Adaptation Confusion? A Longitudinal Examination of the Concept "Climate Change Adaptation" in Norwegian Municipal Surveys

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ABSTRACT: In recent decades there has been a surge in the scholarship on climate change adaptation (CCA) terminology, and diverging interpretations of the term have emerged. Given the crucial role of local governments in building societywide adaptive capacity, understanding how municipalities understand and interpret CCA is important. In this study, we analyze 12 large-scale questionnaires from 2007 to 2020 distributed to all Norwegian municipalities. Using a combination of directed and conventional content analysis of the questions and answers, we summarize and map the progress of adaptation work over the 14 years and assess the consistency and the scope of the surveys in light of the current research on climate adaptation. We find diverging views on what adaptation entails, both from the researchers, in the phrasing of questions, and from the respondents. The empirical evidence suggests an overall imbalanced interpretation of CCA, in terms of the risks and consequences we may face, the climate to which adapting is needed, and adequate adaptation strategies. We go on to discuss the implications of these findings, highlighting the need for a shared and well-communicated framework for local CCA and a closer monitoring of the actual efforts of the municipalities. If instead left unchecked, this confusion might lead to unsustainable maladaptation at the local government level throughout Norway and beyond.

KEYWORDS: Social science; Adaptation; Planning; Policy; Local effects; Vulnerability; Societal impacts

1. Introduction

In many countries, including Norway, a crucial role in adapting society to climate change has fallen to the local level of government (Dannevig et al. 2012; IPCC 2014b; Porter et al. 2015). As the principal spatial planners, local governments are strategically positioned to deliver climate change adaptation (CCA) strategies devised from above and in coordinating bottom-up action (Dannevig and Aall 2015; Porter et al. 2015). In a Norwegian context, the emphasis has traditionally been on preparedness for, and mitigation of, natural hazard risk (Aall et al. 2018). Gradually, the role has evolved and expanded, from CCA being a voluntary undertaking at the local level, to a requirement for several municipal activities. Changes in the planning and building legislation have made it mandatory to include consequences of climate change, such as rising sea levels and changes in river flood regimes, into account in municipal spatial planning and mapping of natural hazards (Aall et al. 2018; Dannevig and Aall 2015). Furthermore, the municipality must be restrictive of development in risk-prone areas and ensure that new buildings and constructions are adapted to a changing climate (Aall et al. 2018). The municipalities are also required to carry out risk and vulnerability assessments that include both existing and future consequences of climate change (Aall et al. 2018; Ministry of Environment 2013).

Similar to the gradual expansion of the municipal CCA mandate, the term itself has also been in constant development. In IPCCs assessment reports, CCA was not introduced until the 1996 Second Assessment Report, where it was sparsely discussed as a response to impacts of climate change (Bassett and Fogelman 2013; IPCC 1996). In the Third and Fourth Assessment Reports, CCA was given greater attention (Bassett and Fogelman 2013; Watson et al. 2001; IPCC 2007). In these reports, CCA is linked to a broader understanding of vulnerability. The reports recognize, for example, that other drivers than climate change can impact a population's vulnerability to the effects of climate change, albeit without much elaboration (Bassett and Fogelman 2013). In the Fifth Assessment Report, six chapters were dedicated to CCA. It was defined as the "process of adjustment to actual or expected climate and its effects" (IPCC 2014b, p. 5). The concept of vulnerability was largely expanded and defined as the "propensity or predisposition to be adversely affected" and further elaborated as a "variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt" (IPCC 2014b, p. 5). This reflected the upscaled effort in scholarship during the period (Bassett and Fogelman 2013). A "variety of concepts and elements" had indeed emerged. Among them, was the gradual shift, in one part of the literature, from the narrow, impact-driven interpretation of CCA toward the social, economic, and political

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context of vulnerability (Eriksen et al. 2015; Robinson 2020). Yet, much research on climate change has continued "to situate vulnerability within analyses of *climate*, rather than in *societies* and *political economies*" (Eriksen et al. 2015).

The ongoing conceptualization and corresponding debate have culminated into three overarching interpretations of CCA, which Pelling et al. (2015) calls resistance, incremental adjustments, and transformation. Pelling et al. (2015) defines resistance as "measures taken to preserve stability and resist the drivers of hazard and vulnerability," incremental adjustments as "adjustments that preserve systems integrity when conditions change," and transformation as "measures that challenge the stability of current systems." Proponents of the transformation strategy argue that as the challenges with social and environmental sustainability lie within the very structures of the present economic and power system, a radical transformation is imperative to achieve real sustainable development (Hopwood et al. 2005). In short, CCA means "different things to different people" (Bassett and Fogelman 2013) and "what is seen as positive adaptation to one group of people may be seen as maladaptation to another" (Eriksen et al. 2015).

In this paper, we see the development of CCA efforts in Norwegian municipalities in relation to the development of the term itself. Based on data from 12 CCA surveys conducted on Norwegian municipalities from 2007 to 2020, we partition our analysis into two parts: First, we investigate how the term CCA has been treated, that is, which aspects of the term are captured in the municipal questionnaires. Second, we identify time series data across the 12 surveys consisting of similarly phrased questions suitable for assessing the development of Norwegian municipal adaptation over these 14 years. By assessing the consistency in the survey questions as well as in the responses given over time, we are able to shed light on the role of terminology and how it affects the validity of survey results. In addition, it gives us novel insights into the interpretations of CCA embedded among Norwegian municipalities. We conclude with a discussion of the potential harmful effects of confusion connected to the CCA concept.

2. Theory—How are we adapting to what, and why?

In this chapter, we present our taxonomy for climate change adaptation, relating to the terms' relevance for local governance. As we will show, a multitude of well-established concepts exist.

The taxonomy categorizes CCA into three dimensions: the "why" (risks), "how" (adaptation) and "what" (climate), shown in Fig. 1. The why relates to the risks that we adapt to, the how relates to the actions that we undertake to adapt to climate risks, and the what relates to the temporal perspective of the climate risks and the adaptation actions.

Many attempts at creating a taxonomy of CCA have been made over the last two decades (Berrang-Ford et al. 2011; Enríquez-de-Salamanca et al. 2017; Hallegatte et al. 2011; Moser and Ekstrom 2010; Smit et al. 2000), with the most authoritative probably being the IPCC's Fifth Assessment Report glossary (IPCC 2014a). Still, categorization of the wide range of concepts is unlikely to be universally agreed upon, as

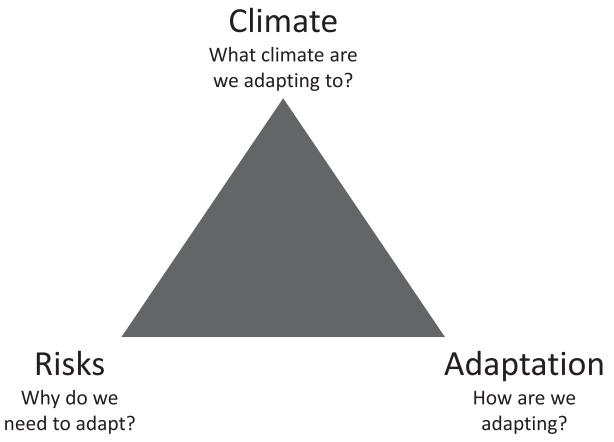

FIG. 1. The three dimensions of CCA. How (adaptation) are we adapting to what (climate) and why (risks)?

the typologies fit different purposes and fields (Bassett and Fogelman 2013; Moser and Ekstrom 2010). The following categorization is not necessarily exhaustive. Instead, we consider this typology's main contribution to be simplification and clarification of existing terminology, as well as contextualization of recent scholarship. We focus on the terms' relevance for local governance and have therefore excluded certain well-established distinctions, such as positive versus negative risks and autonomous versus planned adaptation (IPCC 2014a). A summary of the key concepts in our taxonomy with short descriptions is available in the online supplemental material.

a. Risks (the why)

The climate risk literature defines climate risk as the function of climate hazards, vulnerability, and exposure, meaning, in short, that climate risk is constituted by an interaction between socioeconomic processes and climate change (IPCC 2014a). Within this overarching definition, a multitude of categorizations exist.

We have identified four key dichotomies for types of risks embedded in the climate adaptation term: direct versus indirect, rapid onset versus slow onset, physical versus transitional, and local versus transborder.

One way to separate between types of risks, are via the direct and indirect risks dichotomy (Ding et al. 2011; O'Brien et al. 2006). The direct risks refer to the physical processes, that is, how potential changes in frequency, intensity, and duration of weather and climate events trigger a range of climate impacts, while the indirect risks refer to a multitude of interactions triggered by the direct, and then cascading through social, ecological, political, technical, or physical processes (Ding et al. 2011; IPCC 2014a; O'Brien et al. 2006; Task Force on Climate-Related Financial Disclosures 2017). Indirect consequences may involve, for example, increased food prices (Ding et al. 2011), long-term ecosystem service effects (Siebert et al. 2019), or psychological stress and deteriorating human health (Doherty and Clayton 2011).

The majority of scholarship on climate change adaptation has so far focused on the direct and local impacts of climate

change (Benzie and Persson 2019; Enríquez-de-Salamanca et al. 2017; Nalau et al. 2015). Recently however, researchers are directing increasing attention to a different type of indirect risk: transborder risk, propagating through trade, biophysical pathways, financial flows, and people across borders (Hedlund et al. 2018). The most prominent examples of this type of risk are decreasing food security, through climate-induced disruptions in global food supply chains, and population displacement and migration (Benzie and Persson 2019; Challinor et al. 2018).

A third dichotomy we wish to include is the distinction between slow onset and rapid onset risks. Natural hazards are an example of rapid onset, local and direct physical risks (Aall et al. 2018). The slow onset risks, however, can be both direct and indirect. Among the direct slow onset risks are sea level rise, melting glaciers, and changes in rainfall variability (Aall et al. 2018; Porfiriev 2015). Among the indirect risks are population displacement as a result of sea level rise, or water availability challenges due to changes in rainfall variability (McLeman 2018; Wetzel et al. 2012).

The final addition to this taxonomy of climate risk we present, is the concept of transitional risks (Task Force on Climate-Related Financial Disclosures 2017; Woodward 2019). Transitional risks have a different point of departure than the risks mentioned above in the sense that they represent risks related to the transition to a low-carbon economy, and not the physical risks posed by a changing climate. The global effort to reduce greenhouse gas emissions to a level in line with the 2° target will require extensive changes in policy, laws and regulations, technology, and the market (Campiglio et al. 2018; Task Force on Climate-Related Financial Disclosures 2017). Depending on the speed and scale of this transition, a variety of new risks might occur.

In Norwegian municipalities, transitional and transborder risks are currently not part of the area of responsibility, at least not in a comprehensive way. Municipalities are, however, required to include risks stemming from outside their geographical area that may affect the municipality in their risk and vulnerability assessments {Norwegian Directorate for Civil Protection [Direktoratet for samfunnssikkerhet og beredskap (DSB) 2018b]}.

b. *Climate (the what)*

The second dimension of our taxonomy is the ''climate'' embedded in the CCA term. We have identified two key dichotomies for the temporal scope of adaptation: present versus future and short-term versus long-term.

As stated previously, IPCC's definition sees adaptation as ''the process of adjusting to actual or expected climate and its effects'' (IPCC 2014a). We interpret this dichotomy as the distinction between present, observed climate change and future, predicted climate change. In the literature, both of these temporal scopes are regarded as useful bases for adaptation measures (Dilling et al. 2015). Several scholars argue that focusing on present climate is a good strategy, especially given the comprehensive uncertainty about future climate (Dilling et al. 2015; Dovers 2009; Heltberg et al. 2009). If we can adapt better to current climate variability and extremes, we will reduce the impacts of future climate as well. Key to this argument is that closing the ''adaptation deficit,'' that is, bringing infrastructure and systems up to current standards, is an important way to counteract indecision and postponement of adaptation measures (Dilling et al. 2015; Dovers 2009; Heltberg et al. 2009; IPCC 2014a).

The counterargument is that there is no guarantee that adapting to current climate variability and extremes will be sufficient for reducing future vulnerability to climate change. Dilling et al. (2015) argue that ''we simply do not yet have the evidence for . . . these claims to be made with confidence.'' Adaptation to the present climate can even introduce new sources of vulnerability into the system. The ''levee effect'' is one such example, where development of flood protection structures might mitigate risks within a certain flood threshold but simultaneously increases the risk of more severe damage when the levee is eventually overtopped (Dilling et al. 2015; Kates et al. 2006).

Closely related to this, is the range of the temporal focus (Enríquez-de-Salamanca et al. 2017; Smit et al. 2000). A short-term climate focus implies considering near future (multiple years) and often tangible impacts. A long-term climate focus instead implies looking further ahead (multiple decades) at a wider set of possible impacts and interactions. As Jones et al. (2017) argue, long-term climate projections are increasingly becoming more powerful and precise; however, their use in, for example, urban planning is still limited. This is likely due to the inherent uncertainty of long-term physical and socioeconomic pathways, as well as the interaction between them (Jones et al. 2017). Jones et al. (2017), in line with other authors (Dilling et al. 2015; Hallegatte 2009; Ranger and Garbett-Shiels 2012; Wise et al. 2014), advice caution against short-term perspectives. Ranger and Garbett-Shiels (2012) argue that if long-term trends are not considered, societies commit to costly, irreversible development paths that might increase climate vulnerability.

c. *Adaptation (the how)*

The third part of our proposed taxonomy contains the CCA measures and strategies. We have identified three key dichotomies: hard versus soft, reactive versus proactive, and effect oriented versus cause oriented. As our taxonomy focuses on local governance, a fourth dichotomy, autonomous versus planned adaptation, has been excluded, as we assume all municipal adaptation to be planned, that is, a result of deliberate policy decisions (IPCC 2014a).

The first dichotomy is the ''hard'' versus ''soft'' adaptation measures (Enríquez-de-Salamanca et al. 2017; Sovacool 2011). Hard adaptive options are distinguished by technological and physical structures, meant to resist a certain direct change or impact. These are often capital-intensive and inflexible infrastructures, such as sea dikes, but may also encompass constructing green spaces or rain gardens and compiling digital maps of expected water levels and flow. Soft adaptive options are based on social and institutional structures, aimed at integrating adaptation into decision-making, such as community networks, incentives, or legal frameworks, as well as regulations, codes, and overall municipal planning (Sovacool 2011).

Both soft and hard options may, to some degree, lack flexibility to accommodate sudden changes: The establishment of

large physical infrastructure is time-consuming, and social and institutional inertia may also hinder swift adaptability to change (Brulle and Norgaard 2019).

The second dichotomy is the reactive versus proactive approach (McDonald et al. 2019). The distinction between the two can be based on the drivers or motivation of the adaptation: whether the adaptation effort is a response to experienced climate impacts or in anticipation of future climate change (Burton et al. 2006). Historically, adaptation has mainly been of a reactive manner (Zilberman et al. 2012). This type of adaptation is directly informed by experiences and observations, although the literature suggests that the costs of deferred action against climate change impacts will greatly exceed the costs of preventative measures (Lecocq and Shalizi 2007).

As well as in motivation, the two strategies differ in form. While reactive adaptation functions by alleviating impacts after they have occurred, it does not necessarily reduce the likelihood of similar impacts occurring in the future (McDonald et al. 2019). Proactive adaptation seeks to avoid the future impacts by reducing exposure to climate risk. One example of reactive adaptation can be building flood defenses and raising the levels of dikes in a flood-prone area, whereas avoiding further development in the said area would be an example of a proactive adaptation measure.

The third dichotomy we wish to include is the effect-oriented versus the cause-oriented approach. We borrow this dichotomy from the sustainability discourse and use it to highlight a key distinction in the adaptation literature: between focusing adaptation on the effects of climate change or the root causes of vulnerabilities (Bassett and Fogelman 2013; Høyer 2010; Santarius et al. 2016; World Commission on Environment and Development 1987; Wise et al. 2014). The effect-oriented approach entails focusing on the risks caused or exacerbated by climate change and implementing measures that aim to protect nature or society from them, such as building rockfall defenses to mitigate the risk of an event impacting transport infrastructure (Pelling et al. 2015). The cause-oriented approach on the other hand, looks at a holistic picture of socioeconomic and environmental development, the interplay between hazards, exposure and vulnerability, and the complex system of causes and effects (IPCC 2014b; Pelling et al. 2015; World Commission on Environment and Development 1987; Wise et al. 2014). Adapting to a rockfall risk on transport infrastructure in this approach, could result in a very different measure. For instance, the threshold for accepting the risk is given by the presence of transport infrastructure and the use of the transport infrastructure is further given by logistics determined by settlement patterns and other social, cultural, and economic drivers. A cause-oriented approach could mean altering the conditions for these drivers to reduce the risk of the transport system as whole (Pelling et al. 2015; Wise et al. 2014).

Important, although they do not use the same specific term as we do, Wise et al. (2014) argue that a key acknowledgment in the cause-oriented approach is that ''climate adaptation is not separable from the cultural, political, economic, environmental and development contexts in which it occurs and is therefore only part of a range of societal responses to change.'' Moreover, as Santarius et al. (2016) argue, the cause-oriented approach does not only include targeting the underlying causes of risks, but also understanding how measures, by themselves, may cause harmful risks and rebound effects, and adversely impact other sectors and policy areas. The United Nations Commission on Environment and Development stated in 1987 that a cause-oriented approach was needed for development to be sustainable (World Commission on Environment and Development 1987). It follows from this that sustainable CCA must be cause oriented.

3. Data

Our data consists of 12 surveys distributed to municipalities in the period 2007–20 (for an overview of the surveys, see the online supplemental material). The selection criteria for the surveys included in this overview are based on reach and relevance. With regard to reach, all surveys in the sample are distributed populationwide, to the administration of all municipalities in Norway, and have a response rate of over 20%. The relevance criterion relates to the status of climate adaptation as a topic in the survey. To fulfill this criterion, the survey must be both specific enough and general enough. By specific enough, we mean that the survey must have adaptation as an explicit theme in at least one question. General preparedness or risk management, for instance, does not suffice. By general enough, we mean that the question(s) must cover several sectors. Surveys relating exclusively to storm water treatment (Ministry of Environment 2015), for instance, have been excluded.

The first large-scale survey with CCA as a specific theme in Norway was conducted in 2007 by the DSB. The survey (DSB07) was conducted to establish a reference point for the start of the coordinated adaptation effort in Norwegian local governments (DSB 2007). The survey showed that only 10% of the municipalities had initiated any form of adaptation effort and highlighted the need for a comprehensive knowledge production on local consequences and policy.

In 2008, the Norwegian Institute for Urban and Regional Research (NIBR) distributed two questionnaires to the municipalities, one addressed to the administration (NIBR08) and the second to the political leadership. In our analysis, we only include the one addressed to the administration, as this is the case for all other surveys in our sample. The key findings were in line with those of DSB07: that few municipalities were adapting, and that more knowledge was needed (Berglund and Nergaard 2008).

In 2011, DSB conducted a follow-up survey to DSB07, illustrating an improvement, as 24% of the municipalities had made their first efforts toward climate adaptation (DSB 2011).

Since 2002, the municipality survey has been one of the most important tools for DSB in monitoring the compliance of preparedness regulations and general preparedness development in Norwegian municipalities. From 2010 onward, the municipality survey has frequently also included questions about adaptation. The adaptation related questions have typically been in relation to preparedness duties, such as the inclusion of climate risk in risk and vulnerability assessments

(DSB 2010, 2012, 2015) or experience with natural hazards (DSB 2016, 2019). The surveys show a steady increase in both items over time. The municipality surveys have been part of the municipalities' compliance efforts with regard to emergency preparedness and have thus had impressive response rates (83%–95%). We refer to these as DSB10, DSB12, DSB15, DSB16, DSB18, and DSB19 in the text.

In 2018, The Norwegian Association of Local and Regional Authorities (KS) published the results from their municipality survey (KS18). The goal was to strengthen the knowledge foundation for adaptation in municipalities (Wang 2018). In contrast to the municipality survey, which is mainly designed as a tool for reporting municipal preparedness efforts, KS18 had to a larger degree a bottom-up approach to the issue, focusing also on the municipalities' challenges related to the topic. The survey found that municipalities view increased and intensified precipitation as the most important future risk, while transborder consequences were viewed as least important.

The last two surveys in our dataset are Centre for International Climate and Environmental Research (CICERO) 19 and CICERO20. The surveys are inspired by similar surveys conducted in Sweden (Eckholm and Nilsson 2019; Roth and Thörn 2015; Thörn et al. 2016, 2017). The surveys find that the size of the municipality and experience with extreme weather events is important predictors for adaptation efforts (Klemetsen and Dahl 2019, 2020). In 2020, 52% of the municipalities had implemented adaptation measures (Klemetsen and Dahl 2019, 2020).

4. Method

The two main questions that we ask in this study are as follows:

1) What aspects of the term climate change adaptation are captured in the municipal questionnaires from 2007 to 2020?
2) What consistent time series for assessing municipal adaptation process and progress do we have in the 12 municipal questionnaires from 2007 to 2020, and what can they tell us about the development in municipal adaptation efforts?

The two research questions (RQ1 and RQ2) relate to different properties of the surveys. While RQ1 examines the questionnaires, that is, the choices made by the researchers, RQ2 examines the answers and understandings of the respondents (municipalities). The two RQs require different approaches.

For RQ1, we are interested in how the term climate change adaptation has been treated by the researchers in the 12 surveys over 14 years. In RQ1, we therefore examine the questionnaires only, meaning the forms distributed to the municipalities. In all surveys, the questionnaires are provided as an appendix to the reports. For RQ1, the assessment categories are defined by the taxonomy and corresponding descriptions that we present in section 2 (for a summary, see the online supplemental material).

DSB12, DSB15, DSB16, DSB18, and DSB19 are not included in this analysis. DSB12 references adaptation exclusively as a response category for several questions, where the phrase "consequences of climate change (extreme weather, sea level rise)" is used consistently. DSB15, DSB16, DSB18, and DSB19 are consciously limited to natural events, and circumvents the terms "climate" and "adaptation" entirely, except for one question in DSB15 and DSB18. For these reasons, we do not find grounds for an analysis of the terminology of these questionnaires. However, DSB18 makes an interesting distinction between actual and expected climate, which we discuss briefly.

Colour	Description
	Not mentioned
	Implied, but insufficient
	Explicit, sufficient

FIG. 2. Coding of analysis results.

To answer RQ1, we use a directed content analysis approach with deductive category application (Hsieh and Shannon 2005; Mayring 2015). We present the results from the analysis using a color coding scheme based on whether a term is implied or explicitly mentioned in the questionnaire according to the identified descriptions in our taxonomy. The color coding scheme is shown in Fig. 2. The coding is based on the formulation of questions, response categories, as well as examples and descriptions given. By "explicit, sufficient," we consider the term being handled with a clear and concise language, providing sufficient relevant examples and leaving little or no room for diverging interpretations. Any shortcomings in these criteria, the term is coded as "implied, but insufficient," as the formulation gives room for misinterpretation and is an insufficient description of the concept. The rationale behind each coded category is given in the results.

For RQ2, we are interested in what 14 years of survey data can tell us about the development of the municipal adaptation process and progress. We do this by identifying similarly phrased questions on similar topics across the surveys that can be used to construct time series. We analyze the reported output from the surveys and code the questions by topic using conventional content analysis and inductive category formation (Hsieh and Shannon 2005; Mayring 2015). In contrast to the deductive approach, this approach means developing the categories directly from the material. In answering RQ2, we follow a three-step approach:

In the first step, we go through every question in the questionnaires and code them by topic, using a low level of abstraction (Mayring 2015). This initial categorization is revised after one-third of the material is worked through with the aim of securing consistency. When all questions are coded by topic, we analyze the questions within each topic and construct time series of the questions with similar topic, phrasing, and response categories across surveys.

In the second step, we turn to the answers in our identified time series. We present the development and level of consistency over

time. We expect RQ2 to be conditioned by our findings in RQ1, that is, that the treatment of the CCA term by researchers in each questionnaire, and the general development of the term over time, affects the answers given by the municipalities, and consequently the validity of the time series. Therefore, in the third step, we discuss the implications of RQ1 on RQ2. We do this in the discussion section.

5. Results

a. RQ1—Directed content analysis

Here, we present the results from the directed content analysis of the implied and explicit terminology used in the questionnaires. Our aim is to identify the concepts covered by the terminology used in the surveys and discuss this in relation to the reported output from the surveys.

Some questionnaires are almost identical, such as DSB07 and DSB11, and CICERO19 and CICERO20. These are therefore treated as the same questionnaires in our analysis and discussion. All translations from Norwegian are the authors' own.

1) INTERPRETATION OF CCA IN DSB07 AND DSB11

In DSB07 and DSB11 (Fig. 3), the interpretation of risk is limited to the direct, rapid onset, local and physical consequences, that is, natural hazards. ''Flooding and landslides etc.'' are given as examples to elaborate on these types of risks in the questionnaires (DSB 2011). We interpret this as explicit, sufficient. Furthermore, a clear distinction between present and future climate is made in the two questions ''has the municipality implemented measures . . . to prevent that areas prone to natural hazard risk are developed?'' and the follow-up ''are considerations of future climate change included in these measures?'' (DSB 2011). Two times as many answer ''to a large degree'' in the first question (23%) than in the second question (11%).

The examples of adaptation measures used in the questionnaire are exclusively soft measures: Changes in crisis management, spatial planning, inclusion of adaptation in municipal master plan, and communication measures are the examples given in different response categories and questions. We interpret the use of soft measures as explicit, sufficient. Furthermore, all the examples are explicit about adaptation action being proactive and targeting a potential future risk. The question cited in the former paragraph, about ''implemented measures . . . to prevent that areas prone to natural hazards are developed'' somewhat implies a preference for a cause-oriented approach in the questionnaire. The phrase does, however, not explicitly consider adaptation in relation to other policy areas, nor dive deep into the underlying drivers of climate risk, and it is therefore coded as implied, but insufficient.

2) INTERPRETATION OF CCA IN NIBR08

Similar to DSB07 and DSB11, NIBR08 (Fig. 3) interprets climate adaptation as adapting to increased natural hazards. We therefore code the direct, rapid onset, local and physical risks as explicit, sufficient. The questionnaire does not specify the temporal perspective, instead it applies the generic ''adapting to climate change'' in all relevant questions (Berglund and Nergaard 2008).

The questionnaire includes mentions of both hard and soft adaptation measures. While the hard measures are multiple and explicit, there are only two mentions of soft measures: ''conservation of wetlands'' and ''information and attitude campaigns'' (Berglund and Nergaard 2008). As there is no broad mentioning of institutional and social measures, we regard this as implied, but insufficient. The mention of conservation of wetlands also implies that adaptation measures can be cause-oriented and in synergy with other related policy areas, such as conservation of biodiversity and climate mitigation. However, this standalone example is not enough to regard it as explicit, sufficient. The mentions of effect-oriented measures are, on other hand, numerous and explicit: ''design of water and sewage systems,'' ''flood and landslide risk measures in building projects,'' ''flood defenses,'' and so on (Berglund and Nergaard 2008). The questionnaire does not distinguish between or imply whether climate adaptation measures are proactive or reactive.

3) INTERPRETATION OF CCA IN DSB10

In DSB10 (Fig. 3), the only reference to types of climate risk is given in the response category ''consequences of climate change (extreme weather, sea level rise etc.)'' (DSB 2010). Although enhanced extreme weather is a major part of the direct, rapid onset, local and physical risks, we do not regard it as entirely sufficient, as the example do not specify risks beyond the actual weather condition. Furthermore, we regard the mention of sea level rise as an implied, but insufficient mention of slow onset risks.

The distinction between present and future climate is made through the inclusion of a translated and paraphrased definition of climate adaptation from IPCC's Fourth Assessment Report, which translates back to English as ''assessments and measures to adapt nature and society to the effects of present or future climate, to prevent unwanted consequences or exploit opportunities'' (DSB 2010; IPCC 2007). This definition also explicitly states that adaptation is effect-oriented and proactive, and we code these as explicit, sufficient. The only other examples of adaptation measures given in the questionnaire, are soft measures. These are related to important processes in municipal planning and preparedness, which we regard as explicit, sufficient.

4) INTERPRETATION OF CCA IN DSB18

Because of a lack of relevant questions, we do not include a full analysis of DSB18. Still, the questionnaire makes an interesting distinction between present and future climate that merits a mention. The distinction is made in two questions asking whether the municipality have taken either ''risk and vulnerability towards serious natural events'' or ''increasing risk and vulnerability as a consequence of climate change'' into consideration in municipal planning (DSB 2018a). In the first alternative, 67% of the respondents answer ''to a large

DSB07 & DSB11

Risk		Climate		Adaptation	
Direct	Indirect	Present	Future	Reactive	Proactive
Rapid onset	Slow onset	Short-term	Long-term	Effect-oriented	Cause-oriented
Local	Transborder			Hard	Soft
Physical	Transitional				

NIBR08

Risk		Climate		Adaptation	
Direct	Indirect	Present	Future	Reactive	Proactive
Rapid onset	Slow onset	Short-term	Long-term	Effect-oriented	Cause-oriented
Local	Transborder			Hard	Soft
Physical	Transitional				

DSB10

Risk		Climate		Adaptation	
Direct	Indirect	Present	Future	Reactive	Proactive
Rapid onset	Slow onset	Short-term	Long-term	Effect-oriented	Cause-oriented
Local	Transborder			Hard	Soft
Physical	Transitional				

KS18

Risk		Climate		Adaptation	
Direct	Indirect	Present	Future	Reactive	Proactive
Rapid onset	Slow onset	Short-term	Long-term	Effect-oriented	Cause-oriented
Local	Transborder			Hard	Soft
Physical	Transitional				

CICERO19 & CICERO20

Risk		Climate		Adaptation	
Direct	Indirect	Present	Future	Reactive	Proactive
Rapid onset	Slow onset	Short-term	Long-term	Effect-oriented	Cause-oriented
Local	Transborder			Hard	Soft
Physical	Transitional				

FIG. 3. Interpretation of CCA in the analyzed surveys.

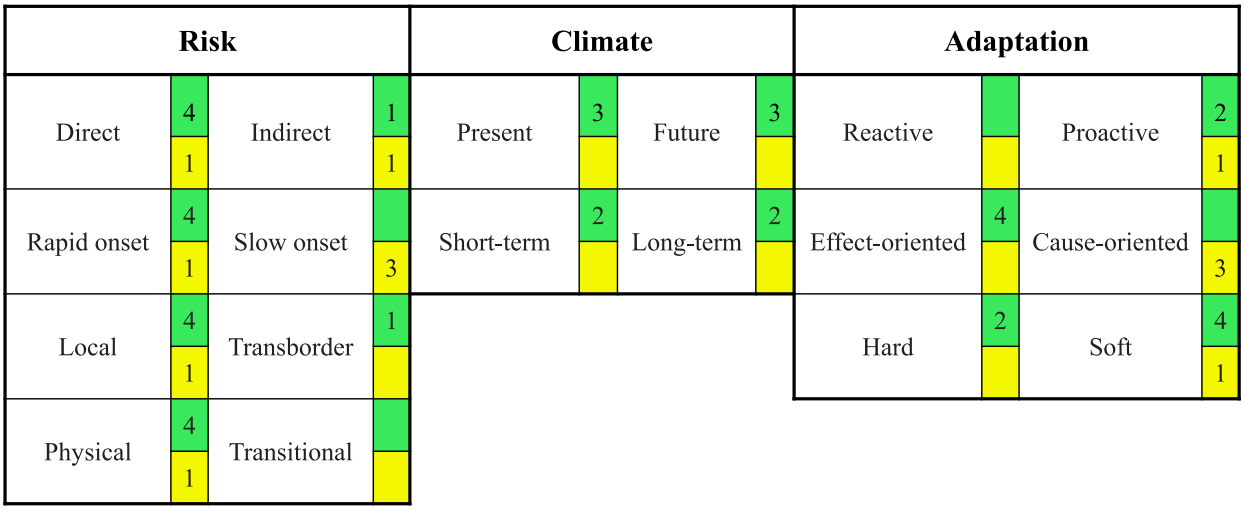

FIG. 4. Summary of the terminology used in the analyzed questionnaires ($N = 5$).

degree,'' whereas in the second alternative, 47% of the respondents answer the same.

5) INTERPRETATION OF CCA IN KS18

In KS18 (Fig. 3), the direct, rapid onset, local, physical risks are well defined. Indirect risks are implied using reduced freshwater quality as an example of a climate risk. Slow onset risks are also implied using sea level rise and increased rot in buildings as examples. The questionnaire also states that climate adaptation includes both short-term and long-term perspectives. Transborder climate risks are explicitly stated in one of the questions as ''consequences of climate change in other parts of the world (for example more immigration or reduced possibility of food import)'' (Wang 2018).

KS18 exclusively mentions soft measures as examples of adaptation measures. These include institutional measures via the municipal master plan, spatial plans, economic plan, as well as reporting schemes and risk and vulnerability assessments, and social measures, such as internal and external communication and information, and cooperation with other institutions and stakeholders. We regard this as explicit and sufficient. The focus on effect-oriented adaptation is given by defining adaptation as ''planning and implementing measures to manage natural hazards . . . and other challenges that climate change causes'' (Wang 2018).

6) INTERPRETATION OF CCA IN CICERO19 AND CICERO20

CICERO19 and CICERO20 (Fig. 3) have mostly a clear and unambiguous use of terms in their questionnaires. We interpret the direct, rapid onset, local, and physical risks to be explicit, sufficient, as the questionnaires use a multitude of examples of natural hazards. Future climate change is explicitly stated in a number of questions, and the distinction between present and future is made in two questions stating whether the municipality has been impacted or is expected to be impacted by climate change.

The slow onset risks are implied using sea level rise as a response category. The indirect risks are explicitly treated by the question ''have you analyzed the indirect consequences of future climate change/extreme weather? (e.g., that inhabitants cannot get to work because public transport/roads are affected by an incident, consequences for business and local society from interruptions in daily activity?'' (Klemetsen and Dahl 2020). Although the example is rather specific, it includes a multitude of possible interactions, which we regard as explicit, sufficient. Short-term and long-term climate change are well defined with concrete time frames.

Although most of the examples of measures can be interpreted as both reactive and proactive, the ''restrictive measures (e.g., guidelines for development, prohibiting development in flood- and landslide-prone areas)'' implies a proactive approach. There are also a number of questions assessing whether the municipality has analyzed future risks of climate change, further implying that adaptation measures are proactive, targeting potential future risks. However, in the questions about actual measures, only the example of restrictive measures points to a proactive approach, so we regard this as implied, but insufficient. The example of restrictive measures additionally implies that adaptation can be cause-oriented, underpinned by the response category ''blue-green measures (e.g., green roofs/walls, wetlands etc.).'' Still, there is no explicit mention of underlying drivers of risk or considering adaptation in relation to other policy areas. Furthermore, the questionnaire is rather explicit about measures being first and foremost a response to the effects of climate change, so we code the cause-oriented approach as implied, but insufficient and the effect-oriented approach as explicit, sufficient. Both soft and hard measures are explicitly mentioned in the questionnaire.

Last, we summarize the terms used in the analyzed questionnaires in Fig. 4. The figure shows that a preference for direct, rapid onset, local and physical risks, that is, natural hazards exist. All analyzed questionnaires include these

TABLE 1. Categories of questions.

Categories	Inclusion criteria	Surveys
CCA efforts	Questions about the CCA effort/presence of measures	NIBR08, KS18, DSB18, CICERO19, CICERO20
CCA in municipal master plan	Questions about integration of adaptation/risk/change in municipal master plan	DSB10, DSB11, KS18, CICERO19, CICERO20
CCA in risk and vulnerability assessments	Questions about integration of adaptation/risk/change in risk and vulnerability assessments	DSB07, DSB10, DSB11, DSB12, DSB15, KS18, CICERO19, CICERO20
Climate change expectations	Questions about expectations toward climate change/risks	DSB07, DSB11, KS18, CICERO19, CICERO20

concepts, and they are mostly explicitly mentioned. Other risks are sporadically mentioned, transborder risks brought up explicitly once, while transitional risks are not included. The distinction between present and future climate is explicit in three questionnaires, while two questionnaires separate between long- and short-term climate impacts. Among the concepts related to adaptation measures, the effect-oriented and soft measures are the most commonly explicitly mentioned. Hard and proactive measures are explicit in two questionnaires, while the cause-oriented approach to adaptation is implied in three questionnaires. None of the questionnaires relates adaptation to a reactive approach.

b. RQ2—Conventional content analysis

Here, we present the results from our conventional content analysis of the 12 questionnaires in our sample. Our conventional content analysis has identified four categories of questions, shown in Table 1. The categories all consist of questions relevant for evaluating the development in municipal adaptation efforts in the study period (Aall et al. 2018; Dannevig et al. 2012).

The different response scales within and between questionnaires pose some difficulties for comparing items. In the questionnaires, two response scales are prominent: dichotomous and ordinal Likert-type scales in the range ''to no degree''–''to a small degree''–''to a medium degree''–''to a (very) high degree.'' Although it seems logical to assume, for instance, that the positive responses in a Likert-type-scale item would correspond with the positive responses in a dichotomous item, generally, this is not the case. Likert-type scales opens up for socially desirable responding (Paulhus 2002), meaning ''the tendency to give overly positive self-descriptions,'' which skews responses toward positive. Treating an ordinal, Likert-type-scale question as simply dichotomous is also impossible without losing crucial information (MacCallum et al. 2002). To nuance this in Tables 2–5, we therefore report both the sum of all responses above negative as well as the sum of all responses above ''to a small degree'' in the Likert-type-scale questions. All translations from Norwegian are the authors' own.

Table 2 shows that the development of the self-reported CCA efforts in the municipalities is hard to determine. Given the different scales and lack of similarity between items, directly comparing surveys and percentages is difficult. Still, there are two findings that we want to highlight.

First, the distinction made by CICERO19 and CICERO20 between ''working with CCA'' and have ''implemented CCA measures'' shows an interesting disparity (Klemetsen and Dahl 2019, 2020). The difference is substantial: while 88% is ''working with CCA'' in CICERO19 and 91% in CICERO20, only 64% has ''implemented CCA measures'' in CICERO19 and 52% in CICERO20 (Klemetsen and Dahl 2019, 2020). The fact that the percentage of respondents who report they have ''implemented CCA measures'' decreases between CICERO19 and CICERO20 is, according to the authors, likely due to the increase in the response rate from 2019 to 2020 and consequently increased representativity in the sample (Klemetsen and Dahl 2020). Therefore, 52% is likely the most reliable number of the two. There are other items that also proxy the municipal adaptation efforts in CICERO19 and CICERO20. CICERO20 asks whether the municipality has ''identified different adaptation measures,'' where 43% answer positively, and whether the municipality has ''assessed different adaptation measures,'' where 45% answer positively (Klemetsen and Dahl 2020).

Second, if we compare the results from CICERO20 with the results from DSB18, although the response scales are not the same, the difference is interesting: 86% and 81% answer in DSB18 that they have ''to some degree'' or ''to a large degree'' implemented measures to reduce risk and vulnerability in different areas of the municipality's responsibility, while only 52% report that they have implemented adaptation measures in CICERO20. One key difference between the two questionnaires, apart from the response scale, is that DSB18 does not explicitly state that the measures in question are CCA measures.

This category shown in Table 3 is one where the questions are similar enough for comparison. DSB11 and CICERO19 does not specify which element of the municipal master plan climate change or adaptation is included in. If we attempt to compare the two, the percentage of responses > ''to a small degree'' in DSB11 (51%) seems to be more comparable to CICERO19 (55%) than the total positive responses in DSB11 (89%). DSB10, KS18, and CICERO20 distinguish between the land-use element and the social element. Of these three, KS18 stands out, as the responses are far more positive than in the other two. It is reasonable to assume that this is mainly a result of the different response scales. Still, the fact that 89% report that adaptation is integrated into the land-use element to some degree, to a large degree, or to a very large degree in KS18 seems excessive, given that

TABLE 2. CCA effort.

Survey	Key phrase	% (% > "to a small degree")	Scale
NIBR08	Adapting to climate change through design of water and sewage systems	82 (56)	To a large degree, to some degree, to a small degree, or to no degree
	Adapting to climate change through flood and landslide risk measures in building projects	77 (55)	To a large degree, to some degree, to a small degree, or to no degree
DSB18	Implemented measures to reduce risk and vulnerability in critical societal functions exposed to natural hazards	94 (86)	To a large degree, to some degree, to a small degree, or to no degree
	Implemented measures to reduce risk and vulnerability in developed areas exposed to natural hazards	93 (81)	To a large degree, to some degree, to a small degree, or to no degree
CICERO19	Working with CCA today	88	Dichotomous
	Implemented CCA measures	64	Dichotomous
CICERO20	Working with CCA today	91	Dichotomous
	Implemented CCA measures	52	Dichotomous

only 60% answer positively to the very similar question in CICERO20.

If we disregard KS18, the percentage of municipalities that have included CCA into key parts of their municipal master plan seem stable. In DSB10, 61% and 37% have taken CCA into consideration in the master plan's land-use element and social element, respectively, while in CICERO20, the numbers are 60% and 49%. The results also show that CCA is more frequently included in the land-use element, than in the social element, but that inclusion in the latter have become more common.

Apart from one question in DSB10 and DSB12 that limits the respondent to reporting the activity within the last four years, the questions in Table 4 are similar enough for comparison. If we compare the results across surveys, we see an indication of an increase over time, illustrated in Fig. 5. We also make two interesting discoveries. The first one is the inconsistency in responses between the more recent CICERO surveys and the rest. As in our previous categories, we are cautious with comparing the ordinal-scale responses with the dichotomous ones. Still, the fact that 95% respond having integrated the work on CCA into risk and vulnerability assessments (RVAs) "to some degree," "to a large degree," or "to a very large degree" in KS18, is interesting, given that only 56% answer positively in a similarly phrased question the following year, in CICERO19. Even fewer answer that they have analyzed how future climate change may affect the municipality, only 39%. Even if we disregard KS18, there is still a significant reduction in inclusion of CCA into RVAs, from DSB15 (70%) to CICERO19 (56% and 39%).

The second finding is the difference in responses within CICERO19 and CICERO20. The surveys each pose two different questions with relation to RVAs. The first one is generic: Whether the municipality has integrated the work on CCA into RVAs. The second specifies, however, whether future climate impact has been analyzed or assessed. The responses in CICERO19 are 56% and 39% for the first and second question, respectively, and 72% and 62% in CICERO20.

TABLE 3. CCA in municipal master plan.

Survey	Key phrase	% (% > "to a small degree")	Scale
DSB10	The land-use element of the master plan takes CCA into consideration	61	Dichotomous
	The social element of the master plan takes CCA into consideration	37	Dichotomous
DSB11	Consequences of future climate change are incorporated into municipal plans	89 (51)	To a large degree, to some degree, to a small degree, or to no degree
KS18	CCA is integrated into the land-use element	98 (89)	To a very large degree, to a large degree, to some degree, to a small degree, or to no degree
	CCA is integrated into the social element	94 (75)	To a very large degree, to a large degree, to some degree, to a small degree, or to no degree
CICERO19	The work on CCA is integrated into the municipal master plan	55	Dichotomous
CICERO20	The work on CCA is integrated into the land-use element	60	Dichotomous
	The work on CCA is integrated into the social element	49	Dichotomous

TABLE 4. CCA in RVAs.

Survey	Key phrase	% (% > "to a small degree")	Scale
DSB07	Has conducted RVAs connected to consequences of future climate change	52 (22)	To a large degree, to some degree, to a small degree, or to no degree
DSB10	Has conducted RVAs on consequences of climate change in last four years	24	Dichotomous
	Has taken CCA into consideration in RVAs/risk assessments	46	Dichotomous
DSB11	Has conducted RVAs connected to consequences of future climate change	79 (54)	To a large degree, to some degree, to a small degree, or to no degree
DSB12	Has conducted RVAs on consequences of climate change last four years	31	Dichotomous
DSB15	Has included CCA in RVAs	70	Dichotomous
KS18	Has integrated the work on CCA in RVAs	99 (95)	To a very large degree, to a large degree, to some degree, to a small degree, or to no degree
CICERO19	Has integrated the work on CCA in RVAs	56	Dichotomous
	Has analyzed how future climate change can affect the municipality	39	Dichotomous
CICERO20	Has integrated the work on CCA in RVAs	72	Dichotomous
	Has assessed how future climate change can affect the municipality (e.g., by including CCA in RVAs)	62	Dichotomous

The final category of questions is shown in Table 5. Results across the five surveys indicate an increasing acknowledgment that climate risks will impact the municipality. However, given the difference in response scales, it is not possible to conclude. The development in responses from DSB07 to DSB11, which use the same question and response scales, shows that the expectation of climate risk was relatively constant in that period. The responses from CICERO19 and CICERO20 imply the same.

6. Discussion

In the first part of our analysis, we find that the terminology applied in the questionnaires during the study period has varied to a large degree. In DSB07 and DSB11, 9 of the 18 CCA concepts in our categorization were implied or explicit; 8 of 18 concepts were mentioned in NIBR08, 10 of 18 in DSB10, 11 of 18 in KS18, and 15 of 18 in CICERO19 and CICERO20. The increase in included concepts implies an expansion of the term during this period. Considering that climate adaptation was in its infancy in Norway in 2007 (Dannevig et al. 2012), when our study period starts, it is logical that the terms and the concepts used to describe it, both generally and within questionnaires, has steadily evolved since.

When summarizing the results from our directed content analysis based on the three categories (risk, climate, and adaptation), we find that the first category, risks, are most commonly referred to as natural hazards. It is probable that this is a

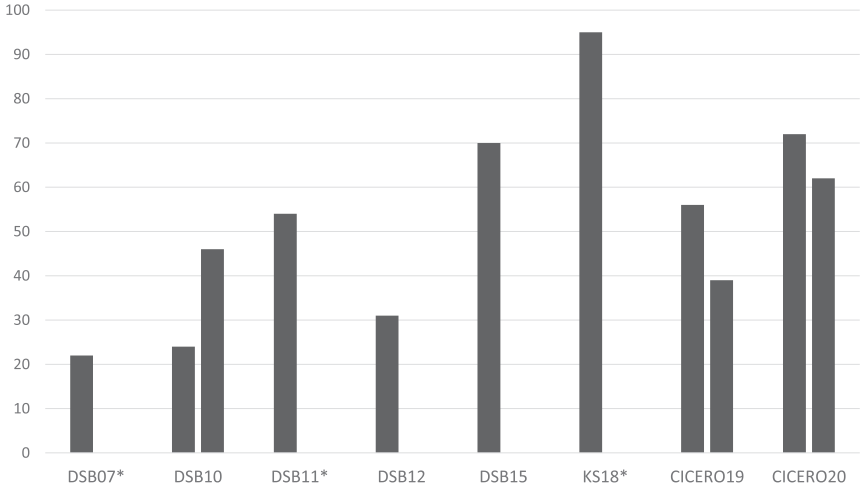

FIG. 5. CCA in risk and vulnerability assessments. Shown is the percentage of positive responses. The asterisks indicate ordinal response scales (see Table 4).

TABLE 5. Climate change expectations.

Survey	Key phrase	% (% > "to a small degree")	Scale
DSB07	Consequences of climate change will have an impact on the municipality in the future	95 (81)	To a large degree, to some degree, to a small degree, or to no degree
DSB11	Consequences of climate change will have an impact on the municipality in the future	99 (80)	To a large degree, to some degree, to a small degree, or to no degree
KS18	Increased precipitation and cloudburst will affect the municipality	100 (94)	To a very large degree, to a large degree, to some degree, to a small degree, or to no degree
CICERO19	Climate change and/or extreme weather events will affect the municipality	97	Dichotomous
CICERO20	Climate change and/or extreme weather events will affect the municipality	96	Dichotomous

conscious choice by the researchers, considering that the mandate of Norwegian municipalities, as well as the mandate of many the institutions conducting the surveys (DSB, in particular), and the general adaptation literature (Bassett and Fogelman 2013), has traditionally evolved around preparedness and vulnerability to natural hazards (Aall et al. 2018). Related to the second category, climate, distinctions between present and future climate (IPCC 2014a) are made by most of the analyzed questionnaires, while a separation between a long- and short-term scope (Enríquez-de-Salamanca et al. 2017) is specified by less than half. We discuss this in greater detail below. The third category, adaptation, is where the applied concepts have the highest diversity among the questionnaires. The effect-oriented approach (Santarius et al. 2016) and soft measures (Sovacool 2011) are explicitly mentioned in most of the analyzed questionnaires, while hard (Sovacool 2011) and proactive (IPCC 2014a) measures are explicit in less than half of them. None of the questionnaires relate adaptation to a reactive approach (IPCC 2014a). The cause-oriented approach, which we describe as a prerequisite for adaptation to be considered sustainable (see, e.g., Santarius et al. 2016; World Commission on Environment and Development 1987), is not sufficiently elaborated in any of the questionnaires.

Although our taxonomy does not directly relate to the three categories of interpretations of CCA in Pelling et al. (2015), it is possible to infer from the results that "resistance" or "incremental adjustments" are the dominant interpretations of CCA in the surveys. For CCA to instead be considered transformative, "measures that challenge the stability of current systems" must be analyzed and implemented. Such measures require considering all types on risks using a cause-oriented proactive approach and a long-term perspective. None of the surveys show or facilitate this interpretation.

In the second part of the analysis, we find that the responses are inconsistent both between and within surveys, and the overall development across 14 years and 12 surveys remains elusive.

There are a number of reasons why the level of consistency in the identified time series is likely to be low. First, the use of different response scales makes comparisons difficult because the ordinal Likert-type items open up for socially desirable responding to a different degree than are the dichotomous items (Paulhus 2002). The survey with the most positive response categories, KS18, where the scale ranges from "to no degree" to "a very large degree" has, it seems, also the most positive responses of the questionnaires. Second, some items contain limitations, making comparisons difficult, such as limiting the respondent to reporting the activity of the last four years instead of indefinitely. Third, the external validity, that is, whether the sample in each survey is representative of the population of municipalities, is likely to be a significant source for the differences in responses. KS18, CICERO19, and CICERO20 have the lowest response rates with 27%, 23%, and 34% of the municipalities, respectively. In all three surveys, the least populated municipalities are underrepresented (Klemetsen and Dahl 2019, 2020; Wang 2018). Given resource constraints and lack of expertise, the smallest municipalities are typically the ones struggling the most with prioritizing CCA (Aall and Rusdal 2019; Dannevig et al. 2012). The low response rates from the smallest municipalities indicate a self-selection bias, that is, that the municipalities that prioritize adaptation, have a higher propensity to respond in surveys on the topic, and therefore leading to lower external validity. Fourth, the differing mandates of the institutions conducting the surveys naturally affect the terminology used in the questionnaires. However, the addressee and the terminology used may also indirectly affect the responses, as the respondents may, for example, be more inclined to answer truthfully when the terminology is more exact or when the addressee is a government institution. Fifth, surveys rely heavily on simplification and top-down categorization in order to cover a full population of different municipalities and avoid being overly extensive. Hence, the surveys are unlikely to capture all aspects of the municipal adaptation work. These efforts extend across multiple sectors, and CCA work taking place may be labeled general preparedness, social security, or similar.

Overall, based on our two analyses, we find (i) that no two questionnaires made by different teams of researchers apply the same CCA terminology, and (ii) that the level of consistency across surveys over time is too low to give any real indication of development. The question is, then, are (i) and (ii) related? Although it is likely to be a contributing factor, we also give several reasons why the time series across surveys would be inconsistent regardless of the difference in terminology. To answer this question, we therefore turn to the information visible within the surveys.

Within the surveys, there are two particularly illustrative examples of the impact of different terminology: how measures are defined, and the distinction between present and future climate.

The first example is illustrated in CICERO19 and CICERO20, where the municipal adaptation efforts are proxied using a number of different questions. In CICERO20, they first ask whether the municipalities are ''working with CCA today,'' where 91% of the municipalities respond positively (Klemetsen and Dahl 2020). Second, they ask whether the municipality has ''identified different adaptation measures,'' where 43% answer positively. Third, they ask whether the municipality has ''assessed different adaptation measures,'' where 45% answer positively. Finally, they ask whether the municipality has ''implemented adaptation measures,'' where 52% answer positively. The gap between the 52% that reports having implemented measures and the 91% that are working with CCA, is surprisingly large, especially considering that the other surveys asking about implemented measures have a significantly higher number of positive responses. Furthermore, CICERO19 and CICERO20 have the widest and most explicit set of concepts related to adaptation measures. The fact that these surveys have the clearest terminology as well as the lowest positive responses for implemented measures strongly indicate that the less well-defined terminology in other surveys provides overly optimistic responses.

The second example is illustrated in four instances where the distinction between present and future climate is made. In DSB11, the distinction is made in the two questions ''has the municipality implemented measures . . . to prevent that areas prone to natural hazard risk are developed?'' and the follow-up ''are considerations of future climate change included in these measures?'' (DSB 2011). Two times as many answer ''to a large degree'' in the first question (23%) than in the second question (11%). In DSB18, the distinction is made in two questions asking whether the municipality have taken into consideration ''risk and vulnerability towards serious natural events,'' and ''increasing risk and vulnerability as a consequence of climate change'' in municipal planning (DSB 2018a). In the first alternative, 67% of the respondents answer ''to a large degree,'' while in the second alternative, 47% of the respondents answer the same. In CICERO19 and CICERO20, the questionnaires each pose two different questions about the inclusion of CCA in risk and vulnerability assessments. The first one is quite generic: whether the municipality has integrated the work on climate adaptation in risk and vulnerability assessments. The second specifies, however, whether future climate impact has been analyzed or assessed. The responses in CICERO19 are 56% and 39% for the first and second question, respectively, and 72% and 62% in CICERO20.

These distinctions provide us with important novel insights. They show that the efforts of Norwegian municipalities, in terms of actually implementing measures, might be less developed than some surveys indicate. Furthermore, the distinctions show that not all municipalities that are adapting to climate change are making efforts to adapt to future climate change. Some authors argue that adapting to present climate variability is a good strategy, as adapting to present climate and closing the ''adaptation deficit,'' that is, bringing infrastructure and systems up to current standards, is a low-regret strategy that does not have to handle the uncertainty of future impacts (Dilling et al. 2015; Dovers 2009). However, others argue strongly against it, stating that adapting to present climate may introduce new sources of vulnerability into the system, as measures implemented under one climatological normal might constitute a risk under a different normal (Kates et al. 2006). Using adaptation to current climate as the strategy for circumventing decision-making under a high degree of uncertainty, is also a questionable solution (Hallegatte 2009). Although observed climate variability and extremes will ultimately provide an answer to the full range of climate risks, and consequent adaptation needs, it will not do so for a long time (Hallegatte 2009). Important, as Dilling et al. (2015) argue, change may occur in means, ranges, frequency, or timing of climate variables, and these changes will not be linear: ''extremes may change more and faster than shifts in means suggest'' (Dilling et al. 2015). Basing adaptation on observed climate change may therefore indeed lead to poor adaptation to future climate. Proponents of the transformative strategy for adaptation further argue that if future long-term trends are not considered, societies might be committing to costly, irreversible development paths that ultimately might end up increasing climate vulnerability (Dilling et al. 2015; Hallegatte 2009; Jones et al. 2017; Ranger and Garbett-Shiels 2012; Wise et al. 2014).

The distinctions made between working with CCA and actually implementing measures, and between present and future climate change within the surveys, also clearly illustrate that terminology is important. The impact of different conceptualizations within the surveys indicates that the results from 14 years of survey data are largely affected by the application of the CCA term, and that the conclusions drawn from these surveys should be scrutinized. Furthermore, it indicates that diverging interpretations of CCA exist in the municipalities. As Bassett and Fogelman (2013) writes, CCA indeed means ''different things to different people.''

There are three implications of these findings that we wish to highlight. First, the validity of survey data about municipal climate change adaptation is largely determined by the terminology applied, meaning that past surveys might be less reliable than anticipated, and that future surveys should strive for a more concise terminology. In this, we do not suggest that researchers uncritically implement terms from our taxonomy into their questionnaires, but instead that they strive to embed the content of and distinctions between them, using a clear-cut language and relevant examples.

Second, because past surveys might be less reliable than anticipated, we know less about the actual CCA efforts of Norwegian municipalities than we think (Aall et al. 2018), highlighting the need for a closer monitoring and evaluation of actual adaptation measures in the municipalities. Further empirical research is also needed, using a wider range of methods and types of data, to get a more complete view. Large-sample approaches will still be important but should be increasingly supplemented with small-sample approaches. An in-depth case-study method could provide crucial insights into how municipalities are interpreting the CCA mandate, within what frame of reference using what vocabulary, and how this translates between

different sectors and levels of government, insights that this study and other large-*N* approaches are less suited to provide.

Third, the fact that different interpretations of CCA exist in municipalities reflects on the higher levels of government responsible for knowledge provision. It shows the need for a clear and concise adaptation language, with well-defined and explicit terminology as well as a concretization of how this applies to the adaptation mandate of Norwegian local government.

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