



Stakeholders' Perceptions of Climate Change in the Baltic Sea Region

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Abstract

The project “Developing Policies & Adaptation Strategies to Climate Change in the Baltic Sea Region” (AS-TRA) assesses regional vulnerabilities to climate change and aims for developing adaptation options. To determine whether the participating municipalities are prepared to climate change, this study investigates stakeholder perspectives and knowledge in multiple case studies. Based on a qualitative survey, institutions perceived to be relevant as well as climate change impacts and exposure units were collected, which mainly relate to the urban area, the natural environment and economic sectors. Institutional failures are identified. While factors constraining adaptation are found more on the local level, enabling factors are seen at higher levels. Most importantly, climate change is not a priority issue on the municipal level. Respondents have difficulties in identifying concrete susceptibilities and response options, leaving the impression that many municipalities are not prepared to climate change. This is due to uncertainties, but also to missing frames of reference, indicating that many municipalities are only in a stage of “pre-learning”. Therefore, as confirmed by stakeholder opinions, current priorities should be given to knowledge transfer and communication processes. The study further indicates that most actions happen on the mitigation part. This contradicts state-of-the-art theory on adaptation such that the study gives impulses for future research.

1 Introduction

Climate change is a global problem with potential varying regional impacts. It is widely accepted that anthropogenic climate change is a fact and that even strict mitigation efforts will not be sufficient to avoid significant impacts of climate change (e.g. IPCC 2007A). It is therefore urgent to complement measures against the causes of climate change with measures that reduce its consequences (e.g. STERN 2006, PIELKE ET AL. 2007). The latter domain of activity – coherent adaptation measures – is yet of minor importance in the global context of climate change foci, e.g. in the Kyoto Protocol. Strong difficulties exist in the attribution of specific weather related events to climate change. River floods, storm floods, droughts etc. occur in many world regions in varying intervals and magnitudes; and depending on a nations' administrative- and infrastructure, on economic prosperity, on population distribution, and on other factors of influence there might be already institutionalized management structures to adapt to those singular events. Every country has particular experiences with natural hazards and therewith different emphasis on impacts and action.

This study explores whether communities and regions in the Baltic Sea Region (BSR) are prepared to adapt to climate change. The paper first investigates what theories might suggest and then tests this expectation with a study of stakeholders' views. Knowing to what extent municipalities in the Baltic Sea Region's coastal zones are capable to face the challenge of climate change is essential. The most vulnerable settlements are generally those in coastal plains, which are exposed to land loss and coastal erosion. In Europe, anticipated future impacts include more frequent coastal flooding due to sea-level rise and storminess (IPCC 2007B). For the North Sea coast an intensification of storm surges is expected by the end of the century (WOTH ET AL. 2006); for the Southeastern North Sea scenarios and

models show “that extreme wave heights may increase by up to 30 cm [...] by 2085” (WEISSE & GRABEMANN 2007). Previous projections on global mean sea level rise in the IPCC Third Assessment Report (IPCC 2001) were lower than the actual rise and therewith underestimated the change and “a rise of over 1 m by 2100 for strong warming scenarios cannot be ruled out” (RAHMSTORF 2007). The coastal zone deserves special attention, also because of its density of urban areas and its economic and social functions. Worldwide 352 million people (or 13 %) live in coastal urban areas less the 10 metres above sea level (MCGRANAHAN ET AL. 2007).

In cities, the highly condensed co-existence of production, innovation, consumption and living offers advantages due to economies of scale. On the other hand, urban areas are centres of unique resource use, demand for status consumption, enormous emissions, and exposure units to extreme events where high densities of assets are concentrated. One of the future challenges is to develop and utilize the enormous potential of cities for both mitigation and adaptation policies. First attempts of cities to exchange experiences and join forces, like the European based Climate Alliance¹, are promising first steps.

A similar effort, the INTERREG III B project “Developing Policies & Adaptation Strategies to Climate Change in the Baltic Sea Region” (ASTRA)² is the background for the current study. It involves case study regions in Finland, Latvia, Estonia, Lithuania, Poland and Germany. The project focuses on adaptation at the local level, since many impacts occur within a specific context such that particular actions are needed locally, although they are imbedded in institutional frameworks on higher levels, which are essential “in the context of overlapping social, economic, political and physical spaces” (ENGELS & MOSS 2003). The aim of the ASTRA project is to raise awareness of ongoing climate change, and to develop transboundary and coherent adaptation policies. The connective element between climate change impact and adequate adaptation policies is a vulnerability assessment; vulnerability assessments can identify lots of necessary actions and improve the compliance of unpopular strategies or decisions (for example see KROPP ET AL. 2006). There is a need for synopsis of results to initialize learning processes between involved stakeholders as well as a need for jointly analysing sensitivity and adaptive capacity to identify vulnerabilities.

By *mitigation* the IPCC means all efforts to reduce or avoid climate change from its causes, in particular by reducing greenhouse gas (GHG) emissions. In contrast, *adaptation* refers to adjustments in social behaviour (including, e.g. improvement of flood defense infrastructure) to reduce adverse consequences associated with climate change (SMIT ET AL. 2000).

In this paper we try to answer, based on this distinction, how the state of affairs with respect to adaptation to climate change is in municipalities in the BSR. Before presenting the empirical study we might wonder what outcome available theories might suggest. When it comes to comparing both types of response options, it is often stated that mitigation requires long-term and joint global efforts, since GHG emissions are easily distributed globally into the atmosphere. Adaptation activities are likely to be concentrated on local level, where potential impacts occur (e.g. extreme weather) and where direct or short-term answers are needed (IPCC 1997, KLEIN ET AL. 2005). Economic analysis typically classifies mitigation as a contribution to a global public good, meaning that its benefits are not subtracted by its „use“ and that no actor can be excluded from these benefits. In this terminology adaptation contributes to a private good in the sense that only those who adapt benefit from their effort (KANE & SHOGREN 2000). From this it can be concluded, that in absence of a strong institutional framework there is no incentive to mitigate because the costs of such activities are solely borne by the mitigating actors, while the benefits are distributed globally. If many actors mitigate, there is an incentive to be more reluctant in this respect due to the free-rider problem. It is a further common place in the climate change community that adaptation occurs on another spatial scale than mitigation.

¹ <http://www.klimabuendnis.org>

² <http://www.astra-project.org>

All these arguments suggest that adaptation is more likely to be observed on the local level than mitigation – as adaptation is a rather short-term answer on impacts with direct benefits or avoidance of (further) damage. Since in this study municipalities are chosen as focus of investigation, we will verify whether this expectation is valid for the Baltic Sea Region. This requires identifying concrete action already going on, an understanding of current knowledge levels and institutional arrangements. Environmental institutions or authorities, e.g. responsible for flood protection, have different nation-based structures and responsibilities. Decision-making mostly is based upon a specific spatial hierarchy of the organizational structure – national, regional or local. The manner of organization of institutions and the inter-institutional communication is fundamental for flexibility respective to changing environmental conditions linked to climate change. It is thus important to know whether these existing institutions and their organizational structures are adequate to deal with diverse and modified incidence of climate change impacts.

Environmental problems often trigger “*policy-driven forms of institutional change*” as “*expressions of earlier learning processes*” (ENGELS & MOSS 2003). Those “*earlier learning processes*” are condensed small-scale experiences or problem perceptions which can become part of more generalised policies.

First impressions, perceptions, and (not yet well-structured) knowledge on the exposure to climate change impacts on small spatial or sectoral scale constitute the basis for further reflection and learning. This could lead to a more specific collection of data and experience as the input for advanced learning processes. In this regard we refer to “pre-learning” as a precondition of the creation of adequate adaptation strategies. “Pre-learning” represents a preliminary stage of knowledge generation, and creates conceptual frames as basis for knowledge construction – which constitutes the causal chain of a learning process.

Learning determines institutional capacity building and can help to “*to improve the quality of scientific assessments for addressing [...]*” impacts of climate change (SIEBENHÜNER 2003). “*Many environmental problems cannot be understood if they are analysed at one isolated scale only. Accordingly, searching for institutional innovations to address these problems mostly involves the complex interplay of different scales*”. Communication structures on local scale “*support competence building [...]*” while “*bringing together relevant expert and local knowledge [...] and “entails a feedback process in which the bearers and/or addressees of institutions assess the past impact of institutional arrangements and adapt their own actions accordingly”*” (ENGELS & MOSS 2003). This can be supported by adequate training and communication tools (for an example see RECKIEN & EISENACK 2007).

A first step for the development of adequate instruments for institutional learning would be the evaluation of the institutional perception of climate change. Stakeholder dialogues and/or questioning can provide substantial information on the respective status-quo of administrative duties, functions and lacks concerning climate change issues. “*Environmental problems or environmental institutions thus cannot be treated in isolation; they are bound up with other policy fields*”. The transboundary exchange of concrete experience in the climate change context, where the ASTRA project is an example for, seems to be an appropriate next step. “[...] *environmental problems [...] require policy solutions not just at the international or national levels but in particular at regional and local levels*” (ENGELS & MOSS 2003).

In this paper we present a qualitative assessment of local stakeholder views on climate change adaptation, including perceived impacts, exposure units, actual or potential responses as well as constraining and supporting factors for adaptation policy. The study does not only reveal priorities of the respondents, but also their problem framing and knowledge level. In the next section the methodological approach of the study is introduced. Then the main results on concrete stakeholder knowledge are presented, culminating in a more abstract assessment of stakeholder frames. This provides the basis

for the main conclusions, which are related back to the theoretical discussion of the introduction. Finally, we suggest lines for further research and for action on the municipal level.

2 Methodology

The study is based on a qualitative research design, which takes advantage from a modified grounded theory approach. It was designed for multiple purposes. The main objective is to pave the ground for the development of adaptation strategies by assessing the state-of-the-art in local climate protection, stakeholder framing and knowledge on climate change. It should also identify basic adaptation needs in the BSR in an explorative style to formulate working hypotheses that can guide further scientific work.

The assessment of stakeholder views and framing is important for multiple reasons. It has to be expected that there is a very diverse knowledge about climate change impacts, about adaptation and mitigation strategies, and about the certainty of climate projections. Assessing this knowledge gives an overview where to start from with the developments of new instruments and with the provision of information to the stakeholder partners. More basically, the case study screening should reveal how stakeholders perceive the issue of climate change. This is deeply related to problem awareness, but is also a pre-requisite to initialize adequate learning processes and to assess whether municipalities are prepared to adapt. This assessment should reveal how far such processes currently reach, and where they are probably only in a pre-learning stage. If institutions cannot effectively communicate about adaptation to climate change it is not likely that they can engage in related activities. Analyzing perception patterns requires a qualitative approach since scientists' views on adaptation should not be superimposed on stakeholders beforehand.

The knowledge-related objectives aim at discovering views and information of participating stakeholders that cannot be hypothesized by theorists from the onset. This can be due to gaps in current scientific knowledge or different perspectives of scientists and practitioners. This also implies a qualitative approach: the study is intended to describe a broad range of differences in their entirety but not to discover general features common to a representative set of cases. Instead of drawing conclusions from the frequency of certain responses, it is meant to generate hypotheses which lead to further research. The exploration of focal exposure units, responses and policy options is an important input for the selection of common research efforts.

For the same reasons, open interviews with project partners were accounted. However, since for a synopsis it is necessary to produce comparable responses to identify the most urgent climate change adaptation needs and perceptions that are common, a semi-structured questionnaire was developed. Due to the qualitative approach and the embedding of the study in a transdisciplinary research project, the case selection was straightforward by including all participating stakeholders. The questionnaire was distributed via email among 33 project partners. Of these, nine were scientists taking care for particular case studies (which were asked to consult local stakeholders for their responses), the rest being stakeholders from various institutional levels (six national, six regional, 21 local). Some sent it to further stakeholders. Finally, 15 answers were retrieved. The respondents are located in cities (Gdansk, Espoo, Riga, Hamburg, Klaipeda, Kokkola, Neringa, Pärnu, Tallinn, Warnemünde), regional (Salaca River Basin, Pirkanmaa) or national institutions (Swedish Environmental Protection Agency, Estonia). The respondents were encouraged to answer the questions shortly and rapidly due to two reasons: (i) time requirements for respondents should be low to have a fast and efficient follow-up; (ii) rapid answers increase the likelihood to reveal problem frames or otherwise hidden assumptions.

The conceptual base of the questionnaire was developed from Environmental Impact Assessment (EIA) and the DPSIR (Driver – Pressure – State – Impact – Response) Framework (OECD 1993, EEA 1999). Although this approach is criticised for several reasons, it offers a relatively easy accessible and established terminology. Put into this framework, climate change refers to changes of the *state* of

average of meteorological properties (e.g. temperature, precipitation). This is distinguished from *impacts*, being the consequences of a changing climate state influencing society and the environment (people, species, institutions, businesses etc.). All that can be potentially affected by impacts is subsumed under the term *exposure unit* (e.g. people, species, economic sectors, infrastructure, ecosystems, places, institutions, firms and organizations). *Responses* are planning procedures, policy options and other societal reactions to impacts and climate change. This easy conceptual base was likely to be picked up in the respondents' answers. In contrast, the terms 'adaptation' and 'mitigation' were only mentioned in the cover letter. It was interesting to know whether respondents will use these terms or are aware of this distinction.

The first block of questions focuses on the impacts stakeholders find likely and the exposure units that are affected to their opinion. The second block assessed already existing (or potential) responses. This was complemented with questions related to more general policy objectives, to supporting and to constraining factors. The latter concepts are modified versions from the SWOT method in policy analysis (e.g. HOUBEN ET AL. 1999), which establishes opportunities and threats for proposed policy instruments. To ask for constraints and supporters aims at identifying basic strategic conditions that have to be taken into account for the development of adaptation strategies. A final block gave the opportunity to deliver background information of the case study areas³.

The evaluation of the retrieved questionnaire was technically implemented by using the coding software atlas.ti⁴, which iteratively produces a data base of quotes from the questionnaire which are linked to codes developed during analyzing the responses. This qualitative approach based on grounded theory (e.g. STRAUSS AND CORBIN 1990). In our context, such methods are necessary to make a potentially incommensurable variety of problem patterns and responses comparable on an adequate level of abstraction (EISENACK ET AL. 2006, 2007). The coding procedure was modified not to be completely open, in particular because the semi-structured questions give first structural pre-qualifications, and to cluster the large number of codes using the following abstract categories:

- Built environment (to code exposure units)
- Natural environment (to code exposure units)
- Economic sectors (to code exposure units, constraints or supporters)
- Actors and institutions (to code exposure units, constraints, supporters or responses)
- Impacts and States.

3 Results

Institutions, Impact and Exposure Units

The foci of the partners and the particularities of the case studies are very diverse.⁵ The responses provide a broad set of institutions somehow relevant for climate change, collected from the answers related to exposure units, responses, constraints and supporters. In the final coding system institutions, actors and instruments are not distinguished. From the theoretical viewpoint, institutions are only the rules of behaviour, such that e.g. a planning office (an actor) has to obtain another code than the planning regulations. This distinction would have substantially extended the code book, and the information provided by the respondents is often not sufficient to decide between these options. When we speak of institutions in this section, we also mean actors.

³ See EISENACK AND KROPP (2006) for the questionnaire and the email letter to the interviewees.

⁴ <http://www.atlasti.com>.

⁵ For complete list of codes and quotes consult the technical report under <http://www.pik-potsdam.de/~eisenack/downloads/CSreport-fd.pdf>

Institutions are mainly described in general terms. Only a small number are particular local arrangements or specific actors which could or should be taken into account if adaptation strategies are to be implemented in singular case study regions. The variety of institutions can be systematized along several dimensions. One obvious is the scale, where the local, regional, national, European and international level are distinguished. The institutions mentioned in the questionnaire are summarized in *Table 1*.

Table 1: Selected institutions collected from the responses.

| Level | Institution |
|------------------------------|--|
| Local | Local administration, authorities and sectoral departments (e.g. construction, environment, development, coast), local climate strategy |
| Local and/or regional | Planning in general (instruments, procedures), sectoral planning departments and utilities (technical, energy, water and transportation infrastructure, coastal protection), rescue services, building restrictions and recommendations, spatial planning (e.g. identification of affected areas, protection of areas, retention areas, legal and economic responsibilities), county administration, regional authorities, committees (crisis, investigation), port authorities, environmental centres |
| National | Ministries (e.g. environment, building and regional development, forestry, trade and industry, transport and communication), national environmental protection agency, national strategies (coastal protection, adaptation, mitigation, promotion of renewable energies), national environmental objectives |
| Local to national | Compensation of losses, politicians and political parties, strategies for coastal management |
| European and global | EU policies, law and research, international pressure |
| Informal | Training, education and knowledge transfer (education of planners and the public, seminars, education system, involvement of science in decision making, availability of relevant information and adaptation research), scientific research, coordination and cooperation (e.g. compilation of planning procedures, coordination between hazard management and planning, communication between scientists, policy makers and administrations), environmental awareness, changing lifestyles, anticipatory instead of reactive planning, inaction |
| Economic sectors | Energy utilities, industry, construction sector, forestry, fishery, water utilities, finance sector (insurance companies, investors), service sector, agriculture, transportation sector, pastoralists, tourism, private households |
| Further mentioned | Investment policies, sustainability targets, climate protections as global business, stakeholder involvement, nature conservation, environmental permission processes, NGOs, local residents and employees |

The broad variety of local to regional institutions may be attributed to the diversity of local institutional settings (independently from climate change issues), but also to the diversity of sectors which are somehow involved. Despite this variety, many codes for institutions are still very general in the sense as being easily transferable between cases (see *Tab. 1*) or too unspecific to reveal concrete options or constraints (e.g. “*gaps in legislation*”). This may be interpreted as efforts of most respondents to provide information to “outsiders”, but alternatively as a limited awareness of particular responsibilities, supporting or constraining factors.

Exposure units are roughly characterized in *Tab. 2*. Compared to institutions, the heterogeneity of terms is less broad. Most exposure units are presented in a general way not making reference to local particularities. The view on the economic sectors is mostly generalized, e.g. no particular firms are mentioned. It may be that these exposure units are not derived from local experience, but by causal reasoning from the mentioned impacts. In many cases, they are only provided in a very unspecific way (e.g. “*ecosystems*”, “*economy*”, “*economic losses*”, “*companies*”, etc.), one extreme example being “*all sectors and activities*”. This leaves the impression that exposure units were phrased not with particular local problems or experience in mind, but from causal reasoning or lay knowledge. It must be assumed that stakeholder intuitions about exposure units are not well-developed in many cases.

Table 2: Selected exposure units collected from the responses.

| | Exposure Unit |
|--|--|
| Built environment | Buildings and urban area in general, in particular buildings near the shore, cultural heritage, heating (energy demand depending on temperatures and housing conditions), infrastructure (shore infrastructure, water supply systems, coastal protection, communication, transportation and technical infrastructure, waste dumps) |
| Natural environment | Ecosystems in general, in particular coastal ecosystems, beaches, shoe meadows, municipal parks, rivers |
| Economic sectors | Economic and material losses in general, tourism, forestry, transportation (roads, sea transport, ports, airports), energy utilities (transmission lines, hydro power, renewable energies, demand for heating energy), agriculture, fishery, industry, water utilities (groundwater, water supply) |
| Institutions and further actors | Inhabitants and private households, public health, coastal management authorities, local administration (and local budgets), spatial planning authorities |

The list of impacts collected from the questionnaire is relatively small compared to the other lists. This may be caused by a relatively limited amount of distinguishable weather events of climatic stresses. However, some of them refer to very specific impacts, indicating that respondents might have concrete ideas or experience in mind. On the other hand, not all mentioned impacts are related to climate change. It is also not straightforward to disentangle impacts from changes in the climatic conditions. Many respondents phrased them in a way that does not allow for disjointed categories. We distinguish the impacts by their relation to climatic or physical variables (see *Tab. 3*).

Table 3: Climate change impacts collected from the responses.

| Climatic condition | Collection of impacts | |
|---|---|--|
| Temperature | Increasing temperatures "less frequency of winter frost", "mild weather in winter", "less cold winters", "winter is shorter", "increasing of summer temperature" | Extreme temperature events "heat waves", "increasing temperature of sea water", "decrease in sea ice cover" |
| Precipitation | Overall increase "more water in reservoirs", "changed water supply", "heavy rainfalls", "increases in winter", "decrease in summer" | |
| Temperature and precipitation | Droughts, changing growth conditions "lengthening of growing season", "overwintering of plants is harder"; less snow | |
| Temperature, wind and precipitation | Changes in winter humidity and summer aridity; eutrophication "shift in nutrient loads", "public health" | |
| Wind | Storms "more frequent and stronger storms", "thunderstorms", "hurricanes" | |
| Sea level | Loss of land | |
| Sea level and precipitation | River floods "flash floods", "changes of [groundwater] salinity" | |
| Sea level, wind and waves | Storm surges "height and frequency of storm tides" | |
| Sea level, wind, precipitation and waves | Erosion "coastal erosion", "land slides" | |

The collected institutions were more closely refined by distinguishing those which are estimated as constraining or supporting adaptation policies (see *Tab. 4* and *Tab. 5*).

Table 4: Selected constraining factors collected from the responses.

| Level | Selected constraints |
|-----------------------|---|
| Local | "local interests are more important than global" |
| Local and/or regional | "it is necessary to work out recommendations on building, measures and recommendations on construction of buildings to prevent heavy consequences of storm", "deficiencies and mistakes of operating of crisis-committee and its divisions" |
| National | "national policies [...] inadequate responses to the threats of climate change", "gaps in legislation [...] different interpretation of what is allowed or what is not" |
| Local to national | "lack of finances (climate change is not a priority in many cases)", "lack of human resources and knowledge", "weak integrated coastal zone management" |
| Informal | "lack of relevant information", "uncertainty of research results on the issue of climate change provides uncertainties in the discussions for investments in better infrastructure", "vulnerability of different economy sectors, social sectors, ecosystems for climate change is not fully evaluated" |
| Economic sectors | "business on county and local authority level (i.e. opposition against building restrictions)", "interest of buildings near streams and lakes", "fishers", "insufficient insurances", "unions of industry, agriculture and employees" |
| Further | "problems related to development of democratic society", "spatial development planning system itself is at the development phase that means frequent alterations in legislation", "missing strategy of development" |

Some constraints advert at local interactions between various actors which may hinder the implementation of adaptation policies (e.g. "opposition against building restrictions", "interest of buildings near streams", "unions of industry, agriculture and employees"). Others confirm the observation that climate change is currently not a priority issue on the local or regional level (e.g. "climate change is not a priority", "lack of human resources and knowledge", "strained municipal budgets"). Finally, some constraints seem to be related to the specific situation of new EU member states.

However, as discussed above in the general part about actors and institutions, there is a wide variety of informal institutions. This may also be attributed to the current state of local adaptation policies, namely that they are in most cases not in the implementation phase, but at a stage at which the mere necessity of such policies has to be established. It may also be more deeply rooted as a kind of non-explicit and difficult to resolve barrier to communicate about adaptation options. This hypothesis is confirmed by the fact that also formal institutions on various scales are described in a vague way (e.g. "national policies [...] inadequate responses to the threats of climate change").

We make similar observations on the supporting side, but there are also some exceptions of relatively concrete (strategic) supporters (e.g. "coastal protection authorities"), in particular on the economic side (e.g. "Swiss Re, Shell"), which may partially be related to sectors being potential exposure units (e.g. tourism, transport, "refinery"). Most explicit and formal institutions are related to mitigation measures (e.g. "the objective to reduce the emissions", "supra national pressure"), in contrast to that adaptation related supporters are integrated in other policy sectors (hazard management, coastal protection, spatial planning, environmental objectives).

Table 5: Selected supporting factors collected from the responses.

| Level | Selected supporters |
|------------------------------|--|
| Local | "city of [...] office" |
| Local and/or regional | "local planning instruments", "compilation of territorial planning process [...] reducing conflicts between different interest groups", "upgrading of meteorological, hydrological, rescue etc. services", "the status of the National Park helps to release the environmental initiatives" |
| National | "state government", "national environmental objectives", "adaptation: support (financial, information) from the federal level", "the objective to reduce the emissions" |
| Local to national | "political parties in national level"; "coastal protection authorities" |
| Informal | "academic and research institutions", "international recognition of climate change impact importance and need of its mitigation", "visible and tangible impact of climate change can strengthen public attention and pressure on decision-makers", "improvement of education system, particularly for the people involved in planning and making decisions", "efficient regional and global cooperation" |
| Economic sectors | "high oil prices", "engagement of multinational companies (Swiss Re, Shell)", "tourist sector"; "fishers", "possibility to minimise losses caused by storms stimulates investments of harbour". |
| Further | "active work of NGOs", "financial support on the same [EU] level", "mitigation: supra national pressure". |

The comparison of constraining and supporting factors indicates that problems are more found on the local scale, while enabling forces are more biased to higher levels. It is likely that there is a shift of responsibilities to higher institutional scales. Several reasons may explain this:

- (1) Since most respondents are situated on the local level, they are more familiar with the local problems while from higher level preferably positive influences are noticed.
- (2) Constrained municipal budgets, limited human resources on the local level and the high degree of capacity needed for climate related issues hinder implementation, while resources, frame law and information from the national or European level have a positive impact.
- (3) Local conflicts of interest and a closer relation between local administration and their electorates favor myopic compromises where long-term goals and challenges are given low priority.

It can also be observed that the diversity for supporters is lower than for constraints. The positive side is that supporters are perceived a little more concretely, but it can also be interpreted as a pessimistic view on the chances to implement climate change policies on the local level.

Problem Framing

From these above observations on institutions, impacts and exposure units, conclusions about the problem framing of the respondents can be drawn. General problem awareness about climate change is primarily framed by the potential impacts that may affect the case study regions. However, on the local level there is little attention for vulnerable exposure units and to policy responses. This is supported by the observation that many institutions mentioned are not specifically aligned (e.g. "local government"), rather vague (e.g. "politicians") or informal (e.g. "necessity of cooperation on the regional or national level"). This conclusion is further confirmed by the very generalized notions of exposure units used by the interviewees (e.g. "economy"). In this regard it must be assumed that stakeholder intuitions are still very vague when it comes to local exposure units, while there is enough tacit knowledge and attention to formulate vulnerable sectors in an abstract way. In other words, there seems to be little concrete knowledge about whom or what is potentially affected by climate change. Otherwise such actors or institutions were likely to be constituents of arrangements which promote awareness raising or adaptation strategies. Other policy sectors strongly compete with climate change as a field of public decision making. On the other hand, it cannot be stated that there is no problem awareness. The concrete and specific description of various potential impacts of climate change indicates that respondents have devoted substantial degrees of attention towards this issue. It would also

be wrong to claim that there is little done. However, if we conclude that most existing adaptation policies are integrated in other policy sectors, e.g. hazard management and coastal protection, this is in line with the observation that the challenges of these sectors are often not perceived as awareness to climate change per se.

Climate change is mainly seen as mitigation problem, while adaptation issues are vague, unclear or difficult to structure. While questions relating to constraints and supporters typically produce informal institutions, many more formal ones relate to mitigation measures (e.g. “*promotion of renewable energies*”) or the national level (e.g. “*the objective to reduce the emissions*”). The latter is, again, associated with greenhouse gas mitigation strategies, renewable energies and international commitments. As discussed above, adaptation strategies are mainly put in less concrete terms or integrated into other policy sectors. There seems to be little strategic knowledge on actors and institutions that support or constrain adaptation to climate change. The questionnaires provide only a small number of institutions which are particular local arrangements or specific local actors which could or should be taken into account if adaptation strategies are to be implemented. It may be necessary to get a more concrete perspective on local exposure units, actors and institutional arrangements, to disentangle and structure the implementation problems of adaptation policies.

To sum up, except the problem awareness framed in terms of mitigation measures, primal attention is paid to climate change in the form of known or imagined impacts and of complaints about “soft factors” as missing knowledge, inaction and bad coordination.

4 Discussion

This paper started from the question whether the institutional capacities of local communities are adequate for adaptation to climate change. Based on established general economic considerations and on the spatial, institutional and temporal scales of climate protection, we argued for the expectation that on the local level incentives and needs for adaptation are better established than mitigation policies. This would suggest that local institutions are well prepared for the former, entailing that there is broad knowledge about potential responses. Were this is not available, in particular due to the hard uncertainties on future climate conditions, at least well-developed communication and learning processes should be in place.

The qualitative analysis of the email questionnaires showed that the opposite is the case. The most concrete options provided by the respondents relate to *mitigation* of climate change. While there are relatively concrete ideas about potential impacts of climate change, knowledge about exposure units is vague. Many response options are only vague or relate to soft instruments related to education and communication. This is in line with other assessments for the case study areas (HAANPÄÄ ET AL. 2006, HAANPÄÄ & PELTONEN 2007, TALOCKAITE 2007). The difficulties in describing concrete supporting and constraining factors underline that adaptation is currently only framed vaguely. Although there is a “kernel” of basic problem awareness, mainly related to potential impacts and international mitigation policies, little is done in concrete terms. These results provide strong doubts whether coastal municipalities are prepared to react adequately to the challenges of climate change.

Since this contradicts the initial expectations it is worth speculating about reasons that explain the shortcomings of the theoretical arguments in the introduction. This should provide insights about political consequences and can help guiding future research. In the following we formulate three hypotheses about obstacles and chances for the development and implementation of adaptation policies on the local level.

(1) Adaptation is more difficult and complex than mitigation. Standard economic analysis may ignore subtleties such as the fact that also mitigation measures have to be implemented locally (e.g. thermal insulation of public buildings), that adaptation can be a public good (e.g. improving road infrastructure safety against extreme events), and that strong adaptation efforts of one actor may strategi-

cally increase the need for adaptation of other actors. Moreover, there may be higher (social) entry costs for adaptation to climate change, involving extensive efforts in capacity building, as the following argument suggests. Mitigation is connected to emission reduction of greenhouse gases to avoid further atmospheric concentrations and to enhance sinks. Therewith associated are techniques for e.g. low-emission energy production. Such options are quite common and there is wide-spread knowledge. The network of involved actors, in particular energy utilities, is more simply structured than those involved in adaptation, since the latter is (to more or less degree) relevant in all social, political and economic sectors. While many actors important for GHG mitigation are powerful and can make qualified or expensive organizational and engineering investments, a lot of small and heterogeneous actors which have to decide whether and how to adapt don't have this capacity (KLEIN ET AL 2005). Also coordination efforts in a very complex web of exposure units may be more expensive than on the mitigation side. Finding adequate solutions or coping strategies for multiple interconnected sectors on small and larger scales or spatial units entails heterogeneous targets. More generally impacts of climate change cause a wide range of concomitant effects which are not always connected with particular impact in an obvious way. *"The science of adaptation is still in its infancy"* (KLEIN ET AL 2005). Finally, mitigation does not have a short-term effect on atmospheric concentration of GHG's, long-term strategies due to the inertia of the earth's climate system are necessary. This is usually provided as an argument in favour of adaptation strategies that necessary (and beneficial) short-term reactions to extreme weather events as well as to mid-term reactions when it comes to e.g. sea level rise. Short-term decisions require strong commitments, while for long-term targets actions can be easily postponed. This, however, can make mitigation the more "convenient" option on the political agenda.

(2) The structure of local institutions relevant for climate change adaptation hinders adequate learning. As far as adaptation on the local or regional scale is concerned, many sectoral policies and institutions are affected by changing climatic conditions, e.g. when spatial planning considers risk levels for certain places or administrative bodies are responsible for flood protection. Also private organizations as producers associations may observe current or future impacts of climate change, independently of whether they perceive these changes as caused by changed climatic conditions. Within such organizations there is a need for adequate learning in the sense that they need to adjust institutionalized decision-making and information-providing procedures to the necessary degree in an appropriate way. If there is no adequate learning this may be caused by inflexible institutional structures. For example, certain fields of adaptation can stay beyond established responsibilities, and for changed requirements new responsibilities might become necessary. This is hindered if their establishment contradicts other existing procedures (e.g. legal constraints) or invites for shifting them between different organizations. It may also be that although the need for change is clearly perceived on the lowest level (e.g. by harbour officials or farmers), there are no communication channels to those institutional levels that could take action, while the latter don't perceive the problem.

(3) The current framing of climate protection hinders adaptation. The political communication of the need of an adequate adaptive management depends i.a. on the willingness and credibility of political actors and the availability of comprehensive and tangible options. For agenda-setting as societal responses, decision makers must be able to frame the issue in a way to understand vulnerabilities to climate change. This is a pre-requisite for the development of appropriate measures including quantitative and qualitative decision tools. However, the public discourse on "climate change" in the recent years concentrated mainly on the causes of atmospheric concentration of greenhouse gases and their impacts for the earth's climate system. Further reasons may have shaped this framing. First, the difficulties of adaptation outline in hypothesis (1), in particular that pathways to mitigate are much clearer (e.g. technical options to lower CO₂-emissions are at hand, the media informs comprehensively about mitigation options; those options offer short- and long-term economic opportunities). This eases the communication of targets and decision-making with respect to mitigation due to a positive public image. In contrast, established regional scenarios and estimates of potential impacts and losses are not easily available. Second, giving mitigation a higher priority may be more close to the public expression of justice that the causers of damages are responsible for action (as the success of the "polluter

pays principle” shows). Third, all countries have more or less well-rehearsed routines to deal with the impacts of climatic or weather-related events (e.g. flood protection). National (government) authorities dealing with the impacts and responsible for e.g. compensatory measures are very diverse not only in their institutional configuration and vertical or horizontal hierarchies but as well in their embeddedness in national policies. In this respect, reducing damages from extreme weather events is not captured by a “climate frame”, but a “hazard frame”. Adaptation therewith is not “new” but confronted with new exposures and the need of bundling functions and therewith to generalize adaptation options for more effectiveness and exchange of experiences. Fourth, the need to discuss adaptation to climate change is more difficult to establish when other structural problems are urgent (e.g. high rate of unemployment). Finally, urban actor networks may hinder adequate urban planning (cf. RECKIEN AND EISENACK 2007), and power elites may be able to prevent adaptation from being put on the agenda (HARDING 1995).

All three hypotheses confirm the opinion of many stakeholders in this study: There is currently a major need for “soft” instruments related to awareness raising, education and communication efforts, to provide local actors with the capacity to structure their perceptions, to clearly talk about the challenge and to set the agenda (3), to assign adequate responsibilities and to make relevant knowledge available (2), and to disentangle the complexities of adaptation (1).

The current situation may be characterized as being on the threshold between a “pre-learning” and a learning phase of the involved institutions - an intermediate period between recognition of the scope of the problem and steps towards more concrete policy frames. Whether or how this threshold is passed is likely to depend on the next actions to take.

5 Conclusion

The study suggests that besides awareness raising and coordinative efforts it may be important how local and national institutional levels interact such that the supportive capacity of higher levels is complemented with detailed knowledge from lower levels. Due to local capacity limits it may be helpful to enhance adaptive capacity by supplying regional and local authorities with an appropriate mix of information, education, obligations and resources. In addition it would be valuable to enhance the strategic awareness of local actors on how to overcome reservations against adaptation measures. For that actual or potential links to key players that can be activated to promote adaptation should be identified. This could change the situation by providing new strategies and opportunities. Joint work of scientists and stakeholders may help putting attention to exposure units and adaptation issues, contributing to a shift in thinking to deal adequately with uncertainties.

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References

- EEA (1999): Environmental indicators: typology and overview. Technical Report No. 25.
- Eisenack, K. & J. Kropp (2006): Regional stakeholder perceptions of climate change: Baltic case study screening, ASTRA technical report, available from <http://www.pik-potsdam.de/~eisenack/downloads/CSSreport-fd.pdf>

- Eisenack, K., M. Lüdeke & J. Kropp (2006): Construction of Archetypes as a Formal Method to Analyze Social-Ecological Systems, Proceedings of the Institutional Dimensions of Global Environmental Change Synthesis Conference, available from <http://www2.bren.ucsb.edu/~idgce/abstracts.php>
- Eisenack, K., M. Lüdeke, G. Petschel-Held, J. Scheffran & J. Kropp (2007): Qualitative Modelling Techniques to Assess Patterns of Global Change, erscheint in J. Kropp und J. Scheffran (Hrg.): Advanced Methods for Decision Making and Risk Management in Sustainability Science, NOVA Science Publishers.
- Engels, A. & T. Moss (2003): Institutional change in Environmental Contexts. In: Breit, H., A. Engels, T. Moss & M. Troja (eds.): How Institutions Change. Perspectives on Social Learning in Global and Local Environmental Contexts. Leske & Budrich, Opladen: 355-356.
- Haanpää, S. & L. Peltonen (2007): Institutional vulnerability of spatial planning systems towards climate change in the BSR, ASTRA technical report.
- Haanpää, S., S. Lehtonen, L. Peltonen & E. Talockaite (2006): Impacts of winter storm Gudrun of 7th-9th January 2005 and measures taken in the Baltic Sea Region, ASTRA technical report, available from www.astra-project.org.
- Harding, A. (1995): Elite theory and growth machines. In: Judge D, Stoker G and Wolman H (eds.): Theories of Urban Politics, Sage, London.
- Houben, G., K. Lenie, et al. (1999): A knowledge-based SWOT-analysis system as an instrument for strategic planning in small and medium sized enterprises." *Decision Support Systems* 26: 125-135.
- IPCC (1997): IPCC Special Report on the Regional Impacts of Climate Change - An Assessment of Vulnerability. Intergovernmental Panel on Climate Change.
- IPCC (2001): Climate Change 2001: The Physical Science Basis, Intergovernmental Panel on Climate Change.
- IPCC (2007a): Climate Change 2007: The Physical Science Basis, Summary for Policymakers, Intergovernmental Panel on Climate Change.
- IPCC (2007b): Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability, Summary for Policymakers, Intergovernmental Panel on Climate Change.
- Kane, S. and J. F. Shogren (2000). Linking adaptation and mitigation in climate change policy. *Climatic Change* 45: 75-102.
- Klein, R.J.T., E.L.F. Schipper & S. Dessai (2005): Integrating mitigation and adaptation into climate and development policy: three research questions. *Environmental Science and Policy*, 8(6): 579-588.
- Kropp, J.P., A. Block, F. Reusswig, K. Zickfeld & J. Schellnhuber (2006): Semiquantitative Assessment of Regional Climate Vulnerability: The North-Rhine Westphalia Study. *Climatic Change* 76: 265-290.
- McGranahan, G., D. Balk & B. Anderson (2007): The rising tide: assessing the risks of climate change and human settlements in low elevation coastal zones. *Environment and Urbanization* 19(1): 17-37.
- OECD (1993): OECD core set of indicators for environmental performance reviews. Environment monographs no. 83, Paris.
- Pielke, R., G. Prins, et al. (2007). Lifting the taboo on adaptation. *Nature* 445(7128): 597-598.
- Rahmstorf, S. (2007): A Semi-Empirical Approach to Projecting Future Sea-Level Rise. *Science* 315(5810): 368-370.
- Reckien, D. & K. Eisenack (2007): Urban sprawl processes: using QuAG to sensitize stakeholders for the interdependencies between actors, submitted to Simulation&Gaming.
- Siebenhüner, B. (2003): Social Learning at the Science-Policy Interface – A Comparison of the IPCC and the Scientific Assessments LRTAP Convention. In: Breit, H., A. Engels, T. Moss & M. Troja (eds.): How Institutions Change. Perspectives on Social Learning in Global and Local Environmental Contexts. Leske & Budrich, Opladen: 325-353.
- Smit, B., I. Burton, R.J.T. Klein & J. Wandel (2000): An Anatomy of Adaptation to Climate Change and Variability, *Climatic Change* 45: 223-251.
- Stern, N. (2006) (ed.): The Economics of Climate Change: The Stern Review, Cambridge University Press, Cambridge.
- Strauss, A. & J. Corbin (1990): Basics of Qualitative Research. Grounded Theory Procedures and Techniques. Sage, Newbury Park.
- Talockaite E (2007): An overview of adaptation strategies for climate change existing in the Baltic Sea Region, ASTRA technical report.
- Von Storch, H. & R. Weisse (2007): Storm climate and related marine hazards in the Northeast Atlantic and the North Sea. http://w3g.gkss.de/staff/storch/pdf/weisse/ices_full_paper.2006.pdf
- Weisse & Grabemann (2007), in prep., cited in Von Storch, H. & R. Weisse (2007).
- Woth, K., R. Weisse & H. von Storch (2006): Dynamical modelling of North Sea storm surge extremes under climate change conditions - an ensemble study. *Ocean Dynamics*, 56: 3-15.