Towards tailored adaptation services for sub-national actors in Europe: results from a KIC pathfinder study

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Abstract

Efficient access to relevant knowledge is crucial in the implementation of climate change adaptation action at sub-national level and needs to cover information on climate, vulnerabilities and adaptation, as well as specific methodological guidance and operational tools. However, with a scattered landscape of available adaptation knowledge, actors have difficulties in identifying and accessing appropriate support. This paper presents results of a survey aiming at capturing the needs from local actors for climate change adaptation, based on a framework of adaptation information categories. It was run within the Climate-KIC one-year project ATLA (*Adaptation Tool box for Local Authorities*). Covering 5 sub-national territories in Germany, Hungary, Italy, Poland and Spain, the survey targeted at local authorities and public institutions working closely with local governments and using a multi-sectoral approach. The results indicate an existing imbalance between perceived information needs and available information offer, but also an imbalance between stated information gaps and information needs. Against this background we discuss open challenges in providing efficient adaptation services.

Keywords

climate change, sub-national adaptation, adaptation services

1 Introduction

In January 2014, the World Economic Forum estimated again the failure to mitigate and adapt to climate change as the 5th biggest risk in terms of probability and economic impacts [1]. Actors at sub-national levels will have an important role to play in climate change adaptation, as Yvo de Boer UNFCCC Executive secretary highlighted in 2008: “Almost 100% of the actions taken to adapt to the consequences of climate change are being taken on an infra-state level”. Efficient access to relevant knowledge is crucial in the respective decision making and operationalization processes, and has to cover general information as well as specific methodological guidance and operational tools. However, with a scattered landscape of available adaptation

knowledge, actors have difficulties in identifying and accessing appropriate support. Further, the design of effective adaptation services has to take into account that actors have different needs, depending on individual backgrounds and starting points. In order to prepare a climate adaptation service offer addressing the specific needs of European sub-national actors, the Climate-KIC one-year project ATLA (*Adaptation Tool box for Local Authorities*) aims at identifying existing demands, which are in a later step matched against services that can be provided within the KIC network. To systematically capture adaptation related information needs, we first derived a framework that integrates categories proposed in the literature and / or used in prominent web-based adaptation information platforms. We then designed a questionnaire for sub-national actors, aiming to map their current needs, practices and understanding of the adaptation challenge. We ran a 2-month survey, covering 5 sub-national territories in Germany, Hungary, Italy, Poland and Spain, i.e. countries with varying progress in adaptation at sub-national level.

The survey targeted at local authorities and public institutions working closely with local governments and using a multi-sectoral approach. The remainder of this paper presents the underlying framework (sec. 2) as well as results from our survey, which in total gathered 127 answers (sec. 3). We conclude with a discussion of open challenges in providing efficient adaptation services (sec. 4).

2 Approach

To provide a systematic basis for the subsequent stocktaking of informational needs and available information supply for climate change adaptation at sub-national level, we derived a framework that integrates dimensions proposed in the literature or used in prominent web-based adaptation information platforms to characterize adaptation. Considerable work has been done to systematically characterize adaptation to climate change (e.g., [2]), including the definition of frameworks for assessing adaptation (e.g., [3-5]), as well as towards systematic analyses (e.g., [6-8]) or ranking (e.g., [9, 10]) of available adaptation options. However, besides some agreement on the broad categories we notice the absence of a common classification scheme for adaptation options. The variety of approaches to classify adaptation originates from the inherent complexity of the field and is further complicated by specifics and requirements related to the various sectors that need to adapt to climate change (see, e.g., for the coastal sector [11] and referring to this [12], and [13, 14] for the agricultural sector). As a consequence, various typologies of adaptation have been suggested, including classifications according to timing (*reactive ↔ anticipatory*), scope (*local ↔ regional, short-term ↔ long-term*), purposefulness (*autonomous ↔ planned*), adapting agent (*natural systems ↔ humans; individuals ↔ collectives; private ↔ public*) [15]. The lack of a consistently used classification scheme is also reflected in the growing variety of web based applications aiming to provide access to adaptation related information, which, as a rule of thumb, all appear to apply (at least slightly) different classification schemes.

The approach we follow here is multi-layered. On a high level, informational needs with respect to adaptation can be framed along the widely used policy cycles. Framing adaptation processes through policy cycles is applied in the scientific literature (e.g., in [16]), as well as used in different variations in several web-based platforms for adaptation information, including the UKCIP Adaptation Wizard[1], the Adaptation Support Tool of the European Climate Adaptation Platform CLIMATE-ADAPT[2], and the Adaptation Pathfinder of the MEDIATION Adaptation Platform[3]. While different in detail, these approaches agree that adaptation can be framed along a set of overarching phases, as identified in Moser and Ekstrom 2010 [16]: (a) *understanding:* understanding the climate change related problem to be faced, as well as vulnerability and risk related to this problem; (b) *planning:* identification of available adaptation options or strategies to cope with this problem, and deciding between available options; (c) *managing:* implementing the selected option(s), and monitoring and evaluating the effect of the implementation with respect to the addressed problem in order to learn and improve.

[1] http://www.ukcip.org.uk/wizard/
[2] http://climate-adapt.eea.europa.eu/web/guest/adaptation-support-tool/step-1
[3] www.mediation-project.eu/platform

To gather more precisely the dimensions of adaptation informational needs we elaborated a set of four top-level questions, orthogonal to the three high level phases. These top-level questions encapsulate the outline of a "gross anatomy" of adaptation as proposed by Smit et al. 2000 [4]: (i) *adaptation to what?* (ii) *who or what adapts?* (iii) *how does adaptation occur?* In order to reflect the growing role that economic estimates of adaptation play in a decision-making context [17], we extended the approach of [4] by including a fourth top-level question, related to (iv) *what are the costs (and benefits) of adaptation?* Additionally, we aimed to capture feedback on the managing part of the adaptation process, in particular on monitoring and mainstreaming.

We then identified a set of information categories for each of the top-level questions. Note that we have consciously refrained from including information categories for which a consistent labelling is difficult to achieve in describing real world adaptation. This comprises, e.g., distinguishing between autonomous and planned adaptation [4], proximity of effect [7], or no-regret characteristics [18-20].

The first set of information categories relates to the description of the respective stimuli that trigger adaptation (*adaptation to what?*). Taking into account that it is often likely to be a combination of climatic as well as non-climatic stimuli that will trigger adaptation, we included (i) the manifestations of *climate stimuli* – and the respective impacts – a system aims adapting to, including changes in mean climate conditions as well as changes in climate variability and extremes [4]; (ii) *non-climate forces or conditions* that trigger adaptation [4]; as well as (iii) the *timeframe of climate change effects* and (iv) the *role of climate change in motivating adaptation* [7, 4].

Second, adaptation will further depend on the system affected by climatic stimuli, hence the need for identifying *who or what adapts?* [4]. We address the categorization of the affected system by including three information categories, (i) the – not necessarily economic – *sector* aiming to adapt due to a climate stimulus, (ii) the *spatial context* (e.g., country, sub-national region, or transboundary region) of an adaptation activity, as well as (iii) its *spatial scale*.

The third set of information categories aims to capture and characterize the specific activities and strategies followed in order to adapt (*how does adaptation occur?*). It comprises categories like (i) the *timing* of an adaptation action relative to its stimulus [4], also called adaptive strategy [7]; (ii) *effect emergence* [21], i.e. the time until desired effects are shown[4]; and (iii) *effect persistence* [21], i.e. the time the effect of an adaptation measure will last[5]. Further categories relate to the (iv) *(primary) goal(s)* of an adaptation option (see e.g. [7]) and (v) the *implementation type* of an option (e.g., to distinguish between 'soft' and technical measures). Avoiding maladaptation (e.g., [22]) and dealing efficiently with the uncertainties related to adaptation to climate change [20, 18, 23-25] requires appropriate strategies, e.g., the selection of options that are reversible and/or have synergies with mitigation. To denote these characteristics we add two more categories: (vi) choosing adaptation options that maintain a high degree of *reversibility / flexibility* is judged as one appropriate strategy to decide on adaptation against the background of uncertainty [18, 20]; (vii) finally the potential *synergies with mitigation* (or conflicts, respectively) provide another relevant classification criterion for adaptation (e.g., [19, 18]).

As stated forehand, we added a fourth pillar related to information on adaptation *costs*. Estimates of climate adaptation costs are said to inform decision-makers on adequate levels of investment needed [17], to evaluate optimal policy mixes of adaptation and mitigation [26] and suggested as criteria to prioritize adaptation options [9]. Estimates of potential monetary efforts necessary with adaptation have therefore become an important piece of information required in a decision making context [27].

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[4] e.g., the construction of a dyke can show an immediate effect whereby planting mangroves will not have an immediate effect

[5] e.g., dykes are typically build to last more than 30 years while beach nourishment only lasts a few (less than 10) years.

In addition, aspects related to the management and monitoring of adaptation processes were included. In the multi-level process of development planning, sub-national actors can integrate climate change into project development through the design of climate-resilient projects as well as specific climate change adaptation projects. Mainstreaming climate change adaptation into development projects calls for specific information on climate risks and climate proofing [28-37]. As part of the planning phase cycle, monitoring is a key step to evaluate and adjust its action [38]. Long term change issues and the uncertainty of climate change reinforce the needs for correct and adapted monitoring and evaluation systems [39, 40]. As climate change science evolves quickly and local impacts are still under assessment, it is necessary to identify indicators of local climate change impacts to monitor this change and adapt solutions. To evaluate the effectiveness of adaptation actions, it is required to also monitor their action. To this end, specific governance organizations can be implemented in order to allow monitoring and a transversal co-building exercise [41, 42]. To improve knowledge on possible impacts and possible corresponding relevant adaptation answers, sharing practices and experiences is essential.

Based on the outlined framework we then derived a questionnaire to gather the informational needs of both sub-national authorities and decentralized / sub-national public or semi-public institutions that work closely with local authorities on thematic or transversal issues and that are often in charge of the implementation or monitoring of public policies (e.g. water agencies, chamber of agriculture, etc.). We subsequently tested and improved the questionnaire with five regional project partners. In total, 19 sub categories for informational needs were created; possible complementary needs were also included, namely with respect to guidance assistance, and to operational tools. Since climate change adaptation is a multi-sectoral issue, the list of targeted sub-national actors covered 14 different domains (agriculture, air, biodiversity, climate plan, economy and finance, energy, health, housing and architecture, public services, risk, tourism, transportation and infrastructures, urban and rural planning, and water resources). The survey was mainly conducted via mail exchanges and phone interviews, as well as a smaller amount of face-to face interviews.

Fig. 1 Overview on the resulting sample of respondents: fraction of institutions in the overall sample (left) and for the five regions (centre); fraction of respondents per regions (right).

3 Selected results

The results of our survey cover answers from 5 European regions, based on available contacts of KIC project partners: Central Hungary, Emilia Romagna in Italy, Hessen in Germany, Lower Silesia in Poland, and Valencia in Spain. The questionnaire was answered by in total 127 persons from about 90 different institutions, with help

of a regional focus institution from the KIC network already working on climate in their respective region. Fig. 1 depicts the composition of the resulting sample.

Note that the resulting sample comprises both an imbalance with respect to the number of filled questionnaires per region, as well as varying coverage with respect to institution types per region. The region of Hessen in Germany contributes more than 40% to the overall pool of respondents, while the other regions contribute between 10 to 19%, respectively. As well, the Hungarian subset is composed of a significant part of answers from private companies, while the subsets for Spain and Poland have a majority of public institutions represented, and the subsets for Italy and Germany show a combination of mostly local authorities and public institutions in a second stand. However, the majority of the overall answers was provided either by local authorities or public institutions (42% and 38%, respectively), which corresponds to our target. 32% of the questionnaires were filled by environmental departments (i.e. environment, biodiversity, nature) and 18% by planning and department units (i.e. planning, development, land). On average, 58% of the overall respondents held a decision making position (i.e. manager, head, director, chief executive officer, chairman). 62% state to be familiar with the concepts and methods of climate change adaptation (72% in local authorities).

Given its heterogeneity, the resulting sample does not provide a sufficient quantitative basis for sound statistical analyses, e.g., of existing differences between the 5 regions (which also was not intended). However, as a snapshot of current information needs on a local level for climate change adaptation in Europe, it allows for several general insights, described in the remainder of this section.

In order to identify potential *information gaps*, the respondents were posed a set of questions on available information / knowledge. Each of the questions addressed a different aspect of adaptation related information, according to the framework outlined in sec. 2, and the respondents were, among others, asked to state whether they already have all or part of the required information on the related issue (“yes”) or if they do not have this kind of information (“no”). The overall distribution of “yes” / “no” answers we obtained for these questions, grouped into the sections climate, impacts, adaptation, economic aspects, and management, is depicted in Fig. 2. As can be seen, with respect to information gaps it was most frequently indicated that information or knowledge is not available for questions related to economic aspects and finance, followed by questions related to adaptation options and to management aspects.

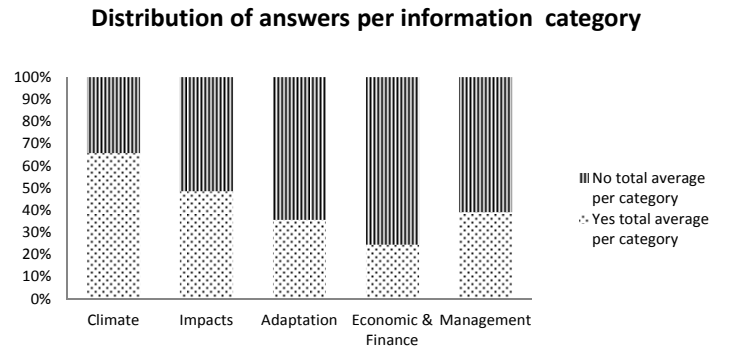

Fig. 2 Aggregated overview over the distribution of answers stating “yes, I have all or part of the required information” / “no, I do not have this kind of information”.

Fig. 3 shows the fraction of “no” answers for selected questions, i.e. the amount of overall respondents stating to not have information or knowledge on the respective issue. As can be seen, for several questions this has been stated to be the case by a majority of the respondents. The biggest gap in available information / knowledge was indicated with respect to the costs of impacts and the costs of adaptation, both with a share of “no” answers clearly above 70% each, followed by monitoring of adaptation actions, funding options for adaptation, and the identification of the “best” adaptation options.

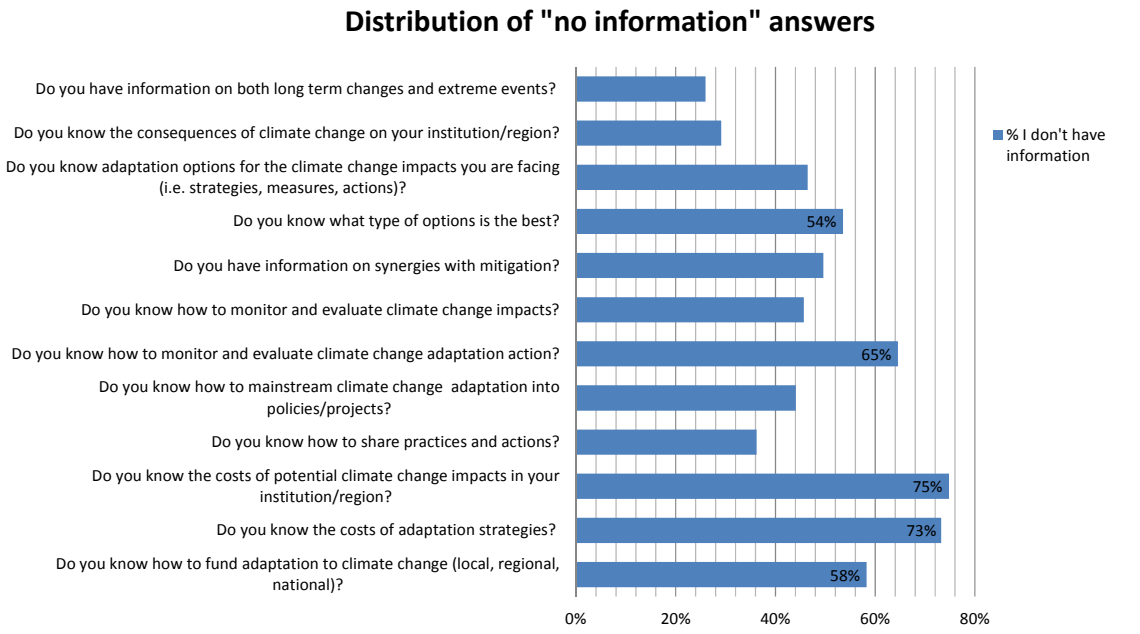

Fig. 3 Stated information / knowledge gaps: fraction of answers stating "no, I do not have this kind of information" for selected questions inquiring on adaptation information needs.

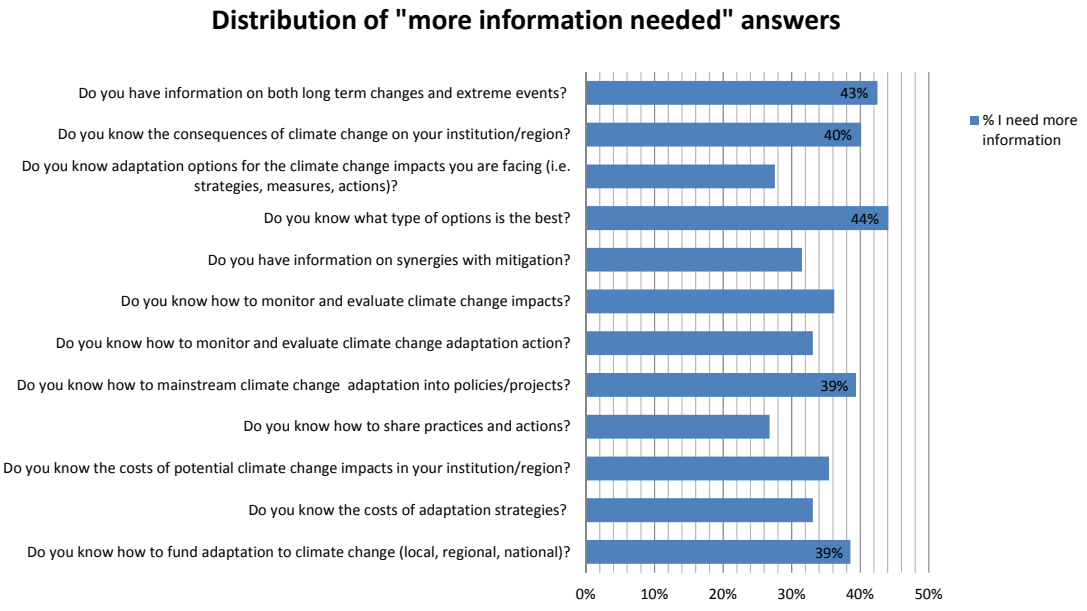

Fig. 4 Stated information interest: fraction of answers stating "I need more information" for selected questions

However, when asking for the *information interest*, the picture is changing: the respondents had been further asked to state whether they think they need more information on the respective issues. Fig. 4 shows the distribution of the "I need more information" answers for the same set of questions as depicted in Fig. 3. As can be seen, the stated information needs appear on the one hand to be generally smaller, and on the other hand also more balanced, as compared to the stated information gaps, indicating that although some parts of information

are not at hand, they also appear to be perceived as (at least currently) not being needed. Note also that the issues for which additional information needs were stated most frequently do differ from those identified to show the highest information gaps: the highest interest was stated for more information on identifying the "best" adaptation options, followed by information on long-term changes and extreme events, information on consequences of climate change in the respective region, information on mainstreaming of adaptation, and information on funding options for adaptation.

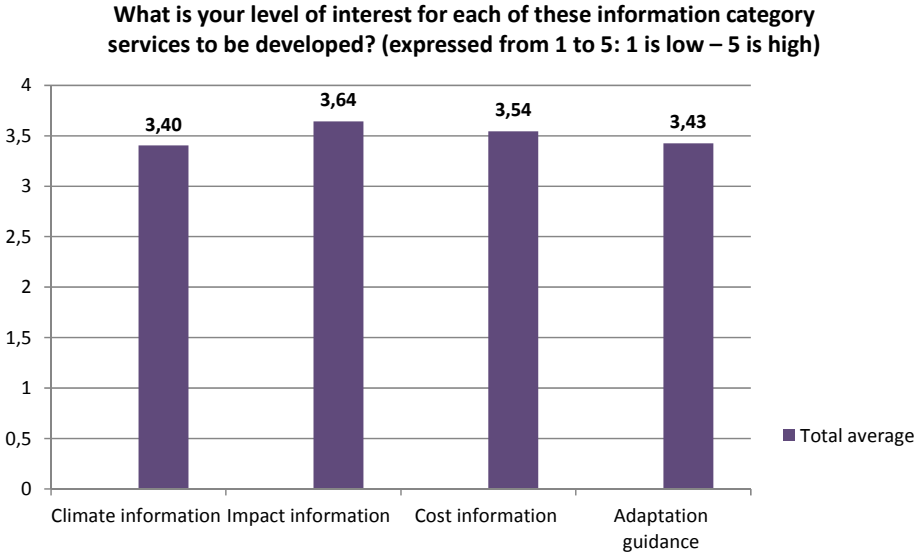

Fig. 5 Average score attributed to information categories to be developed in future services.

This quite balanced impression of expressed information interest is even more apparent in the respondents' ranking of information categories that future information services should develop. The respondents were asked to rank potential information services from 1 (low level of interest) to 5 (high level of interest). As can be seen (Fig. 5), the level of interest expressed for climate information, impact information, cost information, and adaptation guidance is almost equal, with all values in average between an interest level of 3 and 4.

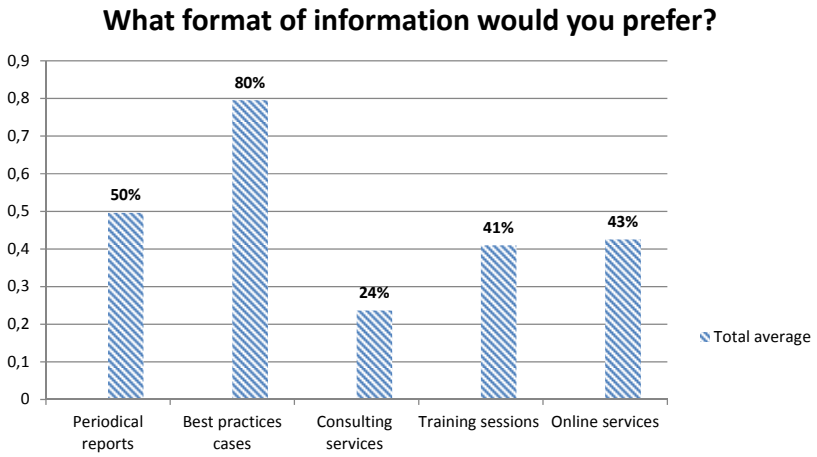

Fig. 6 Distribution of preferred formats of information

Further, the respondents were asked to identify preferred formats of information by choosing from periodical reports, best practices cases, consulting services, training sessions, and online services (multiple selections possible). While consulting services were ranked lowest, the respondents showed a remarkably high interest in best practice cases (80%, Fig. 6). Note also that despite the increasing efforts that have been put in developing

web-based adaptation information services over recent years, only 43% of the respondents did select online services as a preferred information format.

4 Discussion and conclusions

Besides the persistent overall challenge of appropriately providing all information needed by specific actors in order to effectively adapt to climate change, the results of the survey indicate additional challenges with respect to designing appropriate adaption service offers on local as well as on other levels.

First, gathering a clear and concise overall picture of existing adaptation information needs remains difficult. As pointed out in sec. 3, potential biases can occur on several stages. E.g., in our work an unavoidable bias was introduced by the need to base on previously established networks, which resulted in a sample with imbalanced representativeness of respondents. Further, due to the given timing and resource constraints, we were not always able to conduct face-to-face interviews that might have added to further clarifications. As a consequence it can not be ruled out that approaches like the one followed here might cover only a subset of a much broader universe of potential participants, or that the methods used for interviewing do not always allow to pinpoint all information needs of participants. The latter impression was confirmed by feedback of participants claiming that the structured approach followed to elaborate the questionnaire was not always easily understood. Timing constraints, the available networks of contacts, language issues, different levels of background and of familiarity with scientific approaches towards framing of adaptation, as well as different situations in individual regions or countries can all contribute to a blurred or distorted picture when trying the stocktaking of adaptation needs. These potential distortions need to be carefully identified and taken into account when designing adaptation services.

Second, while the challenge of avoiding information gathering biases can be reduced, given time and resources, there are additional aspects that overshadow the identification of information needs for adaptation that are not likely to be easily overcome. These aspects relate on the one hand to the complexity and unclarity of problems associated with the challenge of adaptation (e.g., adaptation to what? what is adaptation?). On the other hand it can not be ruled out that the climate change threat still is not yet perceived as pressing enough for „real“ and specific adaptation-information necessities to be noted. Accordingly, respondents might already perceive different levels of information gaps with respect to the different aspects of adaptation (Fig. 3), yet when asked whether a particular type of information would be useful, they might not refrain from saying yes (Fig. 4). However, this does not mean that actors cannot prioritize which information is more useful for adaptation. Instead, we argue that, in the current stage, for many actors adaptation still might be an intangible problem for which access to diverse types of information (even if potentially redundant or proofed unnecessary in the future) is favored. As well, it should be taken into account that scientific approaches to frame adaptation do not necessarily match given mental models or need perceptions of practitioners. With the evolution of the threats posed by climate change it can be speculated that the challenge of adaptation will become better defined and, as a consequence, that needs on information will become clearer. However, it remains a central challenge to stimulate the identification of information needs on adaptation timely ahead of potential climate change impacts.

Third, although obviously a promising approach, providing appropriate online access to information on adaptation remains a challenge as well. Although an increasing number of web-enabled applications in this context is being developed, less than half of our respondents have ranked such services as a preferred information format (Fig. 6). This might be surprising given the potential advantages of web-based information access (which in principle can be for the users both inexpensive and ubiquitous), and points to the need for further improvements of such services for adaptation. Systematic evaluations of the efficiency of available online information offers in this context are as yet largely missing. We would argue that, despite all efforts made over the last decade, this type of information access is still largely in its infancy, compared to already well-established web-based services like, e.g., online accessible libraries or weather forecast services. This is also reflected in the fact that web based applications in the climate change information context as yet come with

quite heterogeneous user interfaces, which might introduce usability problems and hamper information access [43]. However, the expressed high interest in best practice cases (Fig. 6) as preferred information format indicates potential for improvement of existing and future online adaptation services. While various applications already provide collections of case studies, the overall offer is as yet fragmented, leaving the user with the time consuming task of identifying, compiling and distilling relevant information. Improvements with respect to (1) more consistent case study descriptions and online access interfaces, (2) an active monitoring of adaptation activities, and (3) regularly updated content, could contribute to improve the overall information offer of future adaptation services.

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