Article

Local Constructions of Vulnerability and Resilience in the Context of Climate Change. A Comparison of Lübeck and Rostock

Gabriela B. Christmann [1],*, Karsten Balgar [2] and Nicole Mahlkow [3]

[1] Research Department 3 Dynamics of Communication, Knowledge and Spatial Development, Leibniz Institute for Regional Development and Structural Planning, Flakenstraße 28–31, Erkner 15537, Germany

[2] Disaster Research Unit, Institute for Ethnology, Free University of Berlin, Carl-Heinrich-Becker Weg 6–10, Berlin 12165, Germany; E-Mail: Karsten.Balgar@fu-berlin.de

[3] Otto-Suhr-Institute for Political Science, Free University of Berlin, Ihnestraße 22, Berlin 14195, Germany; E-Mail: mahlkow@zedat.fu-berlin.de

* Author to whom correspondence should be addressed; E-Mail: christmann@irs-net.de; Tel.: +49-(0)-3362-793-299; Fax: +49-(0)-3362-793-111.

Abstract: Climate change is globally defined as a "reality". This does not mean however that the way in which it is understood is the same all over the world. Rather, perceptions may differ at different places and times, even if physical and geographical conditions are similar. For the time being, this phenomenon has not been dealt with on a theoretical-conceptual level. The article will address this desiderate. Based on the approaches of social constructivism as well as actor-network theory, a theoretical concept will be suggested as a heuristic model for empirical analysis. By the examples of Lübeck and Rostock, two cities on Germany's Baltic coast, it will be shown that climate change related perceptions of vulnerability and resilience may build on physical-material aspects but that they are above all considerably interwoven with specific cultural and social patterns of interpretation. In the framework of the local discourse in Lübeck, it is the strong Hanseatic tradition which consumes the climate change issue, whereas in Rostock it is the problems and historical breaks of a transformation society which shape the way of viewing climate change.

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1. Introduction: Climate Change as a Social Construction

Climate change cannot be simply observed in everyday life. What can be observed is a spatially and temporally limited clustering of (extreme) weather events. Only on the basis of the systematic knowledge provided by natural sciences which has found its way into public discourses and has been widely disseminated via the media, it is a shared assumption these days that weather events are not to be conceived as isolated regional or local phenomena. There is a consensus that these events are rather to be seen as being part of a changing global climatic system and that climate change might have disastrous effects [1,2]. However, even if climate change is meanwhile globally conceived of being a (threatening) reality and even if societies are aware that they might be vulnerable and that they should develop measures to build resilience, this does not mean that the way in which climate change and related vulnerabilities or resiliencies are understood is the same all over the world.

We will argue that climate-change related perceptions of reality rather may differ between different societies at different places and times, be it due to physical conditions and/or to cultural factors, particularly to culturally based social attributions of meaning to physical-material phenomena and to specific systems of relevance. In other words, we understand climate change as a social construction (cf. [3]). Thus, given that societies construct their specific *social* reality of climate change, this would mean for an empirical (comparative) analysis as well as for a theoretical reflection of this fact that, besides physical-material aspects, also immaterial factors in the form of socially shared meanings are to be investigated.

This also applies for *local* societies, where perceptions of climate-related vulnerabilities and resiliencies may be seen as being influenced by local geographical and climatological conditions while at the same time being rooted in cultural traditions and interpretation patterns of the local society, above all in past experiences of hazards in the local history.

It is our objective to report from an empirical investigation on local constructions of climate change. By the example of Lübeck and Rostock—two German cities at the Baltic coast—we pursued the question of how these local societies conceive their threats and requirements to protect themselves. Although Lübeck and Rostock have similar natural conditions, we identified significant differences between the local interpretations of climate-change related vulnerabilities and resiliencies. This calls for a theoretical conceptualisation of this fact, which is another objective of the contribution, as we see previous approaches to vulnerability and resilience as being characterised by more "essentialist" assumptions [1]. They typically view threats and the capacity to resist as being objectively given (see Section 2). Even though most of these studies consider the role of social aspects—such as social factors making a natural hazard event a social disaster or such as social inequality (since not all social groups in a specific situation are equally vulnerable or equally able to develop resilience)—they do not reflect the fact that societies may develop their *own way in perceiving and defining their reality* with

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[1]   For criticism of the previously dominant essentialist perspective see [4] as well as [5].

regard to threats and prevention measures. In response to this desideratum, we suggest a social constructivist approach which thus combines constructivist and essentialist perspectives being able to integrate *both* perceptual-immaterial *and* physical-material factors. To avoid misunderstandings, it is important for us to emphasise that the introduction of constructivist thought into vulnerability and resilience concepts aims at overcoming one-sided approaches. It is not meant to deny climate change and thus to neglect connected physical-material phenomena, but rather to *extend* purely essentialist approaches. The reason to prefer social constructivist over risk perception approaches in this context is that the first are able to explain the emergence of *socially shared* perceptions within societal processes, whereas the latter, originating from the field of psychology, focus on the subjective risk assessments of individuals explaining the psychological bases of risk perceptions or attitudes [2].

From the great number of relevant publications of the past few years it becomes obvious that increasingly the social sciences have discovered climate change as a topic of research. Whereas natural scientists describe on which physical-material factors climate change depends, what the physical reality of climate change will be like in the future and which prevention measures should be adopted, social scientists observe in which ways societies deal with climate change as stated by the natural sciences and how they make it a social reality. As already indicated above, it is problematic however that many of the published studies represent an essentialist perspective which is even true for a large number of social science studies. It cannot be ignored that there are as well empirical investigations showing implicitly that different social entities affected by the same natural hazard may have differing perceptions of vulnerability (cf. [6–11]), whereby the authors of these studies typically do not draw theoretical conclusions from their findings, particularly for an alternative way of conceptualising vulnerability and resilience. At least in the case of climate change research, there are some initial indications for a constructivist way of understanding. By a first overview of the emerging social-scientific debate on climate change in Germany, Renn *et al.*, [12] differentiate between culture-theoretical [13–15], integrative-socio-ecological [1,11,16] as well as system-theoretical [17] concepts. In particular, in the context of system-theoretical contributions, they identify approaches at a constructivist way of conceptualising climate change. In most cases, these works refer to Luhmann's book "Ecological Communication" [18] where Luhmann argues that society develops ecological knowledge in social communications, or to be more concrete, in dependency of the particular communications logics of society's functional sub-systems such as politics, economy, the sciences or religion.

More or less explicitly starting out from this premise, there are empirical—above all, discourse-analytical—studies showing that the way in which climate change is perceived is dependent on the respective, specific social system in the context of which it is negotiated. Particularly emphasised must be the study by Weingart *et al.*, [2] which sketches the different ways of perceiving climate change in "discursive arenas" such as in sciences and in politics in Germany from the 1970s to 1995. The authors demonstrate that there are differences in respect to genealogy, chronology and the essential topoi of the respective climate discourses (see [2], p. 27). As reasons for these differences, they give different sector-related rationalities in the context of climate change-related communication

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[2]   Even when investigating collective entities such as nations, risk perception studies conceptualise their ways of perceiving threats as a psychologically driven mentality, whereas constructivist approaches see them as being socially produced in interactive and discursive processes.

(see [2], p. 11). Further discourse-analytical studies come most of all from the Anglo-Saxon countries. Typically there, by way of quantitative content analysis, national media were analysed with regard to the question of how climate change is presented and in which ways the discourse has changed over time (on this see [19–22]. The contribution by Brown *et al.*, [23] is special in so far as it investigates in which ways the global issue of climate change is debated by the British regional and local press and which topics are of significance there. In this case, it becomes obvious that topics such as the change of landscapes or the immigration of new species are typical contents of the debate and that usually these changes are perceived as a threat for predominant cultural habits. However, the authors do not discuss the question of to what degree it is possible to state local-specific differences of perception.

Thus, we know from social-scientific research that the way in which climate change (and related vulnerabilities and resiliencies) are perceived may differ between different societal entities—for example, in different social fields—and even between different points of time. However, there have been little thought on socio-spatial entities and above all on the integration of physical-material and perceptual-immaterial aspects in the theoretical conceptualisation of vulnerability and resilience.

In the following, we will address these desiderata. In the first two sections, we will reflect on the weaknesses in detail, which we see in previous concepts of vulnerability and resilience (Section 2), to then by way of an approach by Christmann and Ibert [24] suggest an extended concept (Section 3). This concept results from proposals by social constructivism, the actor-network theory (in order to integrate physical-material and perceptual-immaterial factors) as well as a relational understanding of space. In the subsequent sections, we will explicate the research design (Section 4) and key results (Section 5) of our empirical study on local constructions of climate-change related vulnerability and resilience in Lübeck and Rostock. In Section 5, we will also demonstrate in which ways our conceptual approach may be used as a heuristic model for empirical social-scientific climate change research. The conclusion will be a résumé of the main items (Section 6).

2. Vulnerability and Resilience. Widespread Conceptions of the Terms and Desiderata

In the scientific discourse, in the context of natural hazards, the terms vulnerability and resilience have gained increasing popularity (cf. [18,25–32]). They are also used when it comes to endangerments resulting from climate change. For the time being, these terms have been very much influenced by the context of (human) ecology and the research on natural risks [3]. Meanwhile, they were considerably further developed and refined: Worthy of mention are elaborated approaches such as the socio-ecological systems concept (SES) (cf. [35–39]), the approach of the coupled human-environment systems (CHES) (cf. [25,40,41]), but also the social resilience (cf. [28,42,43]) as well as the social vulnerability concept (cf. [10,19,44,45]); there, besides physical-material factors, particularly social aspects have been included in many different ways. For lack of space, in the following, we will not discuss these approaches in detail, especially since the question is not to investigate their individual details [4]. Rather, by the example of the most comprehensive definition—which was selected as a typical representative of the approaches—we aim at pointing out where we still see a fundamental weakness in the former way of thinking.

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[3]   Even though these concepts have their origins in medicine [33] and (social-) psychology [34].

[4]   For a summary of the resilience debate cf. Davoudi *et al.* [41].

In our view, it is Birkmann and colleagues ([46], p. 25) who have suggested such a comprehensive definition of vulnerability and resilience as it integrates important insights from various perspectives. According to their approach, vulnerability encompasses "situations and processes that determine the exposure, susceptibility and also reaction capacities of a system or object with regard to dealing with dangers (…). Here, physical, social, economic and environmental factors play a role". Besides external natural hazards which are seen as being responsible for vulnerability, internal or societal variables are also viewed as determining factors. Furthermore, the definition takes up the idea from other approaches (especially from natural risk research; cf. [41]) to include a system's capacity to deal with threats. This is meant to determine the degree of vulnerability which on the one hand seems to be worthy of consideration since the system's vulnerability may be low even if exposure to threat is high. On the other hand, however, this leads to mixing the vulnerability and resilience concepts.

As regards the term "resilience", Birkmann *et al.*, ([46], p. 18) describe it as the capacity of a system to "absorb shocks and disruptions and to continue to exist with the least damage possible". In the following, the authors identify three different dimensions of resilience: First, the pure resistance of a system, second, the capacity to restore original conditions quickly, and finally, the capacity to learn and adapt within a changing context (see also [38]). By integrating particularly the third aspect of resilience, their concept is far from being limited to the idea of bouncing back.

Thus, a great deal of effort has gone into these terminological concepts, making them far-sighted and integrating various dimensions. However, it is nonetheless noticeable that the conceptions are rarely connected to theoretical approaches. Furthermore, surprisingly, even considering social factors, they still share an essentialist perspective insofar as they typically understand vulnerability as *factual exposure or susceptibility* and *resilience as the factual coping ability* of systems. From this perspective, a system simply *is* in a specific way vulnerable or resilient due to specific, objectively measurable external and internal factors [36]. This understanding is not only widespread among the natural sciences but also among social-scientific approaches.

Such conceptions are without question legitimate, especially as experience to date shows that potential endangerments are not purely fictitious but that there are specific indicators for specific endangerments actually occurring, that some endangerments also really do occur and that they are, when they have occurred, of substantial or even existential nature, then resulting in material (and also immaterial) damages. Yet, we argue that previous approaches of vulnerability and resilience still make the mistake of conceiving the endangerment of a social entity in a rather one-sided manner as an objectively—naturally and socially—given exposure, since they usually consider it independently of the *threat perceptions* that members of an entity have with respect to a potential exposure. There are empirical evidences, however, that entities such as social groups, cities, or regions, when confronted with information or events indicating an endangerment, may develop their own reality of being threatened or resilient. We thus think that it is essential to additionally take the *socially shared perceptions,* or in other words, the social constructions of vulnerabilities and resiliencies into account [5],

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[5] Janssen/Ostrom [30] identified this as a subject that requires further research. Also Voss [10] is one of the few authors who postulates that we have to draw attention to the way in which a system is able to perceive problems and the extent to which it is able to manage the related (public) communication in this field.

whereby the aspect of social construction of reality should not be confused with social factors like for instance social inequalities, of which researchers are already aware.

However, if immaterial factors such as perceptions are brought into connection with materiality, then the *relation between the physical-material and the perceptual-immaterial* needs to be clarified anew. Of course, there are social theory approaches that attempt to overcome the dichotomy of materiality-immateriality [35,47–51]. Most of them, however, understand the relationship as a hybrid one and offer ideas about how these spheres might interact. Thus, these works reiterate the idea of two distinct spheres. In the following, by integrating ideas from actor-network theory, we would like to propose a solution to this problem.

Apart from this, in most of the concepts, there is little reflection on the *spatial dimensions of vulnerability and resilience*. Even if few works in the field of spatial planning investigate spatial aspects of vulnerability and resilience (see for example Davoudi *et al.*, [43]), the works primarily focus on the physical dimension of space, as Birkmann ([46], p. 1) has pointed out. The differentiation of various spatial dimensions and the analysis of their linkages have so far attracted only little attention in literature: Above all, the multi-layered structure of spaces—in the form of physical spaces (of bodies and objects), administratively demarcated spaces, economic spaces, cultural spaces or spaces of communication—was hardly considered with respect to their potential impacts on vulnerability and resilience constructions.

Not least, the *factor of time* is also missing in most concepts, although vulnerability and resilience have an inherent temporality and are situated in historical time. Thus, resilience is to be seen as a process of adaptation. Not at last, the content of constructs of vulnerability and resilience are likely to change over time. This means for example that ideas about resilience and concrete measures for resilience building, such as against floods, may change during or after floods.

3. An Extended Concept for the Analysis of Vulnerability and Resilience

Against this background, in our research project on the perceptions of climate change in coastal cities, we used a conceptual approach developed by Christmann and Ibert [24] which addresses the above-mentioned desiderata. The approach adopts ideas of social constructivism, actor-network theory and relational space concepts. It focuses on the socially constructed nature of vulnerability and resilience perceptions while at the same time, notably inspired by Latour's sociology of associations, trying to overcome the traditional dichotomy between the immaterial and the material. Furthermore, the concept includes the dimensions of space and time.

According to social constructivism, in the context of social interactions, subjects construct their social reality by the attribution of meaning to objects. In their sociology of knowledge approach, Berger and Luckmann [3] show how social subjects develop a commonly shared knowledge and how this knowledge is stabilized by way of processes of institutionalisation and legitimisation. Thus, it is demonstrated how subjective meaning becomes an objective factuality—and very much in the spirit of Durkheim—how it becomes a sui generis reality.

In comparison, the strength of actor-network theory lies in its ability to meet the need of integrating both physical-material and perceptual-immaterial aspects of vulnerability and resilience. It says that in terms of a "flat ontology" ([52], p. 58) all phenomena are positioned on the same level. Latour [53]

insists that sociology should be concerned not only with the interactions between different social actors but also with those between social actors and objects. Thus, in contrast to the "sociology of the social", as Latour calls all previous sociology, in his "sociology of associations" which is primarily a theory of action it is not only social actors with their perceptions, motivations and intentions that generate action. Rather, agency is regarded as a dispersed competence across a network of relationships which comprises objects and artefacts, whose existence and availability may suggest, facilitate, promote or even provoke particular forms of human action. To the extent that objects participate in the course of actions, Latour ([53], p. 63) attributes agency to them: "Objects too have agency". They are to be seen as having an active part in construction processes which is a completely new argument in social scientific theory formation. This does not mean that objects themselves are motivated or can act. Rather, the approach focuses on the difference the presence of objects makes for the course of actions.

As already stated, relational conceptions of space have also been taken into consideration [54]. Such concepts include various spatial dimensions and see places as being characterised by a specific network of physical, interactional, economic, or cultural spatial layers.

Against this background, Christmann and Ibert ([24], p. 266) have developed an alternative conception of vulnerability and resilience which is central to our analysis of climate change perceptions in coastal cities.

The authors view *vulnerability* as the result of a social construction process where potential threats are collectively assessed and negotiated by members of a society. Any kind of entity can be assessed by these members, be it a subject, a group, an organisation, a cultural artefact, a technical, economic or ecological system or a territory. Constructing vulnerability means that a collectively *selected entity*, which is defined as being valuable and to be preserved, is delimited and *located at the centre* of an actor-network (with its inherent social, immaterial, material, and/or spatial structure) at a certain point of time. The entity is related to *other material as well as immaterial elements* which are collectively defined as being part of the network, whereby the *interdependences* between the centrally located entity and the other elements are analysed in terms of their injurious effects for the central entity. They are collectively brought into a causal association by the actors and are viewed to affect one another ([24], p. 267). As already indicated, all the parameters in the collective vulnerability analysis—the central entity, the other elements as well as the interdependences—are not to be seen as being quasi naturally given, rather they are an active and selective construction process of the social actors and they may even change in time. Furthermore, 'objects too have agency', and all elements of the network are to be seen on the same level.

Resilience, now, is understood as a construction process which emphasises the possibilities of *action and reaction* within the relational network. It is based on the existing common perceptions of vulnerability at a certain point of time. The intention is to implement more or less far reaching *changes within the relational web* (and its inherent social, immaterial, material, and/or spatial structure) in order to reduce the vulnerability of the centrally placed entity by protecting its functions and ensuring its integrity. Also, in the case of resilience constructions, 'objects have agency'. Furthermore, the forms of action or reaction may change over time ([24], p. 267).

As has become clear in the preceding section, we understand vulnerability and resilience as interrelated constructs. Whereas on the one hand with the conception of vulnerability the focus lies more on perceptions and the construction of meaning of resilience, on the other hand, is closer

associated with collective action and the construction of measures. However, both concepts are closely linked and represent two complementary dimensions of a perspective of action that reduces the perceived threats.

Before going on to present key results of our research and showing how far the alternative concept of vulnerability and resilience proves to be fruitful for the empirical analysis of local climate change constructions, in the following section we will sketch the research questions as well as the method applied to the project.

4. Investigating Local Vulnerability and Resilience Constructions in the Context of Climate Change—Research Questions and Methodology of a Discourse Analysis

As stated before by the example of selected coastal cities [6], a research project was conducted pursuing the overarching research question of which vulnerability perceptions with regard to climate change can be identified *in situ*, which measures are discussed to be necessary for building resilience and not least in how different vulnerability and/or resilience constructions can be observed between the cities, whereby the subject of the analyses were local discourses over a period of eight years (from 2003 until 2010) [7].

Based on the assumption of discourse theorists ([56], pp. 2–4) that recurrent contents of (public) discourses create societal knowledge orders and thus commonly shared interpretations of reality, we believe that local public discourses with their regularly recurring issues on climate change, but also with their narratives of past experiences with hazards as well as of cultural traditions in dealing with them, shape the way climate change is understood in a local community. However, discourses are not only decisive agents in the social construction of reality. In analytical terms, they may at the same time also be seen as mirrors of the typical knowledge structures, of debates on key issues and of the ways of acting in a society. Therefore, discourse analyses give insights to the ways of thinking and acting in a society. By means of discourse analysis, we can investigate how climate change is typically treated in a society, in which way threats are mentioned, where they are seen, which entities are in the centre of vulnerability perceptions, which elements are seen as being threatening, but also how to come up with solutions and to build resilience—the measures of which are most important—and how they are debated, *etc.*

As we expected that it is particularly in the context of the local press that climate-related issues and narratives become highly visible in the local public, we analysed above all journalistic articles from the largest local newspaper (that is the newspaper with the highest circulation in the city). Since we

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[6] The reason for focusing on cities is the fact that in recent years—both in climate policy and in social-science based research—there has been a shift from a more global to a more local perspective on climate change. Still there is a great need for further research on the question of how local societies tackle with climate change. Particularly coastal cities have aroused considerable attention, as in the international discourse, such as fostered by IPCC [55], threats from rising sea levels have become a hot topic.

[7] The empirical study has been carried out from 2009 to 2012 in the context of the project "How societies deal with climate change" at Leibniz Institute for Regional Development and Structural Planning (IRS). The project was part of PROGRESS, the "Potsdam Research Cluster for Georisk Analysis, Environmental Change and Sustainability", which was funded by the German Federal Ministry of Education and Research in the context of the programme "Spitzenforschung und Innovation in den neuen Ländern" (top-level research and innovation in the new federal states).

furthermore suspected that it is also local experts in climate change issues who may shape local perceptions—not least since their knowledge forms part of the respective public discourses as journalists typically refer to it—we also asked how local journalists report on the assessments of local experts. It soon became apparent that it was above all experts from the fields of science and administration who were cited, however also representatives from politics, NGOs, and business played a role. Aiming at understanding the experts' interpretations of reality on climate change as such, in addition to the newspaper analyses, we also investigated the local experts on-site. We were interested in how they view climate-change related vulnerabilities and resiliencies in their city, how they "localise" global knowledge on climate change, and also what they know about the local culture of the city. Against this background, we conducted qualitative guideline interviews with local experts [57] [8], which we see as a part of the local public discourse analysis [9]. In the following, we will mainly report on the results of the local newspapers which do not hide the fact that perspectives of the most important local experts are also represented. For the empirical analysis of the data collected, we used the sociology of knowledge approach to discourse ([56], pp. 69–135) applying grounded theory coding procedures and, for selected pieces of data, also hermeneutical methods.

As this type of qualitative research is very time-consuming, in the research project only four German coastal cities were selected as cases for an in-depth analysis: the German cities of Bremen, Bremerhaven, Lübeck and Rostock [10]. In the contribution, we will refer to Lübeck and Rostock. These cities are interesting for a comparison of local constructions of climate-change related vulnerability and resilience and particularly for the investigation of cultural influences because they share similar physical-material conditions. With a total distance of 100 km, they are very close to each other. Decisive is, however, that the cities are similar with regard to their geographic position on the coast,

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[8] To be more precise, interviews with ten experts per city were conducted.

[9] According to our argument in Section 1—were we resume from previous empirical research that the way in which climate change is perceived can differ from social entity to social entity—it could be assumed that social constructions of climate change may be different *between different cities* but also between different social groups *within the same city*. In the contribution we will highlight differences between cities. However, we also gained some insights of experts' perceptions originating from different fields such as sciences, administration, politics, *etc*. Due to space requirements and the focus on local newspapers we are not able to discuss in detail how experts from the different social fields differ from each other in their view on local climate change. Just one remark: It became apparent that experts are influenced by the rationales of their social fields particularly when it comes to assess specific practical measures of climate-change related resilience building. At the same time, however, it was impossible to ignore that the local experts (even though they belonged to different social fields) were very familiar with the local narratives and that—with all the piecemeal differences—they have common ground: They have imbibed the set of ideas of the local culture of which they form part, even if they were not born and brought up there, and what to some extent sets them apart from other local experts in other cities.

[10] By the way, besides the mentioned case studies, the investigation still had insofar a broader methodological design as in one part of the study we also had a more application-oriented research interest. We asked experts from different social fields to assess potential vulnerabilities and promising adaptation measures for spatial planning in the coastal regions of the southern North Sea and Baltic Sea. Thus, in a quantitative part of the study a standardised Delphi-survey of local experts from coastal cities and communities in Germany, the Netherlands, Denmark and Poland was conducted [58–60]. More than 1000 interviewees from the fields of politics, administration, NGOs, business, natural sciences as well as social sciences gave us their assessments.

that they have comparable natural conditions and that, according to predictions of natural scientists, they will have similar climate-related developments, including the sea level rise. Not at last the selected examples are port cities and, more specifically, Hanseatic cities. However, each of the cities has a specific history. Furthermore, they belong to different federal states; Rostock belongs to a new federal state and was part of the former GDR.

5. Vulnerability and Resilience Constructions in Lübeck and Rostock. Findings

In both cities there is a consensus on the existence of climate change. However, there are some differences between them in how the topic is understood.

We will start with the perceptions in the city of *Lübeck*. There, in the local discourse we observed again and again in the data that it is the old part of the city which is perceived as being threatened by flooding, mainly induced by heavy rain as well as by the sea in case of heavy storm surges. The picture in Figure 1 admirably illustrates this perception.

Figure 1. Vulnerability perceptions in Lübeck: the flooding of the old city.

Source: Frank Mentz, Lübecker Nachrichten [61].

What is remarkable in this context is the topos of being a culturally important city. Typically, this topos is connected to the past, especially to the tradition of once having been the leading city of the Hanseatic League, its so called Queen. This is a vital part of Lübeck's urban identity, and it sets also the focal point for perceiving climate change. Thus, what appears absolutely essential to be preserved are the old buildings, the cultural heritage of the city and the inner city itself.
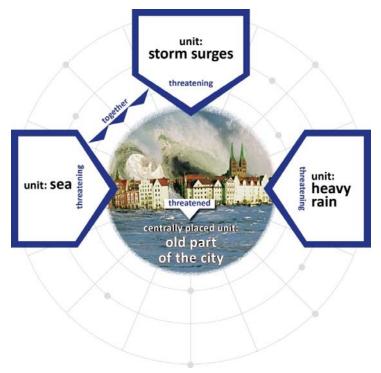
At the same time, however, Lübeck is portrayed as a city that has always defied the biggest challenges in its long Hanseatic history and has traditionally been well-equipped to cope with the

threats to come. Local media refers to a centuries-old tradition and an extensive experience of dealing with the dangers of the sea. Against this background, Lübeck's actors trust in their own competence; they believe that they are up to the climate change-induced challenges of the future.

Taking the theoretical conceptions of vulnerability and resilience suggested above as a heuristic device, in the context of Lübeck the picture is as follows (see Figure 2): According to the empirical data, it is the culturally rich, old part of the city with its historical buildings which is the centrally placed entity. This entity is a delimited physical-spatial unit. Other elements of the relational network construction of Lübeck are the sea, storm surges, and heavy rain. From an analytical perspective, these material phenomena are to be seen as having agency insofar as they, at least occasionally, may contribute essentially to the situation of the central unit and as they definitely challenge the agency of social actors. When it comes to describing the interdependences between the centrally placed entity and the other units of the network, it is typical for the relational web in Lübeck that the old town is viewed as being threatened and worthy of being preserved, whereas the sea together with storm surges as well as heavy rain are seen as being threatening elements.

Figure 2. Relational network and interdependencies in the case of Lübeck.
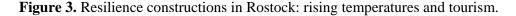

Source: Own representation.

Despite the potential threats, in Lübeck resilience constructions seem to be more or less relaxed. On the one hand, in order to reduce the vulnerability to flooding (of the central entity), it is considered necessary that various measures of adaptation are to be developed with regard to water-induced threats. On the other hand, however, the social actors feel experienced with coping with the possible future endangerments. Moreover, adaptation measures are not viewed as being very urgent.
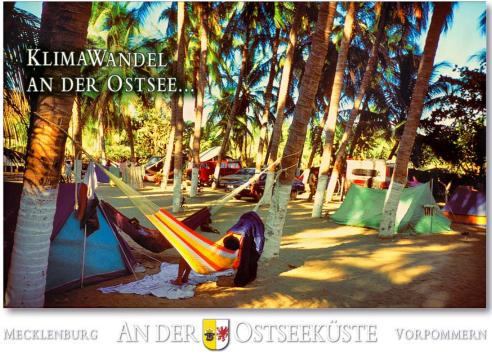
What is remarkable is the temporal structure of the local constructions. Rising sea levels and the increase in flooding are seen to be a problem only in the distant future. However, although possible

vulnerabilities emanating from climate change point to the (distant) future, the debate on climate change stands much more under the sign of the city's history: it is the narrative of the Hanseatic tradition and of the centuries-old experience with hazards which is dominant. It implies the idea that over a long period of history, the city has had a high coping capacity in which one can rely on in the future. Thus, ideas of feasibility are common.

In the local discourse of the city of *Rostock*, we found a different view. There, vulnerability perceptions are primarily focused on the urban economy, on high unemployment and increasing emigration. In regards to vulnerabilities due to climate change there, it is the sea which is seen as being vulnerable because fish stocks are changing. Urban actors anticipate that, as a consequence, former fishing methods will not be suitable anymore, which will also call for the economic utilisation of the sea into question and will further weaken the economic situation of the city. The central narrative, thus, is the problematic economic situation which also consumes the climate change topic. Compared to Lübeck, there were nearly no references to the (Hanseatic) history of the city.

When it comes to resilience constructions, it is typical that climate adaptation measures for the city itself are perceived as being less relevant. Rather, climate change is seen as a chance: Long periods of warmth might help to make the region more attractive for tourists (see Figure 3), which will have a positive effect on the job market. The predominant local interpretation of climate change can be summed up by a term used by local experts: Rostock is a "winner of climate change" ("Klimagewinner").

Figure 3. Resilience constructions in Rostock: rising temperatures and tourism.

Source: Ekkeheart Gurlitt (Foto & Design), postcard.

When taking the heuristic dimensions of the extended vulnerability and resilience approach into account (see Figure 4), it is conspicuous that in comparison to Lübeck, quite apart from climate change issues, the centrally placed entity is not a physical-material part of the city but the economic dimension

of the whole city. Additionally, with regard to climate change, also the coastal area, mainly the sea—or to be more concrete, the marine biology—is constructed as being vulnerable because various fish stocks will probably disappear. This unit, however—which is a material factor—has only the character of a side scene in the arrangement. Other units of the relational network are the structurally weak economy, rising temperatures as well as an (anticipated) growth in the tourism sector. The interdependences in the relational web can be described as follows: The structurally weak economy is seen as threatening and the whole city as being threatened (unemployment, emigration). Besides that, the marine biology is viewed as being endangered; here, rising temperatures are considered a factor of endangerment.
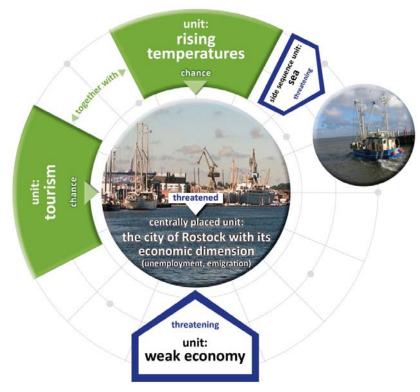
Figure 4. Relational network and interdependencies in the case of Lübeck.

Source: Own representation.

This does not hide the fact, however, that at the same time rising temperatures are primarily seen as a support. According to the Rostock rationale, global warming has agency insofar as it can help to build resilience. Warm and long summer periods promote tourism which will improve the economic situation.

As already mentioned above, in Rostock we can find only very few historical references in the context of climate change issues. Thus, in contrast to Lübeck, we can observe a completely different temporal structure. The past is largely eclipsed, be it the Hanseatic tradition which remains weak or be it, by the way, the recent history of the former GDR from which one distances oneself. Rather, attention is given to the future and to the hope of becoming a "climate winner", the hope for an improvement of the economic situation due to climate change.

6. Conclusions

To sum it up: In the contribution, the overarching research question was pursued of how local societies deal with climate change, *i.e.*, how they perceive their vulnerability and how they conceive of building resilience. Furthermore, it was a question of to what extent local differences in vulnerability concepts and/or resilience constructions can be observed. By the example of Lübeck and Rostock, we have shown that local climate-related perceptions vary considerably and that it is adequate to speak of a local construction of climate change. In this respect, it is important to underline that the differences cannot be explained by different natural conditions or physical risk situations. On the contrary, it has emerged clearly that the differences are rooted in very specific local cultures with their own narratives, rationales and temporal structures. In Lübeck it is the strong Hanseatic tradition which consumes the climate change issue, whereas in Rostock it is the problems and historical breaks of a transformation society which shapes how climate change is viewed.

In order to make the terms vulnerability and resilience useful for a social-science based analysis of climate change, furthermore we have suggested a theoretical approach. In contrast to previous approaches, the strength of this theoretical concept lies in the fact that interactions of immaterial and material factors are taken into consideration and, at the same time, considers socio-spatial as well as temporal dimensions of relational actor-networks. The case reconstructions of Lübeck and Rostock have shown that the theoretical concept can be made fruitful as a heuristic model for empirical analysis. The suggested analytical framework—which starts from a relational actor-network and encompasses components such as the centrally placed entity, other entities as well as interdependences between the elements—makes a tool available which illuminates the facets of local vulnerability and resilience constructions and also reaches deep into (socio-)spatial and temporal structures.

Author Contributions

The following authors are responsible for the following pages: Karsten Balgar for pages 2–4, Gabriela Christmann for pages 1, 5–11, and 14, Nicole Mahlkow for pages 12–13.

Conflicts of Interest

The authors declare no conflict of interest.

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