

Learning from and for rare floods in Dresden – how public officials interpret damage simulation results at the building type level

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Abstract. Public officials in Dresden are concerned about learning from and for rare flood events like the Elbe river flood in August 2002. This is interesting because research on individual as well as organizational learning from rare events indicates that this kind of learning faces significant difficulties (e.g., overestimation of rare events for decision-making based on “emotionalized event experience”). Up to now, only little is known what and how public officials in Dresden *specifically* learn from and for rare floods. Therefore, the paper follows an *exploratory* purpose in line with principles of qualitative social research. Firstly, the paper explores dealing with rare floods with reference to a conceptual framework that highlights relations between regulative, normative, and cognitive institutions on the one hand and learning of public officials on the other. Secondly, it adopts a single case study design in Dresden with embedded sub-cases that are defined with reference to organizations of FRM. The case study shows, among others, that regulations like the Floods Directive are important for justifying FRM with regard to rare flood events which is less obvious than it sounds. However, public officials display different interpretations of the term “rare flood event”, for instance, in the context of analysing the consequences of floods on the building stock. Furthermore, the case study findings indicate that public officials may follow alternative approaches to sustain commitment in the context of rare flood events (systematic versus pragmatic approach).

1 Introduction

Rare floods in urban regions of European Member States triggered significant public investments to reduce flood risk to a tolerable level. For example, in the Dresden region in the Free State of Saxony, Germany, after the Elbe river flood in August 2002, dykes were rebuilt, new dykes and water retention basins constructed, to mention only some measures (for an overview see Müller 2013, DKKV 2015). Changes in ‘material’ assets were and are accompanied by intensive efforts to develop new management approaches at regional and local level. For instance, at the local level, public officials in the City of Dresden are interested in understanding the area-specific future consequences of rare floods using damage simulation with high spatial resolution. Researchers and practitioners involved in the project STRIMA (see Section 3.2 below) analysed area-specific consequences of Elbe flood events with return periods of 100 years and 200 years as well as an flood event that is specified with a return period between 200 and 500 years. The latter corresponds with a water level of 10 m at the Dresden gauge¹. Obviously, in the Dresden region, some actors are willing to consider rare floods systematically as “reference points” for improving flood risk management.

From the viewpoint of the scientific literatures on psychological learning from rare events (e. g., Kahneman 2011) and organizational learning from rare events (e.g., March et al. 1991, March 1994, 2010, Lampel et al. 2009), these observations about FRM in Dresden are interesting because the literatures suggest that actors have significant difficulties in learning lessons from rare events such as floods in particular as well as crises and disasters in general. Actors may be able to learn from rare events, but exactly what lessons these are and how they contribute to effective and acceptable management solutions is less clear (due to psychological, organizational, and political conditions of analysis, interpretation, and decision making, see, for instance, Bazerman & Watkins 2008, Hutter 2016). Therefore, this paper analyses the specific lessons that public officials learnt with regard to managing flood risk based on experience with the Elbe river flood in August 2002 and also the flood event in June 2013 (see DKKV 2015 for a comparison of these events).

Despite significant activity in practice to improve FRM in Dresden and research on these attempts of improvement, only little is known about what specific lessons officials learn from rare floods in the Dresden region (e.g., Hutter 2007, 2016). Therefore, the paper adopts an exploratory research perspective based on conceptual considerations about relations between institutions, learning, and rare events. Section 2 briefly

¹ In August 2002, the maximum water level of the Elbe River at the Dresden gauge was 9.40 m.

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elucidates this conceptual background. Section 3 explains the research design and methods used to develop this paper in the context of completed and ongoing empirical research activities. Section 4 presents an overview over the (preliminary) case study findings and interprets selected findings with regard to the conceptual framework. Section 5 concludes the paper and gives an outlook on future research.

2 Conceptual background

Learning is an important topic in various scientific disciplines and policy fields (e.g., see Easterby-Smith & Lyles 2003 with regard to learning, especially of organizations and networks, see Benz & Fuerst 2002 on policy learning in regional networks). Carroll and colleagues (2003) focus on learning from and for *experience* which is also the focus of this paper. They define learning “as a change in situation-action linkages, and *organizational* learning as an analogous change at an organizational level. Whereas learning is a process of change, the *content* of that process, the situation-action linkages, is *knowledge* (broadly construed to include explicit information, tacit know-how, etc.)” (Carroll et al. 2003, 575) Research about organizational learning seems to be at the stage of consolidation (e. g., see Argote & Miron-Spektor 2011 for a review). There is also increasingly a specific literature on learning and especially organizational learning from rare events (e.g., March et al. 1991, Lampel et al. 2009, see Kahneman 2011 for a review of the psychological literature on rare events). However, this paper highlights the role and “agency” (Emirbayer & Mische 1998) of public officials that decide and act under complex institutional conditions in political-administrative settings. Therefore, the following clarifies in a first step relations between institutional conditions and learning of public officials. Then, the conceptual background for understanding rare events and for developing new knowledge about situation-action linkages is explained to some extent.

Learning from an institutional research perspective: In a widely cited book on institutions, Scott (2014) conceives institutional analysis as a comprehensive framework for understanding, analysing and interpreting social action at different societal levels (social groups, organizations, networks, populations of organizations, and so forth) and with regard to the multiple dimensions of institutions as well as institutional change and “institutional work” (Lawrence & Suddaby 2006, Lawrence et al. 2011) Following Scott (2014), institutions are characterized by regulative, normative, and cognitive-cultural aspects. For instance, the Floods Directive of the EU may be seen as an institutional condition of FRM in urban regions that synthesizes regulative requirements (e.g., developing plans for FRM within a certain procedure), normative expectations (e.g., there is a growing consensus that FRM *should* be adopted in line with the Floods Directive, Hutter 2016), and cognitive elements (e.g., distinction between three “scenarios” for developing flood hazard maps, see Art. 6

(3) of the Floods Directive). Further institutional conditions of FRM may be present through political decision-making and economic pressures that highlight issues of “safety” and “efficiency” in using increasingly scarce financial resources in the public realm. Analysing learning from an institutional perspective is important to acknowledge that public officials involved in FRM (e.g., officials in local administration) learn from experience in complex and changing institutional conditions. Learning therefore is both *process-oriented* towards knowledge development and *outward-oriented* towards institutional conditions.

Understanding rare events: Lampel and colleagues (2009) distinguish between two different understandings of rare events: (1) understanding a rare event as “probability estimate”, often based on a series of observations and on frequency accounts, and (2) understanding a rare event as “enacted salience” in which case private and public actors define events as “rare events” based on collective interpretation in the context of existing, partly institutionalized frameworks for “sensemaking” (Weick 1995, 2001, Weber & Glynn 2006, Scott 2014). Collective interpretation may or may not *converge* to the understanding of rare events based on frequency accounts and/or probability estimates. In principle, it seems reasonable to assume that public officials will act decisively in case of consistent understandings between probability estimates and collective interpretation. However, this paper argues that convergence in understanding should be demonstrated through empirical findings, not assumed in line with notions of “rational decision making” (March et al. 1991, March 1994). Learning from rare events therefore is both validity-oriented and consensus-oriented in institutional settings (March et al. 1991, March 1994, 2010).

Commitment to action for dealing with rare events: March (1994) argues that low-probability events tend to be neglected in institutionalized planning and management procedures in organizations. Furthermore, the psychological literature on rare events stresses that decision-makers display inconsistent thinking and acting on rare events *over time and in relation to experience* (Kahneman 2011). For instance, decision-makers are tempted to neglect low-probability and high-impact events *before* they have happened. In contrast, *after* experiencing such events, decision-makers tend to overestimate their relevance for future decision-making in political-administrative settings (e.g., due to high public pressures to improve the management of floods and their consequences after catastrophic flood events like the flood in Dresden/Germany in August 2002). In this research context, it is interesting that public officials in Dresden show high “agency” for and commitment to learning from and for rare flood events over some time now (Hutter 2007, 2016). Therefore, the following seeks to understand in more detail how public officials learn about rare floods in Dresden.

3 Research design and methods

The City of Dresden is one of the few cities in Eastern Germany that is experiencing population growth. Politicians and public officials expect a further significant increase in population until the year 2025. Not surprisingly, investment pressures occur in flood-prone areas in Dresden, for instance, nearby the City centre. Local planners and public officials responsible for FRM in the local administration of the City of Dresden are busy now for some time to develop an integrated and area-specific strategy for FRM that takes, in line with the Floods Directive of the EU, events of high, medium and low probability into account (LHD 2012, 2014). This strategy for FRM in Dresden also received outside acknowledgement through an audit conducted by external experts (audit “Hochwasser – wie gut sind wir vorbereitet” developed by the “DWA – German Association for Water, Wastewater and Waste” and conducted in Dresden in May 2011). However, the audit also showed that the strategy of the city of Dresden shows some specific shortcomings, for instance, with regard to dealing with extreme flood events².

Furthermore, regional planners in the urban region of Dresden argue that regulating only new built development in flood-prone areas is not sufficient to learn adequate lessons from the rare flood event in August 2002 and the more recent flooding in summer of the year 2013. In case of extreme floods, much larger areas are prone to be flooded than the area that is delineated based on the return period of 100 years according to German water law. Extreme floods are of high relevance for already built-up areas, not least because, in sum, unregulated small developments cause a significant increase in flood risk. Based on this problem perception, regional planners are also busy now for some time to develop a new contribution to sustainable flood risk management through regulating built-up areas with statutory regional planning (RPV OE/OE 2012).

3.1 Research questions

Against this background and based on the conceptual considerations in the previous section, the paper seeks to answer the following Research Questions (RQ):

RQ1: How do public officials frame and justify the consideration of rare flood events? Learning is, as mentioned above, process-oriented and outward looking, for instance, to consider institutional conditions of problem solving. Complying with regulations, seeking consensus, and using classifications for clarification of terms and causal relations are important activities to develop legitimate contributions to FRM. Public officials, therefore, perceive, analyse, interpret, and act with an eye on how these activities and efforts may be justified in the

² Public officials as members of the office for environmental protection in the City of Dresden themselves pointed to the result of the audit that showed shortcomings of FRM specifically with regard to dealing with rare flood events.

face of important peers, superiors, and stakeholders. This may hold especially for public officials in “high positions” and with formal authority and responsibility. This may also hold especially with regard to rare events for which efficient solutions through using public financial resources are difficult to find (see the discussion about the significance of “high probability and low damage” flood events versus “low probability and high damage” events in Merz et al. 2009).

RQ2: What actions are placed in the foreground for dealing with past and future rare floods? Patsy Healey (2009) uses the expression of “framing selectively” to stress that strategies in institutionalized contexts of urban regions imply a focus on specific institutional conditions, understandings, and actions. Justifications and actions are placed in the foreground of discussions based on frames of reference that may significantly differ between actors and that are embedded in “deep” cultural assumptions about accepted governance modes and values, to name only a few factors. This paper simplifies these complex and dynamic relations between institutions, contents and processes of learning through adopting the conceptual framework outlined in Section 2 and through focussing on a specific type of actors – public officials with specific responsibility for elements of FRM in urban regions based on formal institutions and that may be seen as “forerunners” of dealing with rare flood events based on experience.

Empirical activities to answer these two research questions follow a single case study research design that includes document analysis and expert interviews with public officials belonging to three organizational units: the office for environmental protection in the local administration of the City of Dresden, the office of the regional planning authority in the urban region of Dresden, and the Saxon State Agency for Environment, Agriculture and Geology (LfULG). The following explains this further.

3.2 Design and methods

The authors of this paper accomplished a series of research projects on FRM, often with an empirical focus on activities in the urban region of Dresden (e. g., Hutter 2007, 2016, Naumann et al. 2015). Therefore, the paper is based on extensive background knowledge about managing flood risk in Dresden, also managing the risk of rare flood events. The authors were motivated by a specific research activity to develop this paper: the project STRIMA which stands for “Saxon-Czech flood risk management” with a project duration of April 2013 until February 2015. The involved core partners of the project were the Saxon State Agency for Environment, Agriculture and Geology (LfULG), the Saxon State capital Dresden, and the Regional Development Agency (Agentura regionálního rozvoje, spol. s r.o.). STRIMA was financially supported by the European Commission within the “European Regional Development Fund” and the “Objective 3 Programme (Ziel 3/Cíl 3)” With a

funding area along the border districts between the Saxony and the Czech Republic, the overall objective of STRIMA was to intensify cross-border cooperation in FRM between these neighbouring regional administrations. After project completion, the participants of STRIMA were confident that the overall project objective and more specific aims for co-operation were successfully implemented. For instance, STRIMA aimed to establish joint forums of various actors involved in FRM, especially also actors from municipalities and from different phases of FRM (pre-flood risk management, emergency or event management, and so forth). A further aim of STRIMA was to develop methods for damage simulation and evaluation that are applicable in the context of different physical as well as institutional conditions of the Free State of Saxony and the Czech Republic. The project also followed the purpose of coordinating the various relevant concepts for FRM.

FRM requires robust prognosis of flood damage on both sides of the border between the Free State of Saxony and the Czech Republic. Therefore, the participants of STRIMA discussed and developed in-depth analyses of areas exposed to risks using the building type approach and synthetic depth-damage functions as well as a GIS tool called HOWAD which calculates flood damages with high spatial resolution (Neubert et al. 2016). The major advantages of the methodology is a site specific characterisation of the building stock as one important receptor exposed to flood risks. In terms of the cross-border usage, the methodology can especially take into account country-specific building types, object-related parameters of buildings and price levels of regions.

Within the project, the methodology was tested in Turnov (Czech Republic) regarding the flood risks of the river Jizera and in Dresden (Saxony) regarding the flood risks due to the Elbe-river and its tributaries. In terms of the river Elbe, the case study Dresden focused on various sites and different flood scenarios with water levels of 9.24 m, 9.50 m and 10.00 m at the Dresden gauge. These water levels corresponded with a return period of 100 years, 200 years and “between 200 and 500 years”. Up to now, the highest actual water mark is 9.40 m, measured in August 2002. The results of the damage analysis provided a differentiated view of the financial consequences of less frequently and rare flood events in view of the building stock (Naumann et al. 2015).

Based on the results of STRIMA, the two authors of this paper developed a specific case study approach to understand and to analyse how public officials in the urban region of Dresden learn from and for rare flood events. Results of the damage analysis at building type level developed in STRIMA served in this research process as specific content to discuss the more general issues of dealing with rare flood events in an institutionalized political and administrative setting – settings that are, how could it be otherwise, often contested given a diversity of actors with different perceptions, interests, institutional constraints, and so forth (Hutter 2007). The case study design is defined as a single case study because we assume that public officials act as “members” or “representatives” of their specific organizational units (especially the office of

environmental protection as organizational unit within the local administration of Dresden that is responsible for specific parts of FRM in the urban region of Dresden). However, with regard to the questions about what and how public officials learn from specific experiences of rare flood events and for future events, methods for data collection and analysis may be designed as part of a single case study with embedded sub-cases that are the three organizations of FRM in the urban region of Dresden (mentioned above). Therefore, the case study research design as single case study refers to the collective experience of multiple flood events in August 2002 in the urban region of Dresden. Within this single case, three sub-cases are defined with regard to specific organizational structures that clarify membership of public officials, their formal responsibilities, resources and so forth.

The authors conducted an extensive analysis of documents about FRM from practice (e.g., LHD 2012, 2014, RPV OE/OE 2012). Important further documents were included into analysis, especially the comparison of FRM with regard to the flood events of August 2002 and June 2013 provided by the German Committee for Disaster Reduction (DKKV) (2015). The case study also includes the data collection method “expert interviews” with public officials in local and regional administration in line with considerations about “semi-structured interviews by adopting an interview guide” (e.g., Bogner & Menz 2009, Kruse 2015). The overall design may be seen as an exploratory research design that seeks to stimulate discussion and the formulation of propositions for future inquiry.

4 Findings

It is no surprise to find extensive empirical material through conducting a case study about rare floods in the urban region of Dresden. Firstly, collective experiences of flood events are of high significance for many actors, for instance, public officials, but also citizens and actors organized in the “civil society”. Secondly, the case study deliberately focused on public officials as experts and forerunners of FRM in the urban region of Dresden (Hutter 2016). These officials are active to formulate their arguments and ideas in documents as well as presentations. Based on an exploratory document analysis and expert interviews with public officials, Section 4.1 indicates the range of findings, whereas Section 4.2 provides a more focused account.

4.1 Overview over empirical findings

The overview is structured in accordance with the two research questions of the paper.

RQ1: How do public officials frame and justify the consideration of rare flood events? One public official described the basic relationship between rare, unusual, surprising flood events on the one hand and the tendency of public organizations, like local administration, to focus

on frequent, usual, and unsurprising events on the other as “a permanent conflict”³. *Rareness and routine are seen as in a basic tension* and this requires a “permanent balancing act” to stay involved in dealing with rare floods also in Dresden. In this context, public officials highlighted the important role of the Floods Directive of the EU to justify the consideration of rare flood events in political-administrative settings. “Local administration always acts based on a mandate and in the range of the mandate.” (Interview with public official, City of Dresden) Being able to refer to the Directive facilitated processes to reach a mandate that also covers issues of dealing with rare flood events. In this context, the interviewed officials also often mentioned professional practices, standards, and “technical” regulations as somehow “obvious inputs” for case-specific work. “As engineers, we always seek to consider some sort of design measure or standard in our work. We need to consider limits of engineering work which, then, evokes the consideration of residual risk.” (Interview with public official, City of Dresden) The interviewees also pointed to the “positive” development that professional associations are increasingly seeking to develop guidelines and tools for dealing with residual risk and structuring the “unknown”. As an example, one public official referred to the audit of the DWA mentioned above at the beginning of Section 3.

An important topic in the interviews was the understanding, definition, and specification of what is a “rare flood event”. Some public officials referred to professional standards and also legal regulations of German water law at national and State level (Janssen 2012). The documents and interviews show significant diversity in meanings and specification of “rare flood” which cannot be explicated here due to space limitations. However, there is a broad consensus that the “100 year flood event” indicates the border between floods of high and medium probability on the one hand and floods of low probability on the other. There is also, with some limitations, a consensus in the data that an “extreme flood” is a kind of “constructed” or even “utopian event” that serves as a reference point for design considerations. Rare floods, in contrast, may be rather well-specified and based on experience like in case of a 200-500 year flood event of the river Elbe or the 500 year event of the river Weisseritz in Dresden. Public officials from the City Dresden also pointed to the difference between the statistically defined “localized rare flood event”, especially with reference to locally limited events due to heavy rainfall, and their “growing” relevance for the strategy of FRM of Dresden, especially with regard to non-main rivers which are in the responsibility of the municipality.

A further topic, especially in the interviews, was the relevance of efficiency concerns with regard to decisions about design standards for localities and for deciding about measures to implement these standards. Some public officials stressed that the Floods Directive of the

EU also clearly justifies the *limited relevance* of efficiency concerns for FRM in general, and dealing with rare events in particular. Limited relevance of efficiency especially with regard to rare floods was also justified through pointing to the “obvious fact” that these events may also be “sudden” or “unexpected events” in which case communication structures and delivering “the feasible during the event” would be more important for damage reduction than efficiency arguments. Officials also pointed to the difference in understanding rare floods as element of economic calculation on the one hand and as “highly emotionalized event experience” on the other, especially in case of citizens.

RQ2: What actions are placed in the foreground for dealing with past and future rare floods? The document base of the case study encompasses a broad spectrum of statements about specific actions for dealing with floods in general and some statements for dealing with rare floods in particular. In contrast, interviews were more focused on RQ1. A full report of the findings with regard to RQ2 is beyond this paper. However, the following seeks to highlight one topic: Important social science work has shown that actors in general, public officials in particular, have multiple possibilities to connect ideas, interests, and actions (see the seminal article by Swidler 1986, Scott 2014). All officials selected as interviewees showed high motivation to further deal with rare flood events in the future which is not very surprising because these officials were chosen as interview partner with regard to active involvement in participating in projects of research and practice (e. g., “Modellprojekte”) and with regard to developing specific documents for dealing with rare events like brochures for the “general public” and so forth. However, the findings of the case study also indicate that two approaches based on high motivation to deal with rare flood events may be contrasted: a synoptic approach on the one hand and a more pragmatic approach on the other. The following explains this further.

A synoptic approach to dealing with rare floods follows the purpose of integrating FRM and “the prevention of disaster and catastrophes”. Therefore, the synoptic approach focuses on extreme floods as a crucial reference point for argumentation (e.g., the concept of a “Probable Maximum Flood (PMF)”⁴ in RPV OE/OE 2012). Based on extensive communication and attempts to inform peers, superiors, and stakeholders, officials that follow this approach argue for a combination of “soft” and “hard” measures, whereby, “soft” measures refer to awareness raising, provision of target-group-oriented information, and “hard” measures, for instance, to more effective and restrictive legal regulations in specific localities where catastrophic consequences may occur. In short, the concept of an “extreme flood event” is a crucial reference point for this approach to dealing with rare floods, even if this event is communicated as a constructed one.

³ The public official even used the term „inertia“ („Trägheit“) to describe the tendency of administration to focus on the frequent and the usual.

⁴ The PMF is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation, and where applicable, snow melt, coupled with the worst flood producing catchment conditions.

In contrast, a pragmatic approach may also refer to the concept of an extreme flood event, but this is considered as a possibility in a more flexible manner, less for justifying the overall management to rare floods and its implications. Furthermore, the notion of an extreme flood is also used to inspire how the addresses of FRM interpret their own experience with flood events in the urban region of Dresden. For instance, one of the public officials in the City of Dresden referred to the possibility to motivate private actors to imagine the experience of the flood event in August 2002 as “personal experience with an extreme value” that should motivate to think of possible even “more extreme” flood events in the future. This pragmatic approach, therefore, may be also characterized by a preference to deal with the unknown of extreme events through expanding imagination step-by-step through analysing and interpreting experience of the past. Public officials stated in the interviews that they interpret the methods used in STRIMA as in line with such a pragmatic approach to FRM.

4.2 Interpretation of selected findings

The case study shows that some public officials in the urban region of Dresden are highly committed to dealing with rare flood events. The study focused on public officials in the office for environmental protection as organizational unit within local administration of Dresden and officials in the regional planning authority. This is *not* to say that *all* public officials in the urban region of Dresden are highly committed to FRM in general, and to managing risk related to rare flood events in particular. The study highlighted local and regional “forerunners” of FRM to understand what and how public officials learn from and for rare flood events in highly institutionalized and partly contested settings of political-administrative decision making. The following interprets selected findings in relation to the conceptual framework outlined in Section 2.

Institutions and learning for effective and efficient FRM: Public officials justify their commitment to dealing with rare floods through referring to the Floods Directive of the EU (e.g., Art. 6(3): “floods with a low probability, or extreme event scenarios”). They state that specific justifications of dealing with rare floods are “necessary” because local administration and politics tends to focus on “the usual and regular” instead on dealing with rare, extreme, and surprising events – even in cities with collective experience of catastrophic rare floods like Dresden in August 2002. Public officials interpret efficiency as contested evaluation criterion for managing flood risk in general, rare floods in particular. They perceive that efficiency concerns may be of little relevance for private actors that have been significantly affected by a rare flood in the past. From their viewpoint, some of the affected actors tend to overestimate the relevance of rare floods for the future. With regard to own action in the public sphere, one public officials even argued that “inefficient use” of public resources could perhaps be justified in some areas to *avoid inefficient*

private investments in flood protection – somehow arguing for a *deliberate* “crowding out” of inefficient private resource allocation.

Understanding and agreeing on terms and causal relations of rare floods: The interviewed public officials related multiple meanings to the word “rare flood event”. In principle, rare floods are distinguished from floods with a medium probability. Public officials interpret floods with a medium probability in line with German water law regulations as “floods with a return period of 100 years (100 year event)”. However, some public officials sometimes also distinguish between “rare floods” on the one hand and “extreme floods” on the other, for instance, to develop a scenario for analysing the consequences of floods at building type level and with regard to specific areas within the territory of Dresden (see Naumann et al. 2015 based on input for scenario definition and data analysis by public officials in Dresden, see also above Section 3.2). The interviews show that rare floods are understood in this context as an event with a return period of 200-500 years (or a return period of 500 years like in the case of the Weisseritz flood in August 2002 in Dresden, LHD 2012, 2014). Therefore, the case study findings confirm that the term “flood of medium probability” is consistently specified for decision making in Germany as the 100 year event (HQ100), whereas flood events of lower probability show some heterogeneity in meaning and specification (see DKKV 2015, 94). Therefore, we propose that *convergence in collectively understanding and defining rare flood events still has to occur* (e.g., through widely diffused classifications that are highlighted by neo-institutionalism, Scott 2014).

Commitment to action for dealing with rare flood events: It is widely acknowledged that the rare flood events of the river Elbe and its tributaries in August 2002 triggered significant policy changes in dealing with flood risk in Germany, in Dresden in particular (Vulturius 2013, Hutter 2016). In this context, the interviewed public officials in Dresden are able to sustain their commitment to dealing with rare flood events over a period of over 10 years (approx. 08/2002 – 02/2016). Thereby, they follow diverse “lines” of argumentation for justifying and specifying their commitment to dealing with rare flood events. For instance, some officials seem to interpret extreme floods as “absolute” reference point to develop a new integrated approach towards avoiding flood catastrophes in urban regions like Dresden (“systematic top-down approach”). Others seek to expand management approaches for dealing with floods of high and medium probability to convince others that rare as well as extreme floods should also be considered in decision making for FRM (“pragmatic step-by-step approach”). Especially in the case of the latter, it is difficult to observe that public officials tend to overestimate the relevance of future rare events.

5 Conclusion and outlook

Public officials that are highly motivated to learn from and for rare flood events in urban regions think and act in a political-administrative setting that is characterized by complex and changing context conditions. The paper especially focused on institutional conditions as one important element of context for FRM (Hutter 2007). In line with the framework for institutional analysis conceived by Scott (2014), the institutional context of public officials involved in learning with regard to rare flood events shapes and influences thinking and acting, for instance, due to specific regulations, normative expectations based on consensus between actors in urban regions, and more or less explicit cognitive elements (like classifications, typical arguments, beliefs about situation-action linkages).

Some institutional conditions support learning from and for rare flood events (e.g., the Floods Directive of the EU). Other institutional conditions may hamper attempts to deal with rare floods based on continuous learning processes and a strong commitment to action in the face of increasingly scarce financial resources in the public realm (see discussion about the efficiency of reducing the risk of low-probability flood events, e.g., Merz et al. 2009). Furthermore, the “cognitive landscape” with regard to low-probability flood events shows significant diversity in the urban region of Dresden and this seems to hold for other regions in Germany too (DKKV 2015).

Up to now it is difficult to assess whether processes of institutionalization with regard to the whole spectrum of possible flood events are ongoing. Consensus among actors involved in FRM may be limited to the meaning and specification to one “class” of events – the 100 year flood (HQ100). Of course, this “state of the art” may change in the future.

Against this background it seems reasonable to suggest that – at least – two kinds of empirical studies may be of special importance to further our understanding how public officials and other actors (e.g., politicians, members of business organizations) actually learn or may be able to learn from and for rare flood events: (1) studies that focus on processes of institutionalization and institutional change which implies empirical activities at the level of (at least) populations of organizations (Scott 2014) and (2) studies that, like this one, focus on what and how public officials and other actors perceive, interpret and act in the context of complex and dynamic conditions (Weick 1995, Weber & Glynn 2006).

Both kind of studies require significant and continuous effort of research in relations to practice. Hence, learning from and for rare flood events may be understood also as a learning challenge for researchers of FRM (Van de Ven 2007).

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