the considerations that involved actors build their efforts on, e.g. when municipalities search for improved knowledge to increase their ability to perform – while the agencies involved stress formal regulative demands. Studying these types of interactions – in ranges between formal and informal, regulative and normative, understanding and decision, discretion and standardization – suggest that there is still much to learn from perspectives focusing on the organizational action and interaction (e.g. Scott 2013, Powell and DiMaggio 1983).

CONCLUSIONS

In conclusion, there are two related points to make. The first is that a certain degree of wickedness is indeed present. Municipalities, agencies and others contribute to this wickedness, and sometimes end up amplifying their own experiences of climate adaptation and preparedness as particularly difficult. Such wickedness is a third order effect: the social dynamics involved in adaptation and preparedness contribute to increasing difficulties. It is nevertheless wise to avoid a categorical statement that climate adaptation and preparedness is so wicked: 'Third order wickedness', it seems, is contingent on perceptions, interactions, organizational choices and decisions. That suggests that it is also possible to reduce this wickedness, since these factors arise from social interactions.

The second point is that this wickedness influences challenges of governance capacity. As is the case for the degree of wickedness, the degree to which capacity issues arise, depends on how the actors attempt to solve them. However, a high degree of fragmentation correlates with substantial coordination challenges, and efforts to improve analytical capacity involves dealing with uncertainty and coordination. Analytical and coordination capacity thus reflect the relative degree of divergence, fragmentation and uncertainty. Complexity, finally, is certainly difficult to handle, but the municipal actors often have options of reducing wickedness through 'technification' or by allowing collaborative and networked organizational solutions that disperse responsibilities and accountabilities. Thus, they find ways to *handle* adaptation and preparedness problems in terms of delivery capacity – but do not necessarily solve them. How this happens is a

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matter of social and organizational action and choice, which means that, just as the climate itself, third order effects have their own process- and structure-pending properties of variability.

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