Zimmermann, *Cogent Social Sciences* (2018), 4: 1482985
https://doi.org/10.1080/23311886.2018.1482985

cogent social sciences

ARCHITECTURE & PLANNING | RESEARCH ARTICLE

Local climate policies in Germany. Challenges of governance and knowledge

Karsten Zimmermann[1]*

Received: 02 October 2017
Accepted: 22 May 2018
First Published: 26 June 2018

*Corresponding author: Karsten Zimmermann, Faculty of Spatial Planning, Tu Dortmund University of Technology, Germany
E-mail: karsten.zimmermann@tu-dortmund.de

Reviewing editor:
Danielle Sinnett, University of the West of England, UK

Additional information is available at the end of the article

Abstract: Measures and strategies for climate adaptation and mitigation on the local level have become more or less obligatory. However, local governments face epistemic and organisational uncertainties. New agencies are created, new intra- and inter-organisational relationships are established and new competencies are requested. We argue that knowledge orders are of utmost importance for the institutionalisation of climate policies. We compare knowledge generation, the production of evidence and framing in the local administration of the three cities Munich, Frankfurt am Main and Stuttgart and find commonalities and differences.

Subjects: Public Administration and Management; Urban Studies; Urban Politics

Keywords: climate change; local politics; Germany; knowledge; climate adaptation and mitigation

1. Background

In many ways, the same applies to local climate policy as to global climate policy: In recent years, the climate problem has transited from a natural hazard to a decision-dependent risk (Weingart, Engels, & Pansegrau, 2003), which *appears* to be calculable and therefore manageable. However, many statements, in particular on the consequences of climate change, remain

ABOUT THE AUTHOR

Since 2012, Karsten Zimmermann is Professor at the Faculty of Spatial Planning at Technical University of Dortmund where he holds the chair for European Planning Cultures. He is educated as a political scientist and dedicated most of his academic work to the study of cities and regions. From 2012 to 2016, he was the president of the European Urban Research Association (EURA). His list of publications includes numerous articles and books on metropolitan governance, European urban policy, knowledge and planning and local climate policies. This article is the result of a 3-year research process on local climate policies in German cities and benefitted from the support of the members of a DFG research group (FOR 1387).

PUBLIC INTEREST STATEMENT

Climate change is considered to be a global problem, to be tackled by an international alliance of governments and institutions of global governance. However, we know that cities are responsible for a large share of CO_2 emissions. In addition, city dwellers are affected by the effects of climate change (storms, heat and deteriorating quality of life). As a consequence, not only states but also city governments take action. Their defined objectives and action programmes speak of their aspirations of long-term planning and manageability in the face of an exceptionally complex phenomenon. These ambitions come along with an incredible increase of knowledge on what needs to be done in cities with regard to climate change and climate adaptation. As we can show in this article, the city administrations of Munich, Stuttgart and Frankfurt am Main have reacted to the dynamic increase in knowledge about the causes and consequences of climate change and adjusted administrative capacities. The effectiveness of this new organisational problem-solving structures is discussed in this article.

in the realm of forecasts and hypotheses but not in established facts (Beck, 2010; Gramelsberger, 2009; Lefsrud & Meyer, 2012). This means that statements on the actual consequences of global climate change in situ are also associated with considerable uncertainty (Fröhlich, 2009). In terms of the probabilities of occurrence of the consequences of climate change in cities, the uncertainty is even greater because despite numerous and sophisticated regional and local climate projections and scenarios, it is not possible to readily draw conclusions on the extent of local climate change from the forecast changes in average global temperatures. However, this does not limit the thirst for action of the communities and, in particular, a number of German cities. Their defined objectives and action programmes speak, at least in part, of their aspirations of long-term planning and manageability in the face of an exceptionally complex phenomenon. As will be demonstrated in this article, the administrations of the three major cities Munich, Stuttgart and Frankfurt am Main have reacted to the dynamic increase in knowledge about the causes and consequences of climate change and the shift in relevance associated with the two tasks of climate mitigation and climate adaptation by adjusting administrative capacities and by developing new organisational problem-solving structures.

In the remainder of this article, the argument will be developed that in this regard, *practices* and *institutional arrangements* for dealing with knowledge, for which we use the term "knowledge orders", develop in the city administration. These knowledge orders influence the generation, acquisition and distribution of knowledge or, in other words: "Bringing climate change to the city" (Bulkeley, Castán Broto, & Edwards, 2012) implies a shift in what is considered to be a relevant problem in local politics, and this shift depends on what is considered a fact on environmental changes. Knowledge orders primarily influence the methods for validity testing and for the validation of knowledge; that is, they decide what knowledge even finds recognition as relevant knowledge in local climate policies (Straßheim, 2013). Thus, we do not focus as much on the knowledge itself as on the regulatory aspect in the generation, selection and distribution of knowledge.

This article is based on extensive empirical analyses (around 60 interviews and document analyses) carried out in the three cities by a research group during the period 2010–2013. This article is structured as follows: First, climate policy at the local level in Germany is briefly introduced and the relevance of knowledge generation emphasised. The theoretical approach and the central terms are then described (knowledge order). Finally, the three cases are described and compared in the concluding section.

2. Local climate policies in Germany

Climate change is usually regarded as a global issue (Grundmann, 2007; Miller, 2007). However, we have observed climate policy measures in major German cities since the late 1980s (Kern, Niederhafner, Rechlin, & Wagner, 2005). As early as the 1990s, local climate policy in Germany reached its first pinnacle with numerous energy efficiency measures and the specific funding of renewable energy sources. Since then, almost all German cities have passed comprehensive climate protection concepts and action programmes, and created separate, specific powers within the administration in order to manage them. Currently, in addition to the strategies for preventing climate change, which primarily affect the energy and building sectors (Bulkeley et al., 2012), climate adaptation is forcing its way onto local policy agendas. Here, climate change, with its already manifest and manifold local consequences, is accepted as inevitable, and more emphasis is given to adaptation, for example, in urban planning or public health policies. In the course of these debates, many towns and cities define more ambitious targets than does the federal government. Here, it must be emphasised that local climate policy in Germany remains an element of the catalogue of voluntary tasks and is, therefore, the result of local policy negotiation processes. Only recently have statutory provisions in the building sector and in energy policy, with their origins in the European context, begun to increase. The revised national building code imposes a stricter legal framework, which, however, rather retrospectively acknowledges what the communities have already been practising or demanding for a long time (Krautzberger, 2010).

Ultimately, both the federal government and the state governments merely play a supporting role by way of funding programmes.

Open in principle, however, and therefore decidable in terms of local politics, is the catalogue of measures to be implemented related to the fields of building technology, energy provision, quality of life and health, green open spaces or dealing with extreme weather events, from extreme rainfall to extended dry periods. As discussed, however, the decisions are made under conditions of non-knowledge (Böschen, Kastenhofer, Rust, Soentgen, & Wehling, 2010). The frequency, the spatial localisability and the intensity of the occurrence of climate changes are associated with a large degree of uncertainty. The city councils, therefore, follow specific strategies for minimising this problem of non-knowledge (Fröhlich, 2009).

Overall, local climate policy since the 1990s may be regarded as the introduction of a new, local policy domain, together with new administrative procedures and decision criteria, over and above the needs of environmental protection. This is an interesting process inasmuch as local climate policy is not an obligatory municipal responsibility but instead depends to a large degree on local policy perceptions and priorities, which may play out very differently from place to place. Therefore, we focus on evidence generating practices, in addition to describing the changes in organisational structures (e.g. by establishing municipal climate agencies or coordinating groups).

3. Governance of knowledge in local climate policies

The establishment of local climate policy is closely related to the methods for generating knowledge regarded as valid. In the question of how expectations of climate policy action, shifts in relevance and the growing demand for valid knowledge are handled by city administration, it is possible to identify not only common patterns but also marked differences. In recent years, the partial shift away from climate protection measures, which primarily serve to prevent CO_2 emissions, towards climate adaptation strategies affecting the immediate local consequences of climate change, has led to a notable transformation, diversification and further enhancement of local climate policy. The change in local climate policy occurs, according to our approach, by means of a change in local knowledge orders and methods of evidence production. The existing literature describing the new tasks and their respective local climate policy instruments is large and growing. However, we find less information about the way these novelties are embedded in municipal administrations' organisational knowledge structure and how they fit with existing (and resisting) administrative behavioural routines.

The role of scientific policy advice and expertise needs special attention in this regard. The claim of science as an exclusive producer of valid knowledge is increasingly under critique, such that a plurality of reality definitions endowed with claims to validity, and their associated methods of generating evidence are the result (Jasanoff, 2005; Saretzki, 2005). They battle for interpretative authority not only within the discipline of climate policy (Lefsrud & Meyer, 2012). It can be assumed, especially when it comes to climate policy, that validity claims are recognised compliant with a knowledge order characterised by standards of scientific knowledge production. However, it is widely accepted that the production of policy-relevant knowledge of variable quality occurs within all social fields—and not exclusively in science (Maasen & Weingart, 2005). According to our hypothesis, this plurality of knowledge forms can also, and in particular, be observed in local climate policy. In the larger municipalities, the administration itself appears as a producer and manager of climate-relevant knowledge, developing its own climate change forecasts and problem definitions, professionalising itself and performing testing operations. In this article, we concentrate on developing the question of the evidence generation from the perspective of the administration, considering the primary aspects of administrative organisation and its reorganisation in conjunction with changing forms of knowledge acquisition, together with the demonstration of knowledge in the fields of climate adaptation and climate protection.

Fundamentally, knowledge defines a capacity to act (Stehr, 2002), whereby the capacity to act does not mean that the actions performed always correspond to the available knowledge.

Knowledge, then, does not equate to action, but the implementation of knowledge instead depends on certain social and political conditions. The interpretation and formulation of action and decision options is dependent on selections and decision opportunities that occasionally remain latent, leading to specific context- and actor-related combinations or bundles of different knowledge forms. These selection processes are the result of arrangements, filtering and knowledge routines for which we use the overall term "knowledge order" (Straßheim, 2013). Consistent with Weingart (2003), knowledge orders are defined as "societal arrangements for the production and diffusion of knowledge (…), which regulate the trustworthiness and reliability of knowledge stocks by way of normalisation and certification, and also the hierarchies of knowledge forms by way of crediting knowledge actors (experts)" (p. 139, translation by author).

The methods of generation of valid knowledge are associated with inclusivities and exclusivities because they include and exclude actors by way of the recognition (or exclusion) of their expertise, profession and methodology. Authors such as Jasanoff single out commissions or bodies such as the International Panel on Climate Change as locations of institutionalised expertise and trustworthiness (Jasanoff, 2005, p. 262; Miller, 2007). At the national level, they include selected committees and expert panels (Weingart et al., 2003). There is nothing comparable at the municipal level. It must, therefore, be clarified which equivalent processes and institutions at the local level provide comparable knowledge selection and validation services. It is hardly surprising that local authorities collaborate closely with free research and consultancy institutes, but also with the German Meteorological Service and with universities, to whom they entrust both monitoring of carbon emissions and the formulation of measures. Actor configurations, therefore, develop in the shape of networks.

This argument finds strong support in the work of Rob Hoppe (2011). In his seminal book on the "Governance of problems" (2011), Hoppe describes configurations of governance arrangements, actor constellations and knowledge forms and the respective influence for the *governance of problems* (Hoppe, 2011, p. 132). He describes mechanisms that influence the way problems are structured and what is considered to be a problem that is subsequently addressed by (local) government (Hoppe, 2011).

In recent years, the dominant configuration for the "*governance of problems*" in local climate change policies changed along in the way described by Hoppe as competing frames came up and new actors entered the arena. An increasing number of actors, new ways of knowing, evolved means to evaluate and monitor the success of policies and different guiding principles for governance arrangements are consequent of diversifying considerations relevant to and covered by the term "climate policies". This shift in what is considered accepted practice in local politics indicates an epistemological shift, and there is still much room to address these implications (Holden, 2008).

Hoppe (2011) differentiates four constellations, which we will utilise as a heuristic for studying the different cases (pp. 131–142).

3.1. Closed and institutionalised networks

The first type is called closed networks. The conceptual orientation is determined by a small number of actors. They are recognised experts acting on the basis of a stable political consensus. The network is relatively immune to fast-moving, sentiment-driven policy changes. This goes hand in hand with a technocratic approach and a privileged use of bureaucratic expert knowledge. Hoppe (2011) calls this type of network "invited technocracy", that is, the network has a political mandate and follows rational analytic approaches of problem-solving but is somehow isolated (p. 131). Every problem is considered to be well structured. The mode of knowledge generating "… is analytical, through systematic, intense, preferably experimental or quasi-experimental, sometimes simulated modes of information gathering and new knowledge production" (Hoppe, 2011, p. 133). The political element is widely suppressed. Experts (scientists, professionals and engineers) decide together with high-ranking administrative staff as problem solvers and form a strong epistemic

community. The network management shows a tendency towards hierarchy. Policy change is unlikely to happen without radical changes in the actor composition of the network.

3.2. Open and emerging issue networks

Open issue networks are much more pluralistic and unstable. They allow new actors to enter the network relatively easily and thus introduce new relevancies and knowledge claims. The more open and emergent arrangements allow citizens to participate as well as for (competing) scientific perspectives to be recognised. However, this can also lead to rapid topic and content changes as a consequence of macropolitical changes. The result is a pluralistic knowledge order and an incremental mode of problem-solving ("random-evolutionary processes", Hoppe, 2011, p. 135) that resembles a garbage-can-like problem and goal finding (Cohen, March, & Olsen, 1972). The role of network management is rather weak. The conditions of ambiguous policy goals and a mixture of symbolic and experimental policy-making may result in non-decisions or radical change. However, what is most expectable is that *coalitions of convenience* emerge for opportunistic action (Hoppe, 2011, p. 135). Expert knowledge is predominantly used by the actors to underpin their own position, which tends to harm the trustworthiness of the expertise.

3.3. Competitive advocacy coalitions in oligopolistic, institutionalised policy subsystems

The third type is based on the assumption of intrinsically stable but competing coalitions. The policy network is comparatively closed because the positions and claims are cemented and new actors, in contrast, can barely establish themselves. Knowledge recognised as valid for practical purposes is based less on expertise and science than on the everyday knowledge of the administration's process managers. Expertise is only required and accepted if it appears to serve one of the coalitions active in the field. In terms of problem-solving and decision-making, partisan mutual adjustment (compromises) and incremental analysis dominate. Radical policy changes are not anticipated.

3.4. Designed networks

In conjunction with funding programmes and pilot projects, in particular, implementation networks are often specifically (i.e. problem related) created by the political elite in order to achieve quick results and bring together any possible antagonistic actors (Hoppe, 2011, p. 139). That is, these networks do not develop organically around common interests or belief systems but are instead—often with little time or in a situation of stark controversies—controlled hierarchically by a network management. The number of actors is restricted, and the arrangement is kept out of the influence of politics and the public—in order to facilitate deliberative and procedural accommodation of interest. Scientist and professionals are invited to provide for expertise in this rare type of network: "as specialists or critical scientists they may clarify concepts and values due to their normally larger repertoire of factual knowledge, theories, assumptions, and perspectives …" (Hoppe, 2011, p. 140). At the same time, the networks are limited in time or temporary.

4. Evidence production in local climate policies in Frankfurt am Main, Stuttgart and Munich

4.1. Frankfurt

Essential conceptual and institutional positions, which characterise Frankfurt's climate protection policy to this day, were taken up as early as the late 1980s and early 1990s and facilitated by a specific political constellation of actors: The mayor and former federal minister Volker Hauff (SPD), incumbent until 1991, and the country's first head of an environment department from the Green party, Tom Königs, were not only able to count on a red-green majority in the city council but over and above this also considered energy efficiency to be highly relevant, not only for energy policy reasons but also from a climate policy perspective. Against this backdrop, it was possible to heave the issue of climate change onto the agenda and, by way of the "Klimaoffensive 1991" framework resolution, to lay the programmatic cornerstone for the development and implementation of an energy policy–oriented municipal climate protection policy. The core elements of this orientation in Frankfurt's climate protection policy were maintained until 2008/2009. However, initially, no overall urban climate policy concept existed.

In the course of these developments, the *Energy Agency*, an administrative department for housing the city's energy policy, was created in 1990 as a "municipal energy agency". The Energy Agency is the administration's central point of contact for the city's energy and climate protection policy measures. Simultaneously, it monitors energy-saving measures and regularly compiles an energy and carbon report for the purpose of evidence generation and effectiveness reviews. Moreover, the Energy Agency sees itself as a service provider to urban society by way of providing technical advice and support for private actors when initiating and implementing energy efficiency measures, primarily in the building sector (not least with regard to energetically unfavourable high-rise buildings). From a political perspective, the Energy Agency manifests itself to the public as a missionary *knowledge broker* accepted by all other actors.

Parallel to the Energy Agency, the *Energy Management Department*, established in 1980 within the Civil Engineering Department, performs energy management duties for municipal buildings, motivated by climate protection policy, but simultaneously aimed at reducing energy costs. It compiles the "energy reports" on the energy management of municipal properties—and was already carrying out climate protection policy measures before the Energy Agency came into being.

In 2007, the city council took a remarkable decision. The resolution passed in September 2007 to enshrine the passive-house standard as a voluntary municipal agreement for municipally owned and used buildings as a general rule for all new-builds, and in part for the refurbishment of public buildings (Stadt Frankfurt, 2007), provided the city for a long time with a unique, distinguishing, climate policy feature. This defining standard in the building sector was prepared by the public housing company ABG Frankfurt Holding, in which the city is the majority holder and is primarily implemented by said company. Against this backdrop, led by the guiding "sustainable city" principle, Frankfurt aggressively emphasises that it is the German passive-house capital. The result is a close collaboration in the climate protection field between an interest and knowledge coalition, comprising the Energy Agency, ABG Holding and the Energy Management Department; the long-term stability of which results from an overlapping set of the conceptual interests of the Energy Agency and the Energy Management Department; and the business interests of ABG, politically safeguarded by the conservative-green council coalition (since 2006). Without a doubt, the strong position of the Energy Agency also contributed to conceptual continuity in the climate protection field. As a carrier and communicator of generated, project-related, technical-practical and empirical knowledge in the field of energy efficiency and energy savings, it plays an eminently important role in municipal climate policy. This exclusive knowledge represents a true power base. However, the creation of this special agency also goes hand in hand with a tendency for "encapsulating knowledge" and for "operative closure" in the context of conceptual and institutional self-reference.

Only in December 2009 did the city council pass a first coherent and integrated overall concept for climate protection and energy policy, based on an expert report compiled by an external private research institute (Institut für Energie- und Umweltforschung Heidelberg [ifeu], 2008). In its "Masterplan 100% Klimaschutz", Frankfurt's city council also resolved in March 2012, as a component of its application for the title of European Green Capital, to completely cover its own power needs by 2050 and reduce its own CO_2 emissions by 50% by 2030 using renewable energy forms, in addition to funding programmes in the field of energy-efficiency refurbishment in the existing building stock. In particular, this "Master plan" relies on the two core elements of Frankfurt's "guiding climate protection principle" (Stadt Frankfurt, 2011a), that is, energy-related modernisation of the building stock compliant with self-defined standards, with the aim of achieving greater energy efficiency, and development of heat grids using energy-efficient combined heat and power generation (CHP; district heating). This policy did not achieve dominance and stability merely by its early fixation on energy but also quite substantially due to the generation and demonstration of evidence based on the accumulation of expertise in the Energy Agency and the energy management department, as well as the practical knowledge of the municipal housing company ABG.

In parallel to compiling an overall climate protection strategy, the administration began to address more seriously the consequences of climate change for the heavily built-up urban area of the city and developed *adaptation strategies*, which were presented in the "Umwelt Frankfurt" brochure (Stadt Frankfurt, 2010) and expatiated in the Climate Change adaptation Strategy (Stadt Frankfurt, 2011b) passed in 2011. An interdepartmental "Climate adaptation Coordination Group" was established for this purpose for the first time in 2008[1] in order to develop climate change adaptation measures by way of internal administrative cooperation and coordination across departmental boundaries. From the perspective of administrative organisation, establishing a coordination group as a *cross-cutting* policy exercise—an attempt at *climate (adaptation) mainstreaming* deliberately set apart from the previous administrative policy of encapsulated special responsibilities (Energy Agency and Energy Management in the Civil Engineering Department)—is owed to nature and the issue of climate adaptation. Moreover, in the course of this horizontal interlinking within the administration, new external cooperative relationships between the Environment Office and both the German Meteorological Service and Centre for Climate Change of the state of Hesse (Fachzentrum Klimawandel, a public body providing for climate-related expertise) were established, as well as existing relationships with the faculty of environmental meteorology at the University of Kassel intensified, for the purpose of fundamental development and knowledge generation for specific measures. *On one side*, this move towards integrated study of the consequences of climate change, and the fact that the climate adaptation policy sub-field thematically attained the status of the dominating climate protection field, went hand in hand with the climate policy ascension of the Environment Office to a central knowledge actor in Frankfurt. *On the other side*—and related to this—primarily computer-based, scientific knowledge acquisition and evidence generation methods (*modelling, simulations and climate projections*) were adopted from then on, based on urban climate investigations in the early 1990s. The city contracted the German Meteorological Office (Deutscher Wetterdienst [DWD], 2011) to compile the study "Climate Change in Frankfurt am Main—an Investigation of Municipal Heat Loads". Here, the special feature is in the scaling because municipal climate models allow very small-scaled forecasts and thus conclusions for urban land-use planning. In addition, empiricism, according to which research into (local) climate-related changes in flora and fauna is carried out, also plays an important role. The municipal climate adaptation strategy measures also include the green space concept called "spokes and rays" (Speichen und Strahlen) radiating from city into the surrounding green belt and the countryside. This was developed by the Environment Office with the participation of the Urban Planning Office. In conjunction with the Frankfurt "GreenBelt", it aims to retain areas of cold air generation and keep routes open for fresh and/or cold airflows, thereby preventing overheating in the city. Climate adaptation is explicitly defined not only as a necessity but also as an opportunity to enhance the quality of life in the city and to secure its future viability in both regional and global competition for residents and commerce.

4.2. Stuttgart: climate adaptation as a long-term local task

In contrast to the other two investigated cities, Stuttgart employs a traditional pillar administration for local climate policies. Moreover, the administration structure in Stuttgart differs from the other two cases in the fact that both the Environment Office and the Urban Planning Office are subordinate to the same deputy mayor, and coordination problems can, therefore, in principle, be solved by means of a hierarchical intervention. In Stuttgart, climate change problems are predominantly, but not exclusively, dealt with by two departments in the Environment Office: the Urban Climatology Department and the Energy Economics Department, whereby the designations indicate the division of work topics. Climate adaptation is predominantly dealt with by the Urban Climatology Department, while climate protection in the energy efficiency and climate neutral energy provision manifestations has been dealt with by the Energy Economics Department since 1977.

What characterises the Stuttgart administration in its dealings with climate change is a long tradition of occupation with the local climate as a result of the city's topographic situation (Landeshauptstadt Stuttgart, 2008, p. 55, 2010, pp. 6f, 2012). Stuttgart lies within a deep circular valley, which means that air replacement is poor, leading to overheating especially in summer. As a

result of this situation, the Urban Climatology Department was founded more than 75 years ago (ibid.), predominantly dealing with the impacts of different (primarily structural) measures on the local climate. As a result of this situation, the occupation with climate policy in Stuttgart developed along a different way than in the other two investigated cities. Here, the occupation with climate adaptation has a long history, while climate protection is relatively new in comparison. The first climate protection concept originates from 1997 (Landeshauptstadt Stuttgart, 1997, see also 2012).

The long existence of the Urban Climatology Department and the *scientific examination* of climate adaptation led to a broad acceptance within the municipal administration and the city's political bodies for retaining green and open areas. This also allows acceptance of unpopular decisions, such as demonstrated by passing the so-called Rahmenplan Halbhöhenlagen. Here, parts of an existing land-use plan were repealed in order to secure circulation of fresh air and ventilation of the city.

Climate policy is, however, based on a range of different evidences and forms of evidence generation. For example, insights into the consequences of construction measures for the local climate in Stuttgart are based on data acquired from measurements and experiments using tracer gas in the city, in order to identify air currents (Landeshauptstadt Stuttgart, 2010, p. 17, p. 24). The Urban Climatology Department, therefore, utilises experiments and modelling/simulation for evidence generation. This allows a *hard facts* argumentation and justifies high technical recognition for urban climatology among colleagues in the administration.

Decision-making processes occur within the administration in the usual formalised procedures of internal participation of local government agencies. However, there is also a strong culture of informal exchange. For example, early involvement of the urban climatologists is regarded as useful from the perspective of the planning department, in order to maintain the interests of the city in terms of the city's ventilation needs, in particular, and thus in the field of climate adaptation. The urban planners see themselves in part as the brokers of climate issues within their own department. This makes the Urban Climatology Department the unchallenged source of knowledge on the consequences of climate change in the city. This process also demonstrates that despite the opportunity for hierarchical problem-solving, inter-agency cooperation is regarded as the preferred and more successful strategy. Here, the department works both in terms of its substance and conceptually by providing the relevant data and information to other agencies (in particular urban planning), as well as compiling climate protection and climate adaptation concepts. It enjoys a high level of trust, even across party boundaries. This speaks in favour of evidence generation by institutional and social trustworthiness, which is almost beyond attack by critics.

With regard to climate protection, an additional Environment Office department comes to bear—the Energy Economics Department. Its origins can be traced back to the energy crises of the 1970s and 1980s and the concomitant energy price increases, which also caused considerable extra expense for municipalities. In Stuttgart, this development led to the introduction of energy management,[2] which has attempted since then to reduce the city's energy costs and CO_2 emissions. This is achieved by the close-meshed, constant monitoring and optimisation of the energy consumption of municipal properties in the form of energy controlling. In addition to this, the Energy Economics Department utilises a further instrument: internal contracting. Here, the environmental protection office gives loans for economic energy- and water-saving investments to other departments, which are subsequently refinanced by the achieved savings.

Even the circumstances surrounding the creation of this administration unit emphasise that financial aspects were a central motivation, based on calculation and quantification evidence and very strongly characterised by cost-saving expectations. These forms of evidence generation can also be recognised for emission reductions and resource savings.

In conclusion, it should be noted that in Stuttgart, in contrast to the other two case study cities, the sequencing was completely different: In Frankfurt and Munich, the climate adaptation sub-policy field

only came into being after climate protection was established and today remains in the consolidation phase. In Stuttgart, climate protection policy was established later. The two fields of climate adaptation and climate protection coexist, but following a diverging logic, not least expressed by differing strategies and practices for validity testing and for producing evidence and legitimacy.

4.3. Munich: climate neutral energy supply as a primary objective

Similar to Frankfurt, the state capital Munich was occupied with its own energy policy from an early date, permanently driven by a red-green governing coalition since 1990. With regard to energy policy, Munich's energy commission was a central actor in evidence creation from the very beginning. Its task was to develop long-term energy policy concepts (Kern et al., 2005, p. 69) and assume an advising function as knowledge provider for draft resolutions in the city council. An agency coordinating climate policy such as the Energy Agency in Frankfurt was absent in these days.

This commission was initiated as early as the mid-1980s. It comprised representatives of the Public Health and Environment Agency, the Urban Planning and Building Regulations Agency, the Buildings Control Agency, the city treasury, the city council parties, the Technical University of Munich and Öko-Institut Freiburg (Kern et al., 2005, p. 69). The city-owned public utilities originally headed the energy commission, thus further underlining the relevance of the goal of securing a climate-neutral energy supply for Munich. A decentralised distribution of climate policy responsibilities in the municipal units and formalised cooperation between external and internal knowledge actors can also be discerned from the line-up of the Munich energy commission. All this demonstrates that cooperation with external bodies and decentralised internal coordination of the administration have a long tradition in Munich.

The objective of achieving a climate-neutral energy supply remains in effect to this day. However, in terms of forms of organisation, actor constellations and even the displacement of the relevance of the climate protection and climate adaptation, changes have resulted which are described below as four sequential time periods. The *first period* in Munich lasted from the early 1980s until 1989, as the constitution of the energy commission, which primarily exercised an advisory function for the administration, but did not coordinate this internally, demonstrates. Munich's administration predominantly appeared as a responsible, decisive recipient of knowledge, but in this period, no fundamental, long-term decisions were made. In terms of urban development, the implementation of hard-hitting climate policy decisions was avoided, because climate policy was still new and its political relevance unclear. Munich's political actors relied on evidence of the external experts within the commission whom they trusted. The purpose was to complement their internal expertise and legitimise their climate policy actions.

Between 1989 and 1998, the administration altered its role in the governance of local climate policy. This phase can be characterised by a stronger role of the administration as process and knowledge manager. This phase is initiated by the 1989 Energy-Saving Funding Programme. This established financial incentives under the premise of funding and fostering. The programme supports Munich's citizens in converting to renewable energy sources and in energy-saving measures with grants.

Regular reporting to the city council on the development of CO_2 emissions begins in 1990. As a result of joining the international Climate Alliance of European Cities (Alianza del Clima) in 1992, the state capital entered into a voluntary agreement for reducing municipal CO_2 emissions. In addition, Stadtwerke München (municipal utilities) was converted to a limited liability company but remained to 100% in municipal ownership. The energy portfolio in Public Health and Environment department was expanded. Munich's vice-deputy mayor took up the chair of the energy commission from the head of Stadtwerke until 2014 (Kern et al., 2005, p. 70).

The Department for Public Health and the Environment tried in vain on a number of occasions to assume responsibility for energy management in the municipal properties. However, this remained with the Civil Engineering Department, which is where the Buildings Control Agency is in turn

located (Kern et al., 2005). Responsibility for energy problems, therefore, remained divided, as in Frankfurt. With regard to the *second period*, it can be said that as a result of the Stadtwerke conversion, an additional knowledge actor entered the arena. As a consequence of the beginning local Agenda 21 process, the integration of lay knowledge as a form of evidence creation also begins and procedures for participation are established.

The *third period* of "development and implementation" of a strategic climate agenda in urban development extends from 1998 until 2008. The "Perspektive München" urban development concept was compiled during this period. The 1998, process-based "Perspektive München" can be regarded as the cornerstone of the administrative framework for Munich's climate agenda because the "Leitlinie Ökologie", which is important in terms of climate policy, is enshrined within it. As a consequence of these procedural models, a new form of internal administrative coordination is implemented and participation as an external form of cooperation perpetuated. In 2007, partial policy change began as the result of an evaluation process because climate protection and climate change now achieved greater relevance. The "Leitlinie Ökologie" was supplemented by the "Climate Change and Climate Protection" section (Landeshauptstadt München, 2008) but only passed by the city council in 2012. This supplement can be regarded as a strategic reframing because existing measures were employed, which experienced institutional strengthening by the implementation of the "Leitlinie Ökologie".

The *fourth period* began in 2008 when Munich joined the Covenant of Mayors. The central decision is the "Integrierte Handlungsprogramm Klimaschutz in München" (IHKM), a political document encompassing the objective of supplying all municipal buildings and private households with 100% green electricity by 2025. Membership in the covenant of mayors required that an energy action plan be compiled by 2012, which in Munich took the form of the IHKM. In this context, the establishment of a governance and control structure for Munich's climate policy was new.

Three decision and working levels were established for the purpose of this conversion process (Landeshauptstadt München, 2010). The central IHKM coordinating agency and a steering group, comprising representatives from the management level of the city administration, are located on the first level. This was headed by Munich's third mayor. The Department for Public Health and the Environment is entrusted with conducting business. The project group, which ensures that operative implementation is coordinated, is installed on the second level. This comprises staff from the affected units with the appropriate power of decision. The working groups work on the third level, which are oriented around the spheres of action. As external knowledge actors, "Forschungsgesellschaft für Energiewirtschaft mbH" (FfE) is located on the third level. FfE assesses the measures developed in the field of CO_2 reductions. Munich's climate policy is, therefore, uniquely embedded in a clear control structure. The decentralised climate policy projects will from now on be controlled from within the administration by the Referat Gesundheit and Umwelt/Department for Health and the Environment (RGU). This means that additional, pluralist spaces for knowledge production remain within the administration structure. Klimecki and Gmür (1997) refer to this strategy of coping with contingency in dynamic and complex environments as an organisational opening, going hand in hand with decentralisation, segregation and increased boundary-spanning activities (p. 246). In addition, in the case of Munich, the decentralised, pluralist structure is always accompanied by a hierarchical element, because in Munich's administration, everything eventually comes back to the mayor, who holds a strong position.

Overall, it can be noted, with regard to Munich's climate policy, that the state capital never emerged as the only knowledge provider in evidence creation. Cooperation with external experts and their formalised integration, subsequently also including lay knowledge, are core elements of knowledge generation in Munich's climate policy, as the participatory elements of Perspektive München and the energy commission demonstrate.

Furthermore, evidence generation by calculation and quantification, such as the city's traditional CO_2 monitoring, as well as external expert reports and expert assessments, is primarily dominant.

Indicators for this include the establishment of the energy commission and the development of the energy sector within the RGU. External expert reports, compiled by Öko-Institut Freiburg, for example, are characteristic of the cooperation with external experts. In Munich's climate policy, external expert knowledge also serves as an external source of legitimacy and not solely as an expert consultation. Recent developments confirm this. Only recently, a critical strategic analysis of climate adaptation begun. In this case, local action relevance is created by the compilation of local scenarios. In this way, climate adaptation measures are justified by way of the cooperation with the German Meteorological Office.

5. Conclusion

The cases show that these three communities not only justify their actions differently and define different emphases with their measures and programmes but also address "climate policy" in different administrative structures.

Without a doubt, there has been a shift of relevancies in all three cities. Climate change (in the shape of energy policy) has emerged as an issue of relevance in a constant manner, albeit with different emphases in terms of its objectives, programmes and instruments. In terms of climate adaptation, we were initially able to observe asynchronicities. As a consequence of the early examination of climate adaptation in Stuttgart, a different knowledge order than in Munich and Frankfurt can be observed, both temporally and conceptually. The latter are at varying stages of development in terms of the focus on climate adaptation.

Stuttgart, in contrast, is characterised by a high level of conceptual constancy: Climate protection is also a local, climate policy topic, which is, nevertheless, constantly overlain by climate adaptation.

In terms of the four network types developed by Rob Hoppe, the following picture emerges (Table 1). In Frankfurt, we can observe a transition from Type 1 (closed and institutionalised networks) to Type 3 (competitive advocacy coalitions in oligopolistic, institutionalised policy sub-systems). For many years, the coalition of Energy Agency, Energy Management and the municipal housing company ABG acted on the basis of a stable political consensus and a clear problem definition. The approach to the problem solution can be referred to as a technocratic approach and a privileged use of bureaucratic expert knowledge (invited technocracy in the terms of Hoppe). However, the Energy Agency was also politically and administratively isolated as a result of its special position. Temporally, the transition can be pinpointed to 2007, because this was the year that climate adaptation was anchored in place as the second relevance after climate protection. Here, the main focus was on extreme weather events and more creeping changes for flora and fauna, and even the health and well-being of the city population. Since then, the result for Frankfurt's city administration has been the formation of competing coalitions. In both sub-policy

Table 1. Evolvement of knowledge network types (based on Hoppe 2011)

	Frankfurt	Stuttgart	Munich
Network type and transition (if applicable)	Transition from "closed and institutionalised networks" to "competitive advocacy coalitions", resulting in oligopolistic policy subsystems (from 2007)	Stable Type 2 network, "closed and institutionalised" invited technocracy, expert credibility	Mixture of Type 2 "open and emerging issue networks" and Type 4 "designed networks"
Effect	End of isolation of energy agency as knowledge broker; higher political relevance of climate adaptation and eventual effects on land-use planning (conflicts)	Policy stability with regard to climate adaptation; slow change in direction of climate mitigation	Pluralist knowledge order in decentralized implementation structure with low predictability for success. Climate change is one issue among others

fields, climate protection and climate adaptation, different methods for knowledge generation and evidence creation with respectively differing institutional stabilities dominate (and coexist).

Stuttgart displays a relatively stable, Type 1 network constituted by a group of recognised administration experts acting on the basis of a stable political consensus. The network is relatively immune to external influence. Even more than is the case in Frankfurt, we can speak of a privileged use of bureaucratic expert knowledge. The political backing for the coalition of experts is also greater, and in contrast to Frankfurt, the network is better integrated in the administration. The dominant mode of evidence generation is climate simulation technology, which has been acknowledged by experts throughout Germany. Bureaucratic experts decide together with high-ranking administrative staff as problem solvers and form a strong epistemic community. This is based on the objective of enhancing the climatically endangered local quality of life. However, this frame is also specifically mobilised by the Stuttgart administration in order to produce political assertiveness, which is necessary with a view to coping with virulent conflicts in climate adaptation measures.

In *Munich*, however, the temporal sequence displays a mixture of Type 2, "open and emerging issue networks", and Type 4, "designed networks". The establishment of climate protection in Munich occurred more as a random-evolutionary process and was accompanied by political dynamics and competitiveness between city administration's units. The result is a pluralistic knowledge order and an incremental mode of problem-solving. The role of network management was rather weak. However, citizen participation was granted relatively large prominence. The city administration attempts to counter the relative indifference of urban society to climate adaptation measures by framing them as safeguarding quality of life but is barely capable of compensating for the political subordinacy of adaptation.

For a long time, then, a mixture of ambiguous policy goals, and symbolic and experimental policy-making, was applied. Coalitions of convenience, nevertheless, regularly crystallised and achieved considerable policy successes. Expert knowledge, however, is rarely mobilised and implemented in the context of a technical rationality. Rather, it serves legitimacy. With the creation of the control structure and IHKM in 2007, we can speak of a transition to a Type 4 network. The city of Munich may now be capable of climate policy action, but internal controversies and conflicts of objectives have been stopped in what was, ultimately, a hierarchical intervention.

In Munich, evidence creation based on technical "measurements" is additionally employed, and in Stuttgart almost exclusively: In Stuttgart in particular, in addition to the continuous monitoring and accompanying evaluation, the demonstrable benefits in monetary units of energy and climate protection measures give rise to quite a unique legitimacy: In Stuttgart, but in Munich too, climate protection simply must pay for itself. The cities fall back on "mechanical evidence" for underpinning and legitimisation, that is, on evidence that stakes a claim to exactness, objectivity and forecasting ability (also see Rüb & Straßheim, 2013).

Overall, it was apparent that on one side, the almost ubiquitous generation of new knowledge in local climatic policy by resorting to internal or external scientific expertise (expert reports, scenarios, modelling, etc.) plays a role in attempts to reduce the degree of uncertainty, while the creation of new procedures or of knowledge generation arrangements, with which it appeared possible that new action-relevant knowledge is generated and stored, plays a role on the other. Some of these methods explicitly lay claim to a scientific character, but some remain informal forecasts, which are nevertheless accepted, even though they do not meet evidence-based demands. Rather, these are estimates based on long-term empiricism and partially backed up by the experience of colleagues. In particular, the political utility value of scientific knowledge, which can be differently defined and vary in each community, is therefore decisive. However, methods of evidence generation and the knowledge produced both in and by them must not only assert and prove themselves in local interactions, they also need, as addressed in Section 2, organisational anchors in such a way that they can be allocated to administrative units as practices and strategies.

Funding
This work was supported by the Deutsche Forschungsgemeinschaft [FOR 1387].

Author details
Karsten Zimmermann[1]
E-mail: karsten.zimmermann@tu-dortmund.de
ORCID ID: http://orcid.org/0000-0002-1023-6055
[1] Faculty of Spatial Planning, TU Dortmund, Dortmund, Germany.

Citation information
Cite this article as: Local climate policies in Germany. Challenges of governance and knowledge, Karsten Zimmermann, *Cogent Social Sciences* (2018), 4: 1482985.

Notes

1. In addition to the Environment Office, this coordination group includes representatives of urban planning, the fire service, urban drainage, parks and gardens, the Energy Agency, Road Transport Office, the Public Health Department and the Mobility and Transport Planning Agency.
2. Energy management is a part of the Energy Economics Department.

References

Beck, S. (2010). Vertrauen geschmolzen? Zur Glaubwürdigkeit der Klimaforschung. *Aus Politik und Zeitgeschichte*, *32–33*, 15–21.

Böschen, S., Kastenhofer, K., Rust, I., Soentgen, J., & Wehling, P. (2010). Scientific non-knowledge and its political dynamics. The cases of agri-biotechnology and mobile phoning. *Science, Technology and Human Values*, *35*, 783–811. doi:10.1177/0162243909357911

Bulkeley, H., Castán Broto, V., & Edwards, G. (2012). Bringing climate change to the city: Towards low carbon urbanism. *Local Environment*, *17*(5), 545–551. doi:10.1080/13549839.2012.681464

Cohen, M. D., March, J. G., & Olsen, J. P. (1972). A garbage can model of organizational choice. *Administrative Science Quarterly*, *17*(1), 1–25. doi:10.2307/2392088

Deutscher Wetterdienst. (2011). *Frankfurt am Main im Klimawandel – Eine Untersuchung zur städtischen Wärmebelastung*. Offenbach: Berichte des Deutschen Wetterdienstes/Report of the German Meteorological Service 237 (Frankfurt am Main in times of climate change. An investigation of urban heat load).

Fröhlich, J. (2009). Klimaanpassung im administrativen Diskurs – Das Verhältnis von Verwaltungsakteuren zu unsicherem wissenschaftlichen Wissen. *Zeitschrift für Umweltpolitik und Umweltrecht*, *32*(3), 325–350.

Gramelsberger, G. (2009). Simulation - Analyse der organisationellen Etablierungsbestrebungen der (neuen) epistemischen Kultur des Simulierens am Beispiel der Klimamodellierung. In J. Halfmann & F. Schuetzenmeister (Eds.), *Organisationen der Forschung. Der Fall der Atmosphaerenwissenschaften* (pp. 30–52). Wiesbaden: VS Verlag.

Grundmann, R. (2007). Climate change and knowledge politics. *Environmental Politics*, *16*(3), 414–432. doi:10.1080/09644010701251656

Holden, M. (2008). Social learning in planning: Seattle's sustainable development codebooks. *Progress in Planning*, *69*, 1–40. doi:10.1016/j.progress.2007.12.001

Hoppe, R. (2011). *The governance of problems: Puzzling, powering and participation*. Bristol: The Policy Press.

Institut für Energie- und Umweltforschung Heidelberg. (2008). *Energie- und Klimaschutzkonzept für die Stadt Frankfurt am Main 2008*/Energy and Climate Protection Concept for Frankfurt am Main. Heidelberg: Institut für Energie- und Umweltforschung.

Jasanoff, S. (2005). *Design by nature. Science and democracy in Europe and the United States*. Princeton: Princeton University Press.

Kern, K., Niederhafner, S., Rechlin, S., & Wagner, J. (2005). *Kommunaler Klimaschutz in Deutschland – Handlungsoptionen, Entwicklung und Perspektiven* (Discussion Paper SPS IV 2005-101). Wissenschaftszentrum Berlin für Sozialforschung.

Klimecki, R., & Gmür, M. (1997). Organisationale transformation – Grenzenlos? Struktur- und Prozeßmuster in der kollektiven Bewältigung von Unsicherheit. In G. Schreyögg & J. Sydow (Eds.), *Gestaltung von Organisationsgrenzen* (pp. 235–270). Berlin: Walter de Gruyter & Co.

Krautzberger, M. (2010). *Klimaschutz als Aufgabe der Stadterneuerung und des Stadtumbaus*. Deutsches Verwaltungsblatt, No. 2/2012, pp. 69–74.

Landeshauptstadt München (2008). *Aktualisierung der Leitlinie Ökologie der Perspektive München – Teil Klimawandel und Klimaschutz* (draft), München. Retrieved April 7, 2014, from http://0cn.de/8rem

Landeshauptstadt München. (2010). *Das Integrierte Handlungsprogramm Klimaschutz in München*. München: Landeshauptstadt München.

Landeshauptstadt Stuttgart. (1997). *Klimaschutzkonzept Stuttgart*. Stuttgart: Schriftenreihe des Amtes für Umweltschutz 3/1997.

Landeshauptstadt Stuttgart. (2008). *Umweltaspekte in der räumlichen Planung in Stuttgart*. Stuttgart: Schriftenreihe des Amtes für Umweltschutz 1/2008.

Landeshauptstadt Stuttgart. (2010). *Der Klimawandel – Herausforderung für die Stadtklimatologie*. Stuttgart: Schriftenreihe des Amtes für Umweltschutz 3/2010.

Landeshauptstadt Stuttgart. (2012). *Klimaanpassungskonzept Stuttgart – KLIMAKS*. Stuttgart: Landeshauptstadt Stuttgart.

Lefsrud, L. M., & Meyer, R. E. (2012). Science or science fiction? Professionals' discursive construction of climate change. *Organization Studies*, *33*(11), 1477–1506. doi:10.1177/0170840612463317

Maasen, S., & Weingart, P. (2005). What's new in scientific advice to politics. In S. Maasen & P. Weingart (Eds.), *Democratization of expertise? Exploring novel forms of scientific advice in political decision-making* (pp. 1–19). Berlin: Springer.

Miller, C. A. (2007). Democratization, international knowledge institutions, and global governance. *Governance*, *20*(2), 325–357. doi:10.1111/gove.2007.20.issue-2

Rüb, F., & Straßheim, H. (2013). Politische Evidenz. Objektivierung als Legitimationspraxis. In C. Daase, A. Geis, & F. Nullmeier (Eds.), *Der Aufstieg der Legitimitätspolitik. Rechtfertigung und Kritik politisch-ökonomischer Ordnungen* (pp. 377–398). Baden-Baden: Nomos.

Saretzki, T. (2005). Welches Wissen – Wessen Entscheidung? Kontroverse Expertise im Spannungsfeld von Wissenschaft, Öffentlichkeit und Politik. In A. Bogner & H. Torgersen (Eds.), *Wozu Experten? Ambivalenzen der Beziehung von Wissenschaft und Politik* (pp. 345–369). Wiesbaden: VS Verlag.

Stadt Frankfurt am Main. (2007). *Resolution B 2443 on passive house standard of the city council dated 06/09/2007*. Frankfurt am Main: Stadt Frankfurt am Main.

Stadt Frankfurt am Main. (2010). *Umwelt Frankfurt 2010. Status und Trends*. Frankfurt am Main: Stadt Frankfurt am Main.

Stadt Frankfurt am Main. (2011a). *Project description and funding plan for compiling the '100% Klimaschutz' master plan for Frankfurt am Main*. Frankfurt am Main: Stadt Frankfurt am Main.

Stadt Frankfurt am Main. (2011b). *Frankfurter Anpassungsstrategie an den Klimawandel*. Frankfurt am Main: Stadt Frankfurt am Main.

Stehr, N. (2002). Wissen. In C. Engel (Ed.), *Wissen – Nichtwissen – Unsicheres Wissen* (pp. 17–34). Baden-Baden: Nomos.

Straßheim, H. (2013). Wissensordnungen - Theoretische Grundlagen und analytische Potentiale eines Grenzbegriffs. In A. Busch & J. Hofmann (Eds.), *Politik und die Regulierung von Informationen* (pp. 48–85). Baden-Baden: Nomos.

Weingart, P. (2003). *Wissenschaftssoziologie*. Bielefeld: transcript.

Weingart, P., Engels, A., & Pansegrau, P. (2003). *Von der Hypothese zur Katastrophe - der anthropogene Klimawechsel im Diskurs zwischen Wissenschaft, Politik und Massenmedien*. Opladen: Leske + Budrich.

Cogent Social Sciences **(ISSN: 2331-1886) is published by Cogent OA, part of Taylor & Francis Group.**