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Fighting the Hydra: How local organizations build dynamic decision-making capacities during a global polycrisis

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Crises today occur in manifold variants. Cyberattacks, floods, wars, pandemics – the list of cases is ongoing. Academic literature recognizes them as "transboundary crises" (Ansell et al. 2010) or as "global polycrisis" (Homer-Dixon et al., 2022), referring to their transgressing, cascading and overlapping dynamics in both space and time. In this paper, we discuss how decisions are made at a local level in such dynamic, if not disruptive, environments. By combining dynamic decision making and crisis management literature, we illustrate how the decision-making evolves when the crisis shows transboundary characteristics, that is, when cascading dynamics call for even more decisions (hence the "Hydra" metaphor referring to a monster in Greek mythology that multiplies its heads once it is being fought). The paper draws on a qualitative study on decision processes in local authorities and organizations in Germany during the Covid-19 pandemic. It can show (1) how these local actors build inter-organizational networks (e.g., task forces) in order to synchronize their decision processes against the background of changing federal requirements; (2) how, due to the duration of the pandemic, rather permanent decision systems developed; and (3) how these networks learn to sustain dynamic decision-making capacities in order to cope with crises following Covid-19, such as the effects of the war in the Ukraine or recent climate impacts. With these findings we contribute to an "integrative" conception of crisis in current crisis management literature that seeks definition in a dynamic process view rather than using either objective or subjective criteria. A dynamic decision-making approach allows for a more detailed realization of this conceptual shift by representing the current "cascading disasters" as "cascading decision-making". This understanding focuses on the active role decision-making plays as well as it reflects on the fact that decision-making in today's crises always involves *others* making decisions, too.

Keywords: crisis management, dynamic decision making, global polycrisis, municipalities, public administration, transboundary crisis

Introduction

The Covid-19 pandemic confronted decision-making globally with circumstances of threat, urgency, and uncertainty. Overall, it seems, these times are those of crisis. Impacts of the global warming such as droughts, fires, and floods, but also wars, earthquakes, or hybrid threats seem to emerge in even shorter frequency. Today's crises have in common their transgressing and overlapping character, which is why literature refers to them as "transboundary crisis" (Ansell et al., 2010), "creeping crisis" (Boin et al., 2021), or as "global polycrisis" (Homer-Dixon et al., 2022). While classical crisis management approaches suggest an intense set of decision-making within a rather short time frame and are mainly limited to individual organizations, the specifics of these current cases stretch temporal and spatial boundaries as they necessitate simultaneous decision-making activities in many spheres of social life. To understand how exactly the decision-making evolves when there are multiple agencies at play, becomes a more pressing theoretical question – one that this paper focuses on.

In this paper, we ask how municipal organizations in Germany cope with the distinct challenges posed by one of the most recent "mega" crises (Boin et al., 2021b): the Covid-19 pandemic. Since the pandemic, especially at a municipal level, called for more than one set of decisions, and since the decisions showed to be highly interdependent – also with those of other administrative levels –, we find dynamic decision making (DDM) literature to hold valuable concepts for analysis. Our objective is to enhance the conceptualization of decision-making processes during crises by amalgamating DDM principles with crisis management literature, employing a sociological lens. To address this objective, we explore two primary research inquiries: Firstly, how do involved organizations navigate their decision-making processes? Secondly, how does the trajectory of their decision-making unfold throughout a crisis?

After a brief illustration of our theoretical orientation, we will explicate our research design, centered on qualitative expert interviews with decision makers in German municipalities during the pandemic. Given their status as the smallest administrative entities possessing self-governing authority, these units play a pivotal role in executing operational and tactical decision-making processes, thus rendering them an apt focal point for our research endeavors. Subsequently, we illustrate three findings on how municipal decision-making was organized so that it could tackle

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the challenges posed by the pandemic: Firstly, we will examine the emergence of inter-organizational networks designed to facilitate dynamic decision-making. Secondly, we will delve into the formation of rather informal decision systems that rely on "knowing people" for more agile decision-making. Lastly, we will explore the adaptation of established decision capacities to post-Covid-19 scenarios such as impacts of the Russian invasion into Ukraine. Before resuming, we will discuss these findings again in the light of DDM literature, making use of the image of the "Hydra". Referring to the Greek myth of a monster multiplying its head once it is being fought, in our view accurately illustrates the character of the multiple, dynamically shifting problems decision networks are confronted with today.

Theoretical orientation: A sociological perspective on crisis management and DDM

This section comprises key concepts of decision theory from crisis management as well as DDM literature. We take in an overall sociological perspective, that is, we understand decision-making as well as its cognitive aspects as genuine social processes.

Decision-making under conditions of threat, urgency, and uncertainty

Although the term "crisis" has a rather inflationary use and is applied differently across the disciplines, we can find its semantic core to be rooted in the Greek "krísis" meaning a turning point, argument, and decision (see Steg, 2020). Particularly the interdisciplinary crisis management literature and respective organizational studies build closely upon this semantic core. Here, a crisis is understood as moment of decision-making under conditions of threat, urgency, and uncertainty. To state this with a quote often cited: Crisis is a "serious threat to the basic structures or the fundamental values and norms of a system, which under time pressure and highly uncertain circumstances necessitates making vital decisions" (Rosenthal, Charles & 't Hart, 1989, cited in Boin et al., 2018, p. 24). In other words, a crisis equals a specific kind of decision-making. It becomes "specific" through the dynamics introduced by the three characteristics of threat, urgency, and uncertainty (see Brinks & Ibert, 2021). Usually, the situation is triggered by a perception of threat, for example a detected increase in Covid-19 infection rates. In order to discharge or interrupt this threat from causing further damages, an immediate response becomes necessary. While this is clear almost instantly to all participants of the crisis, it remains radically open *how* exactly the response *can* happen. Particularly in early stages of a crisis, crucial information is lacking or still very volatile. Accordingly, in crisis there is a necessity to act in order to reduce the threat, but at the same time due to the uncertainty there is the experience of helplessness where routines fail to respond (see Graf, 2020).

But how do actors reach decisions despite the situation being deeply threatening, urgent, and uncertain? Organizational literature on "sensemaking" as opposed to models of rational decision-making addresses this question (for a literature review, see Brown et al., 2015). Weick (1993) found a "collapse of sensemaking" in the initial phase of a crisis. Participants (and this can be organizations, too) lose orientation in their rational views of the world. Due to the experienced urgency, they start acting before they grasp a full picture of the situation. Action is "ahead of" cognition at this very first stage of a crisis. Adding to this, Roux-Dufort (2007, p. 110) emphasizes that a collapse of sensemaking is usually followed by a "surge" or "wave" of meaning. Here, too much uncoordinated information communicated by too many participants becomes the problem (see also Harmsen & Ibert, 2023). Kornberger et al. (2019) – taking a step further than Weick – state that decision-making emerges in a dynamically iterative interplay between cognition and action. They find decisions in crises to follow neither shared protocols nor a cognitive script. Instead, the decisions happen in a "rapid switching between cognition and action" (Kornberger et al., 2019).

For further conceptions of this paper, it is important to note that both cognition and action are seen here as *collective* processes. Cognition, and accordingly collapses and surges of sensemaking, are conceived not so much as taking place in an individual's mind, but rather as a product of "the social", that is, as part of interactions, organizations and society.

Although the introduced strand of literature already addresses decision-making in crisis to be dynamical, there seems to be a lack in theorizing how the decision process evolves throughout changing contexts over time, which becomes particularly relevant in long-lasting cases like the Covid-19 pandemic. The pandemic as well as a range of other current cases fall into a category of crises that are shaped by transgressing, cascading, and overlapping dynamics in both space and time. In literature, there are different terms denoting this phenomenon. The transgression in space, for instance, is defined as "transboundary crisis" (Ansell et al., 2010): The crisis does not take a halt at institutionalized borders such as the ones of nation states, organizations or knowledge domains. Also with regard to time, today's crises become harder to grasp in their beginnings and endings, which, for instance, is addressed as "creeping crisis" (Boin et al., 2021a). In transgressing spatial and temporal borders, crises, however, do not stay the same, but multiply and shift their state depending on the systems involved (see Brinks & Ibert, 2021). This is why crises today show overlapping and cascading effects, which at a macro-level are all connected in one "global polycrisis" (Homer-Dixon et al., 2022). With regard to decision-making, this aspect becomes relevant insofar as multiple decision-makers are involved at the same time to handle a global phenomenon, multiplying both decision-making processes and decision environments. However, how such a process evolves and which sec-

ondary effects it can create remains underexplored. Although literature on "cascading disasters" already addresses the phenomenon of secondary effects, their driver is localized externally without connecting it to decision-making. This might be one of the factors that lead to associating "the word 'cascading' [...] with the metaphor of toppling dominoes" as Pescaroli and Alexander (2015) point out. Our paper seeks to tackle this shortcoming by looking at the active role decision-making plays in cascading dynamics. In order to do so, we need concepts explicating the internal drivers of decision dynamics as provided by DDM literature.

Crisis as an eminent case for dynamic decision making

The understanding of a crisis as moment of specific decision-making in crisis management literature and related theories can be seen as inscribed into the very core of the literature on DDM. Both literature strands are not yet broadly connected (although there are exceptions, e.g., Kluge, 2019), which we aim to contribute to with this article. Both share their interest in researching decision-making in extreme contexts (see e.g., Brehmer, 1992, p. 211; Hällgren et al., 2018). Particularly when trying to understand how decision-making and decision-contexts relate to one another over time, DDM seems a promising approach to contribute to the current crisis management literature and can especially inspire further conceptualization of today's transgressing crisis phenomena. Likewise, crisis management literature – as shown above – is able to provide DDM literature with established concepts and methodologies of crisis and thus supports observing a real problem-solving context with DDM.

A central question in DDM literature addresses the interrelation of decision-making and decision-contexts (see Edwards, 1962; Brehmer, 1992). Most simply speaking, decision-making is triggered by the decision-makers' perception of a changed context. This context poses a problem which is sought to be solved by decisions. The decision-making then starts to affect the context, which again changes the next decision's environment, and so on. Therefore, with DDM we can speak of a dynamic interplay of decision-making and decision-contexts.

With their decisions, actors try to gain control over their environment which they are only able to do by controlling their own decision process (see Brehmer, 1992, p. 213). While DDM literature differentiates a variety of different decision contexts in the spectrum of "stationary" and "nonstationary" (see Edwards, 1962, p. 60), a crisis as defined above almost immediately falls into the category of a "nonstationary environment". Here, similar to what was illustrated in the section before (see Kornberger et al., 2019), cognition and action appear to be switching dynamically as this kind of environment "changes while you collect information about it" (Edwards, 1962, p. 60; see also Fischer et al., 2012). Part of the changes cannot be influenced by the actors – another part, however, is directly linked to their decision-making. Thiétart and Forgues (1997) even speak of this as a deterministically "chaotic" context. Crisis, in their words, exemplifies "a situation induced and perpetuated by the same organizational actors who tried to handle it" (Thiétart & Forgues, 1997, p. 119). That is, a crisis is shaped by the interplay of organizational decisions and the context that emerges dynamically from these decisions. Following this understanding, a crisis is nothing that is just "out there" (see also Spector, 2019), but results from decision dynamics: The decisions create "a context which impose[s] itself later [...] upon the actors" (Thiétart & Forgues, 1997, p. 138). Similar to what Schoppek (2023, p. 2) states, it is thus beneficial for scholars to focus on the *process* of the decision-making rather than on problem classification.

How exactly the decision-making process evolves during a rather long-term transboundary crisis such as the Covid-19 pandemic will be the core question of this article. As stated before and unlike much of the DDM research, our focus does not lie on individual "human" actors but on *organizations*. Following a social sciences and organizational studies approach, we understand organizations as decision-makers on their own (e.g., Luhmann, 2018). As mentioned above, decision-making here transcends psychological rules and is shaped by communicative, *social* processes and embedded in a *collective* sensemaking. With this understanding we aim to contribute to DDM literature.

Data and method

The following paragraphs describe the methodological approach of the study. Both the research subject of municipal administrations and the data collection and analysis methods are outlined. Subsequently, a discussion is provided on where the study reaches its limitations.

Context and key actors

The Covid-19 pandemic as a global phenomenon qualifies as a transboundary or "mega" crisis due to its effects on almost all geographic regions and societal sectors (see Boin et al., 2021b). However, the challenges imposed are usually dealt with on a much more local level, with responsibility for decision-making often being passed to municipal administrations as the smallest organizational body of government (Haverkamp et al., 2023).

Formally, the federally organized state of Germany knows two levels of government: the national/state level and the level of the 16 federal states. Municipalities are part of the executive power of the federal states, meaning they are entities with self-governing rights that are indirectly assigned to the federal state administration (Kuhlmann et al., 2021). This is important to note when trying to understand the decision-making processes in municipal authorities since they are – despite their organizational sovereignty – dependent on regulations of the respective federal and national government. This results in

a row of key actors responsible for decision-making on various levels with the local actors in municipal administration (such as mayors) being the final decision-makers at the local level. Thus, while crisis management in the pandemic was in the hands of local actors in order to best address local conditions and the specifics of a municipality or region, these actors were simultaneously reliant and dependent on decisions made by superior authorities. It is not unreasonable to assume that this interplay between different levels of government did not always proceed smoothly in light of the dynamics of the crisis and the presumed rapid switching between action and cognition.

In order to better understand how decision-making and decision contexts are related in crises we analyzed the decision processes in municipal authorities and local organizations with security tasks. Those authorities had to implement federal regulations within their area of responsibility and at the same time establish legitimacy for the measures taken during the pandemic. We were thus particularly interested in the management level in various departments of the local administration, staff in crisis management units, security actors such as the police and the municipal law enforcement authority, but also organizations of disaster management and civil protection.

While the German administration is reputed to be cumbersome and to require long decision-making processes, the individuals involved had to develop new solutions and faster procedures during the crisis in order to deal with the dynamic situation. It is not our intention to evaluate the flexibility and speed of the administration; rather, our aim is to understand the ways in which processes changed and the extent to which these changes had lasting effects. What is evident is that all organizations have had to make decisions based on minimal information, and new inter- and intra-organizational collaborations have emerged as a result. New workflows were established, and resources redistributed.

In a total of 29 interviews, we spoke with 41 individuals in the administration of two large cities (above 500.000 inhabitants), several authorities and organizations with security tasks as well as aid agencies (see Table 1) to better understand the rationale, challenges, and reorganization of decision-making processes in the Covid-19 pandemic.

Data collection: Expert interviews with an organizational focus

Our contribution also brings a new perspective to dynamic decision-making research from a methodological point of view, insofar as we set the entity of the organization as the object of observation on the one hand and investigate dynamic decision-making processes through methods of qualitative social research on the other. Empirical research on DDM in the context of complex problem solving (CPS) has so far mainly been conducted through psychological experimental approaches, often along microworlds in which complex problems are simulated in order to study human decision-making behavior (Dörner & Gundlach, 1992; Brehmer, 1992; Brehmer & Dörner, 1993; Greiff et al., 2015). Our research focuses on dynamic decision-making in and through organizations. According to Luhmann, organizations are "social systems [...] that consist of decisions and only of decisions, and only of decisions that they themselves make." (Luhmann 1988, p. 166, translated from German by authors). Individuals participate in the organizational decision-making through membership. This membership is tied to expectations, the fulfillment of which is the precondition of membership itself (Luhmann, 2018, p. 62). Following Luhmann, our theoretical conception of decision-making is built on the dimension of organizations instead of psychological aspects, which broadens the DDM approach.

Our research design is based on a qualitative methodology. Thus, we obtained our data through interviews we conducted in the field. Expert interviews refer to people's professional role within an organization. By explicating decision-making processes, the interviewees refer to knowledge they have acquired in and through the organization (see Klemm & Liebold 2017, p. 306). However, this knowledge tends to be implicit (see Kaiser, 2021, p. 48) and not directly accessible to consciousness. It must be reconstructed by the researcher and sought virtually "between the lines" of the interview. Implicit knowledge provides information about the organizational logics behind decision-making processes that influence decisions without becoming manifest. Although implicit knowledge remains latent, it has a "system-stabilizing function" (Katenkamp, 2011, p. 198) for the organization. Crises, however, disrupt established decision-making processes and previous relevance systems. The purpose of the expert interviews was therefore to learn how organizations deal with this in complex situations.

The data collection in our project was carried out by means of semi-structured expert interviews conducted with members of the above-mentioned organizations in the period between June 2022 and April 2023. In sampling the experts, it was decisive to interview executives, who were decision-makers by profession, as well as experts from the operational field of crisis management. We expected that this would enable us to depict the interdependencies of decision-making at different levels. The identification of interview partners was based on the selected key actors in the context of the Covid-19 pandemic. As it is an infectious disease, the health departments of municipalities are the primary responsible authority. Due to the emergency-like situation, other state actors from civil security – such as the police, fire services, or aid agencies – were obliged to contribute. These were therefore crucial interview partners for us. The measures to manage the pandemic had to be legally implemented within the municipalities and enforced by the security and public order authorities. However, due to the transboundary character of the pandemic, almost every administrative area of the municipalities was involved in crisis

Table 1. Interview partners by sector

Sector		Interviews	Interviewees
Local emergency services	Aid/Relief agencies	5	6
	Police	5	8
	Fire departments	4	4
Municipal administration	Public health department	4	5
	Public order department	8	14
	Department for social welfare and education	2	3
	Human resources department	1	1
Sum		29	41

management. Since each administrative area and each security actor is charged with specific responsibilities, there are varying levels of knowledge. Thus, we expected divergent decision premises within the organizations.

We selected the individual experts on the basis of whether they were professionals with management functions or professionals with operational tasks. For both, decision-making is part of their profession, although for people with management functions, decisions usually relate to abstract or strategic decisions, while operational staff are confronted with situations and single cases in which decisions have to be made. Due to the hierarchical nature of the organization, we generally approached experts in management positions in the various organizations first. Through them, we were put in touch with experts from the operational area. This approach often led to a snowball effect.

The overall 29 interviews were conducted in-person and online, audio-recorded, then transcribed verbatim, anonymized, and provided with an interview code consisting of a consecutive number (#01–#29). Before each interview, the interviewees were informed about the project, the protection of personal information and data security. Then their permission was obtained. The interviews lasted 90 minutes on average and were usually conducted by one interviewer. All interviews were conducted in German and the following quotes are literal translations. The interviews were conducted with the use of a semi-structured interview guide that covered various thematic areas, which in turn contained a range of questions that were asked in a different order depending on the course of the interview. The interview guide comprised five thematic areas. The first section dealt with the professional understanding of the Covid-19 pandemic as a crisis and the understanding of crises in general. The second block covered questions on the specific involvement in the management of the pandemic and addressed the development of decision-making during the pandemic and its turning points. Here, we were particularly interested in how the course of the pandemic was reflected in organizational actions and decisions and how decisions were communicated within the organization. Inter-organizational cooperation was also addressed there. The third block of questions was dedicated to the issue of how the municipalities implemented the external requirements of the federal states or the federal government. In block four, we collected questions aimed at the organization's external communication. Here, we were primarily interested in the communication of decisions to the public. In the fifth block of questions, we raised perspective questions focusing on the lessons learned from the Covid-19 pandemic. We terminated the data collection period when saturation was achieved, indicating that our sample adequately encompassed the established categories and subcategories in terms of density and variation, and that additional data no longer yielded new insights relevant to our research objectives (Schittenhelm, 2021, p. 288).

Analyzing data: Qualitative content analysis

Mayring's qualitative content analysis was chosen to analyze the interview material (Mayring, 2015, p. 54). With this method, data can not only be systematically analyzed for its content, but also latent meaning can be captured through a qualitative-interpretative procedure (Mayring & Fenzel, 2022, p. 691). In qualitative content analysis, the analysis of the material is strictly rule-guided so that "a systematic, intersubjectively verifiable working through becomes possible" (Mayring & Fenzel, 2022, p. 693). In structuring content analysis, categories are developed in a theory-guided process and then deductively applied to the data material (Mayring & Fenzel, 2022, p. 696). The categories and coding rules are adapted and refined after a first analysis round (Mayring & Fenzel, 2022, p. 694). Our category formation takes place in an alternation of theoretical referencing and out of the material. The developed categories were transferred to a coding guideline, which depicted a hierarchical category system (Kuckhartz & Rädiker, 2022, p. 61). Main categories were formed, which are then further divided into subcategories for a differentiated analysis of the data material (Kuckartz & Rädiker, 2022, p. 62). Every subcategory receives a label, a code, a category definition and an anchor example that represents what is to be depicted by the category. Under the main category "decision-making", we formed a total of four subcategories, which in turn contained different code specifications. The following labels were

assigned to the subcategories: Decision structures, Decision premises, Decision process, Participation in decisions. The coding software MAXQDA was used to support the coding and elaboration of categories. The extracts of the data material presented in the results section reflect the topics on which the interviewees were unanimous. Naturally, the data material also contains individual divergent opinions, but for the purpose of a coherent argument, we will limit ourselves to presenting the aspects that occur repeatedly and, in total, lead to the formation of our result categories.

Limitations

Germany's federal structure resulted in significant variations in crisis management regulations throughout the course of the pandemic. In addition, each district and municipality had room for action within the framework of local-level crisis management. Consequently, the municipalities under study are challenging to compare, as decisions made at the local level often had to adhere to varying state-level guidelines. While there were likely as many organizational approaches to managing the pandemic as there were municipalities, our data has yielded findings that are applicable to all the municipalities and organizations within our study.

It should also be noted that at the time of the interviews, most of the pandemic regulations were no longer in effect or had been mitigated. At the same time, new crises, such as the war in Ukraine and the looming energy crisis, were replacing the pandemic as the main crisis within municipalities. The Covid-19 pandemic and related events were therefore described retrospectively by the interviewees. In our study, the decision-making processes in complex situations are therefore not to be understood as real-time averages, but rather as a retrospective evaluation by the experts. A retrospective view allows only limited access to the situation in which the decision was originally taken, since with the progression of time not only the consequences of the decision have become clear, but also the context against which the decision is seen has changed. This limitation is inherent to the interview method itself: The ascription of meaning always takes place in social interactions and is constantly evolving. Qualitatively based research is interested precisely in this processuality and must understand itself as part of the process of constructing meaning (Strübing, 2013, p. 21). For this reason, our interview guide addressed points of change in the course of the pandemic to be able to elaborate on the processes of the ascription of meaning.

After briefly outlining our theoretical framework drawing on crisis management and DDM literature and elucidating our research design, the following section will present three key findings. They shed light on how municipal decision-making was organized to address the challenges at hand before the findings are eventually transferred into a phase model in the discussion.

Findings

The Covid-19 pandemic confronted decision makers – even professionalized crisis managers – with a new context. Instead of an indeed complex, but only temporarily acute, definable crisis, our interviewees told us they had to deal with an uncertain situation evolving over (more than) two years. This called for more than one set of decisions and for a wavelike crisis management with acute peaks as well as weaker phases. In this section, we portray how the observed municipal organizations coped with this. We discovered an overall buildup of dynamic decision capacities, which we see reflected in three findings: (1) the emergence of coping structures for the synchronization of decision processes, (2) the formation of rather informal decision-making systems, and (3) the transfer of the dynamic capacities onto situations following Covid-19 as a direct learning effect.

(1) Pre-established and emerging crisis management structures

As we have illustrated before, Germany's federal system in the Covid-19 pandemic led to a decentralized decision structure. Decision responsibilities lay in the hands of the 16 federal states and respective municipalities, making the challenge in coordination even more pressing. On the one hand, some of our interview partners described benefits that go along with such a structure particularly for crisis situations – such as being able to respond rapidly to changing local circumstances (#14). On the other hand, they also pointed out difficulties that posed additional problem-solving situations. Adapting decisions at municipal levels proved to be challenging, as highlighted by a precinct commander with a touch of irony, particularly due to the constantly changing federal regulations:

> "*Much to our delight, the legislator [federal state] was always happy to publish a new Corona regulation on Friday evening to take effect the following day. But that meant I had to get my units up to date on the weekend.*" (#05)

An even more pressing difficulty was seen in that municipalities found the outcome of own decisions utmost diverging from the ones of other, sometimes directly neighboring municipalities (#01, #03, #06). For instance, the head of a public order department told us:

> "*Then in [the own city] the drive-in cinema was open, in [the neighboring city] it was closed. Because the colleague interpreted [the legal regulation] differently. So, and of course that caused trouble, right?*" (#06).

Cases like this do not only reveal the interpretative scope and uncertainty a decision is exposed to but put decision-makers even more so under pressure to justify decisions once they are made public (#05).

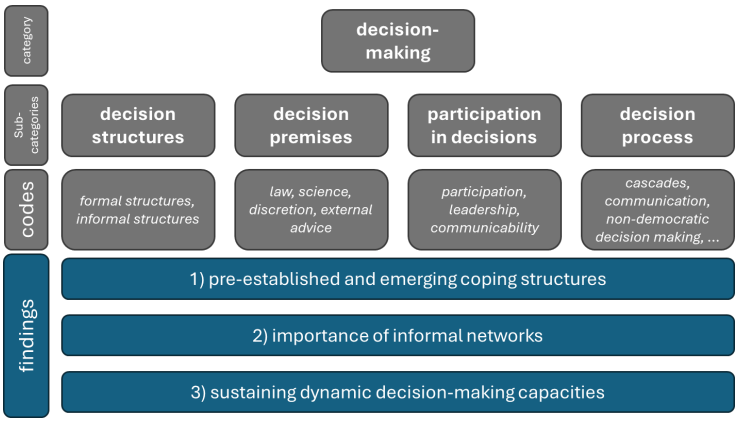

Figure 1. Structure of the category system including exemplary codes

How did the municipalities organize their decisions in the light of such challenges? Public authorities in Germany usually provide formal crisis management structures that can be activated temporarily. Generally speaking, there are two such structures pre-established (#09): one with operative-tactical decision competence ("Führungsstab") where mostly "blue light services" come together in a centralized command; the other one with administrative-organizational decision competence ("Verwaltungsstab"). The pandemic led to an involvement of multiple actors, both from the blue light services, that is, from organizations revolving around emergencies, *and* from organizations with other core activities. Depending on their everyday core activities, organizations were more or less prepared to adapt to the emerging challenges of the pandemic. One of our interview partners from a civil security department explains the difference:

> "*For us [i.e. the emergency and related services], dealing with a crisis [...] is part of our everyday work. That's why we're structured differently, if you will, and that's why we work much faster and better and smoother, while others I have to teach at that moment what crisis management means.*" #09

However, even though, compared to other organizations, their profession gave organizations specialized on emergency management a head start, the pandemic posed a new kind of decision context for them as well. Interestingly, the Covid-19 pandemic was only in a few cases (such as in Bavaria as a whole federal state, or the city of Halle as a municipality) officially declared as a state of emergency ("Katastrophenfall") which usually leads to an activation of the pre-established structures mentioned above. Most municipalities and federal states forwent the official declaration, which is why respective interviewees told us they did not activate the designated operative-tactical decision structure (Führungsstab). However, rapid operational and tactical decisions – such as purchasing and allocating medical supply (e.g., disinfectants) as well as organizing logistics (e.g., renting storehouses or establishing vaccination centers) – did become necessary during the pandemic. In this context, our findings show *emergent decision structures* (additionally to pre-established ones). For these we use a definition provided by one of our interviewees from a civil security department:

> "*The situation we had at the beginning had little to do with our classical, everyday emergency response [...] These are structures that we then have to set up ad hoc, and I'll say it flippantly: have to improvise.*" (#09).

Although there are functional similarities (e.g., in holding operative-tactical as well as administrative-organizational capacities), the emergent structures transcend the logic of the pre-established ones in that they are rather improvised, even more flexible in recruiting, consulting or dismissing members, and highly dynamic in finding and adapting decisions. Unlike regular crisis management structures, the pandemic as a slow-onset, protracted case with acute peaks was not tackled in intense meetings at a stretch, but instead, as many interviewees told us, in regular, mostly weekly meetings: According to the head of a public order department, the networks

> "*did not hold a meeting for 24 hours, but they [...] distributed tasks. A week later everyone came back together, is that done, etc.*" (#06).

The emergent character is reflected in the various names given – for instance, our interview partners speak of them as "*Information Collecting Point 'Corona'*" ("Informationssammelstelle 'Corona'", #03, #05), a regular "*Informative Meeting*" ("Informationsveranstaltung", #07), newly established "*Reporting Centers*" ("Lagezentren", #06), or as "*Task Force*" (#09).

As these names already suggest, we can differentiate two types of networks in this field. Many of them were established in order to share information and form a collective understanding of the situation. Thus, networks of this type did not function as actual decision networks, or as a precinct commander put it:

> "*Nothing was actually decided there.*" (#07).

Instead, they were used in order to *prepare for*, *synchronize*, and *debrief* fast decision-making by aligning information from various actors and departments. Factual decisions were made only when the participants returned to their home organization. However, there was another type of emerging network which actually held decision competencies such as the one called "*Task Force*" or other ones with administrative-organizational decision tasks. Here, the networks emerged in order to shorten decision processes and thus provide capacities for a rapid response. To illustrate this, we can refer to an instance described by one of our interviewees from a civil security department:

> "*And then we went five steps towards the district administrator and said, 'Mr. District Administrator, 200.000 Euros, 15 ventilators, now or never!' He didn't say anything, he just did this [nodded]. All right, thanks, that's enough. Really, then decisions are made like this, using the shortest possible route.*" (#09).

Though not officially declared, the pandemic brought the typical characteristics of a crisis to the fore where decisions had to be made under conditions of threat, urgency, and uncertainty. The decision networks emerged to cope with the situation collectively, and it was evident to an expert advisor in disaster management that

> "*in the end it is important that you make a decision. You always do it with insufficient information, you always do it with uncertainty, you always do it under time pressure. This means that there is actually no right or wrong decision, but there is only a decision.*" (#12).

Interestingly, while becoming able to make prompt decisions, a collective reflection of decisions taken was still considered important in both types of networks. Or, as the same interviewee put it, a consideration of

> "*right and wrong is still carried along all the time.*" (#12).

Especially the information-oriented networks provided grounds for such collective sensemaking processes. Often, direct outcomes of previous decisions were reflected upon there.

Decision situations like the nodding "Mr. District Administrator" illustrate how the networks emerged in order to respond rapidly and collectively to the evolving pandemic, especially at its highly dynamic peaks. Although with differing orientation, we see how both of the network types – the informational one as well as the actual decision-making one – fasten up decision processes and enable actors to adapt dynamically to changing environments. To sum this finding up, we understand these inter-organizational networks as an organizational structure for dynamic decision-making which, in turn, had emerged from decisions made regarding problems of coordination.

(2) The importance of informal networks

Even though we found emergent decision structures to be of less formal, improvised character, the Task Forces and Reporting Centers are still part of the official crisis management systems of a municipality. They are authorized and implemented by the municipal administration, involve central decision-makers in leading positions, and are sometimes given formal names. However, we learned that parallel decision systems arise at the same time, that are characterized by not having an official title or any formal structure provided. One interviewee from a municipal health department called this the s*hadow decision system*, describing that

> "*[t]here is an official system and there is a shadow system, a human system behind it*" (#02).

Both intra- and inter-organizational communication in a crisis and hence decision-making have been found to rely not only on formal – pre-arranged or emergent – decision-making structures, but on informal shadow systems concurrently. In the following, we will illustrate what distinguishes the systems from one another, give examples of how shadow systems unfold in practice, and indicate why shadow systems can be an advantage in long-lasting crises such as the Covid-19 pandemic.

As has been stated in the quote above, parallel decision systems are said to include a human factor. This is not to say that official structures are inhuman, but they often are not designed to consider diffuse social factors. Usually, both operative-tactical and administrative-organizational decision structures rely on "hard facts", and despite always having to make decisions with incomplete information, they aim to incorporate as much reliable data and validated information before reaching a decision. Parallel systems, however, create the opportunity to include rather intangible knowledge such as feelings, motivation, and the personal situation (#02, #06). The head of a municipal department of public safety and order described the exchange with his counterparts in other cities this way:

> "*But this has not been a formal communication in the sense of having structured processes, but a very personal exchange, […] but*

> *rather a bit, how do you feel, how do you currently deal with your employees, how can you still motivate them to now add the 15th hour? To be honest, it was also a mutual coaching, a mutual exchange, because there was simply a group of women and men together who are in a comparable life situation right now, who are a bit overwhelmed by it and who simply needed the help and the collegiality of their colleagues.*" (#06).

The dilemma of fast decision-making in a psychologically challenging environment, especially over a long time, hence promotes communication parallel to official structures in order to also obtain emotional support. Shadow decision systems are always connected to "knowing people", meaning that communication does not only happen through designated positions, but is rather influenced by personal contacts, having worked together before and, most importantly, trusting each other (#02, #04, #05, #09). It is about knowing whom to call to quickly transfer information and get answers, which in turn speeds up decision-making. The goal of shadow systems is therefore quite similar to that of formal systems: a shortening of decision-making paths. The main difference is, that the "human" shadow system incorporates other information, which is especially important when looking at long-lasting crises such as Covid-19.

Shadow systems emerge on various levels, meaning intra- and inter-organizationally, as well as on the management and the employee level. During the pandemic, municipal departments that had never worked together before were suddenly forced to cooperate, which, according to the head of a health department we interviewed, resulted in much better networking within the institution due to interdepartmental cooperation, which has been called

> "*a treasure [...] that we must also continue to cultivate*" (#02).

Next to that, networks between organizations have emerged or been consolidated. The framework of personal exchange with decision-makers from other municipalities has been labeled a

> "*professional circle of friends*" (#06),

which describes a parallel system on the management level. It informs the individual's decision by shifting professional-personal boundaries and including human factors in the process. At the same time, informal networks have been built in order to speed up decisions on the administrative level as well. Interviewees in leading positions report that their staff members independently established connections across multiple municipalities to pass doubts and questions back and forth without them knowing about it (#06). This informal network on the employee level in turn made sure

> "*that we at least demonstrated credibility to the citizens, that there was something like uniform administrative action at the intercommunal level as well*" (#06).

This adds another goal to shadow decision-making systems next to incorporating social factors and shortening decision-processes: enhancing legitimation in the population through aligned actions.

While shadow systems by our interview partners are being understood as offering quite some advantages by being more flexible, personal, and faster than formal decision-making structures, there are downsides, too. An interviewee from a fire department describes

> "*many parallel lines of communication*" (#20)

that spread autonomously instead of proceeding in straight vertical and horizontal directions as is usually the case in disaster management. This caused coexisting strings of information and action, that in turn had to be recollected in more official structures such as the above-mentioned "*Information Collecting Point*". Moreover, though aiming at rendering the decision process faster, relying on the human aspect of "knowing people" might bear the risk

> "*that you always fall back on the same people. That means it will be very one-sided.*" (#12).

Another possibly problematic feature pointed out by an expert advisor in disaster management was that

> *"with these faster ways [...] reporting channels have often been bypassed.*" (#12).

Since the pandemic was a case for crisis management for over two years, municipalities had to deal with the question of how to cultivate the treasure of personal networks after a crisis without undermining the formal decision-making processes.

(3) Sustaining dynamic decision-making capacities

Managing the pandemic on a municipal level did not only lead to the emergence of new networks and shadow decision systems but also to a rather enduring establishment of these structures due to the two-year duration of the pandemic as well as subsequent events. With regard to the shadow decision systems, the head of a health department put it like this:

> "*If we do this for two years, crisis management culture will become company culture.*" (#02).

During the later course of the pandemic, shadow decision systems were established as informal, rather permanent, but very dynamic organizations parallel to the formal ones (#02, #17). To minimize the described downsides of the "*closed-shop mentality*" (#06) and still cultivate positive aspects, many of our interviewees told us how they started enlarging their circle

of participants and advisers in order to broaden the informational capacity used for the decision-making – as well as to legitimize the decisions. After the acute beginning and during the wavelike course of the pandemic, the inter-organizational networks grew to become more flexible, mainly regarding their size, variety of included expertise, and frequency of meetings. One of our interviewees from a public order department pointed out the advantages of this:

> "*Thanks to these Reporting Centers, we have a much greater openness to external expertise and were then certainly able to intercept one or the other communicatively at an early stage, so to speak, before something really went wrong.*" (#06).

As our interviews took place mostly between summer 2022 and winter 2022/2023, the decision makers were not certain whether the then seemingly fading pandemic was ending or just pausing. At this stage, the already routinized structures from managing the acute phases were being kept up. Additionally, the Russian invasion of Ukraine from February 2022 on posed multiple new problems to be solved – which, as the head of a relief agency says, led to the feeling that

> "*we can't get out. We justifiably can't get out because the crisis is here. Only with other topics.*" (#08).

Not only were municipalities confronted with refugee migration, but the political situation led to concrete anticipation of resource constraints and power blackouts. Interestingly, we observed how the decision makers started utilizing the established structures from the pandemic – the inter-organizational networks as well as the highly informal shadow decision systems – in order to cope with the following events (#02, #03, #09, #10). As one interviewee described, their "*Information Collecting Point 'Corona'*" changed names into "*Information Collecting Point 'Ukraine'*" and "*Information Collecting Point 'Scarcity'*" (#03, noted off-record).

Although names and topics changed, the actual network members and general advisers as well as the dynamic decision structure condensing in regular meetings did not, at least not significantly. According to one of our project partners, there were decision makers who even referred to these networks and their changing topics as "*Hydra*" networks: Multiple heads call for combat, but begin to proliferate with the combat itself. Another interview partner from a fire department speaks of a similar context as he additionally addresses global warming:

> "*And that's how it is now, yes, now we have three layers again in January [2023], we have to see that we can make some preparations for every one of them. [...] Well, I'll say climatic changes, then the topic of the Ukraine crisis, and the pandemic*" (#10).

The changing topics but steady decision structure in the eye of some interview partners reflects the increasing importance of not only specialized knowledge, but of general expertise on crises (for further differentiation of the two, see Brinks & Ibert, 2023). Or, as the interview partner illustrates:

> "*I think if you have a toolbox in our area that contains the important tools, then it is ultimately of secondary importance what challenges you work on with it.*" (#10).

According to many of our interview partners (#01, #02, #03, #08, #09, #27), the higher frequency of crisis events starting with the pandemic and overlapping with Ukraine impacts as well as problems of the global warming (such as droughts and floods, e.g., the 2021 European floods) lead to an actual build-up of generalized crisis management expertise as well as organizational structures for dynamic decision-making.

These built-up decision capacities, interestingly, are also described as involving a backlash. In this context, "*Hydra*" is not perceived as an external entity, and the crisis is not viewed as a series of externally cascading events. Rather, it is understood as a direct result of the decisions made. Or, as another professionalized crisis manager reflects critically on the example of decisions with regard to possible power blackouts:

> "*So we also manage to produce these phases of chaos ourselves with such actions, more or less, which are not even due to the situation, because so far the power has not gone out for a second, but which have already gotten us into trouble.*" (#09).

In this understanding, the crisis as decision context is triggered by the decision-making itself – an aspect we find of utmost relevance for our discussion in the next chapter.

Discussion

While the previous passage shows empirical findings from our study, in this chapter we seek to discuss the findings in closer light of DDM literature and against the background of the relation of decision-making and decision-context.

DDM characteristics in pandemic management

Decision-making during the pandemic clearly fulfills the four characteristics of a DDM situation described by Brehmer (1992). Firstly, and most obviously, the pandemic could not have been coped with by only one decision, but necessitated a "series of decisions" (Brehmer, 1992, p. 212). This series of decisions at all political and administrative levels called for coordination, which our finding of the emerging inter-organizational networks pays tribute to. Secondly, and also in line with Brehmer (1992), the decisions depended on one another, such as the changing federal regulations impacting the following municipalities'

decisions. The third, even more interesting characteristic, was also given: "The state of the decision problem changes, both autonomously and as a consequence of the decision maker's actions." (Brehmer, 1992, p. 212). Especially for this feature, "Hydra" seems a very adequate analogy. During the course of the pandemic, the problems to be solved already shifted dynamically (e.g., from coping with an uncertain "deadly virus" to the need to purchase face masks, produce disinfectants, or monitoring whether shopkeepers have closed their businesses as required by the regulations), while at the same time the entire network topics changed against the background of following events such as the Russian invasion into the Ukraine. For the observed municipalities, part of the change in decision challenges remained outside their control as they had already been decided on at higher political and administrative levels. Another part, however, emerged as a consequence of their own decision-making, such as the described inter-organizational improvised networks and the role of these as well as the parallel shadow systems in solving subsequent problems. Last but not least, the fourth feature of DDM was fulfilled since the decisions had to be "made in real time" (Brehmer, 1992, p. 212). Decision-making was urgent, and so the observed municipalities had to act timely without knowing whether they made the right decisions or not.

In light of these DDM characteristics, "Hydra" seems an exquisitely fitting mythological image in order to describe DDM in crisis situations. Decision-making was confronted with the appearance of the "real" Hydra that ultimately lies outside of control of the observed actors: a spreading virus which was soon internationally classified as a full-blown pandemic (e.g., by the WHO). This triggered crisis management activities at almost all societal and administrative levels. National regulations (e.g., the German Infection Protection Act) started changing, and federal as well as municipal ones (e.g., the Corona Regulations of the 16 German federal states) emerged and shifted status in very short frequency. Already at this stage, Hydra's many heads come into appearance. Decisions are made with regard to the problems arising, and in turn shift the decision context which brings to the fore new problems to be solved. Hydra is an external threat on the one hand – on the other hand, the multiplication of heads can also occur as a result of fighting against them. The escalating dynamics urged municipalities to act, too. With our findings we portray how they built structures for this action, and as our findings suggest their decision-making had consequences that influenced their subsequent decision-making and finally led them to transfer their learned capacities onto the next topics such as the impacts of the war in the Ukraine.

In this context, we are now able to identify three phases in the pandemic management that can be generalized for understanding the specifics of current crises with DDM. Again, for the three phases we use the image of the Hydra: While in the first phase, Hydra appears as an external threat with multiple faces that needs to be fought, in the second it is experienced as internally driven by the response – until, thirdly, the decision-makers, by building up dynamic decision-capacities, learn to fight not *against*, but *by accepting* the Hydra in both characteristics.

Phase 1 – Caught off guard by the Hydra: Crisis as externally driven decision situation

Every experience of a crisis for the concerned organizations comes with a moment of overwhelming surprise and a collapse of sensemaking (see Weick, 1993). Even if risks were clearly anticipated beforehand (such as: the risk of a flood in a city where a river runs through, or the emergence of a pandemic in general), and even if crisis management structures have been pre-established: The threat and uncertainty of the real crisis situation always exceed expectations and call for a rapid response beyond known routines which is accompanied by exceptional decision dynamics. It is during this first stage of the crisis, where cognition lags behind action, that quick initial decisions must be made. From the perspective of decision-makers, the crisis at this stage is experienced as an external event they have no control over (see also Williams et al., 2017, p. 736). Their decision-making is activated in light of the experienced "cascading disasters", such as is reflected in the very first recognition of Covid-19 as a rapidly spreading "deadly virus" by international and national organizations, which initiated their response. Hydra here appears to be a "real monster to be fought" and is also communicated as such. At this stage, first decisions are made, many of them improvised, such as the improvised ad-hoc crisis management networks. This might pose one of the conditions for a shift in the logic of decision-making, which was recently addressed by Schoppek (2023, p. 13) as a switch from "default mode", or rather automated thinking, towards "effortful thinking".

Phase 2 – Hydra's multiplying heads: Crisis as internally driven decision situation

After the initial experience of the new external situation, and after first improvised decisions are made, the decision-making itself appears to influence the context, and it does so not only in the intended way. While, for instance, the initial decision-making during the pandemic happened with the primary goal of minimizing the virus' chances for spreading, these decisions showed unforeseen dynamics in many social systems. From the perspective of the municipalities the deadly virus very quickly lost its status as a primary trigger for action as it was replaced by shifting federal regulations. Interviewees expressed how annoyed they were for having to adapt so often to changing regulations, or that they had to hold too many weekly meetings. At this stage, the initial fight against the Hydra already led to its multiplication of heads, each posing a different set of problems to be solved. Here, the crisis is experienced as a decision-driven dynamic, which

goes hand in hand with a shift in understanding the situation as an external event towards an internal process (see Williams et al., 2017, p. 735). Hydra's heads multiply through the very fight against them. In our findings, this is also reflected in the established inter-organizational structures that quickly develop a "life of their own" in the form of the described shadow decision systems. Crisis, here, additionally becomes a management of decision consequences. For instance, once a federal state decides on new regulations, municipalities are still confronted with how they interpret them, which as described also led to differences between neighboring municipalities, that is, municipalities liable to the same external regulations. And this, again, influences their subsequent decisions, for instance the perceived need to coordinate the decisions inter-organizationally.

Phase 3 – With the Hydra, not against it: Building dynamic decision-making capacities

Respondents reported that municipalities' understanding of the situation had changed over the course of the more than two years the pandemic lasted. While first experiencing the crisis as highly externally driven with the trigger for decision-making (mainly "the virus") lying outside their control (Phase 1), in the later course they recognized decisions – national, federal, and own ones – as actively partaking in the situation (Phase 2). With our finding of their transfer of decision structures onto solving other problems such as the war or climate impacts, we can make out yet another interesting shift (Phase 3). Municipalities built upon their experience and thus could start off right away with accepting that both, decision-making and decision-context, are mutually interdependent. As described in the findings, to cope with the continuing dynamic environment the municipalities became more open for integrating a wider circle of members and advisers into their decision networks. They started basing their decisions on multiple perspectives, and thus broke with the described "closed-shop", or silo mentality that was recognized as restricting dynamic decision capacities. One could say, municipalities developed an extended "toolbox" in their efforts to defeat the Hydra. Parallel to this, we see a build-up in general crisis management expertise in this phase, even in organizations that usually act outside any emergency tasks. Since the crisis was never experienced as having come to a clear end and more dynamical phases were still anticipated, much of their work concentrated on keeping up agile structures in order to be able to activate dynamic decision-making capacities when needed. By sustaining their inter-organizational structures, they also found a way to further gain control over the decision-making context as the coordination of decisions increased. Thus, decision-makers in this third phase accepted to some extent that the many-headed monster cannot be completely overcome but developed capacities to deal with its presence in the long run.

Needless to say, the three phases of managing crises (see Figure 2) do not necessarily occur in this particular order, but rather engage in an iterative process. What we would like to emphasize, however, is that municipalities face new external crises differently because of the dynamic decision-making capacities they have built, and they have developed a more comprehensive understanding of crisis.

A shift from cascading disasters to cascading decision-making

Especially with the last phase, we see a recognition of what has been referred to as "integrative" concept of crisis (Voss & Lorenz, 2016, p. 48; see also Bonß, 2021, p. 38). Here, crisis is neither located in objective measures only (such as the increasing number of Covid-19 infected persons), nor exclusively in subjective aspects (such as the perception of crisis by e.g., one group of the population), but instead is seen as driven by the interaction of the two in a mutual process. Although crisis management literature has already reflected on the fact that crises are inherently social processes (see Bundy et al., 2017, p. 1663), there still seems to be an overall trend in locating the driver of the typical cascading dynamics of today externally. Decision-makers in this view are urged to act by external disastrous events, as was illustrated with the "outside Hydra" in Phase 1. However, this understanding falls short when looking more closely at the cascading processes from a DDM perspective. As recently pointed out by Schoppek (2023, p. 2), "the focus should be on the processes on the side of the problem solver; and insights about these do not depend on the exact classification of the problem." DDM literature in our view supports an integrative concept of crisis as well as a process view that enables us to give more detailed insight into concrete dynamics that are shaped by a shift between all phases: An initially perceived problem triggers decision-making (Phase 1), which induces a changed decision-context (Phase 2) that again affects further decision-making (Phase 3). From this perspective, today's "cascading disasters" can be revisited as "cascading decision-making". The image of the Hydra in its three phases reflects such cascading decision process, and in our empirical study shows a build-up of dynamic decision capacities in and between the municipalities.

Dynamic decision capacities support a fast orientation in an overly uncertain environment. In Hydra situations we can observe how decision-makers cope with two kinds of uncertainty as described by Osman and Verduga Palencia (2019). The municipal organizations we studied were on the one hand confronted with an "inherent noisiness of the conditions [...] of the problem" which is defined as "aleatoric uncertainty" (Osman & Verduga Palencia, 2019, p. 1). Not only the unknown virus, but also the changes in federal regulations were experienced as introducing this kind of uncertainty they have no control over. On the other hand, they were confronted with "epistemic uncer-

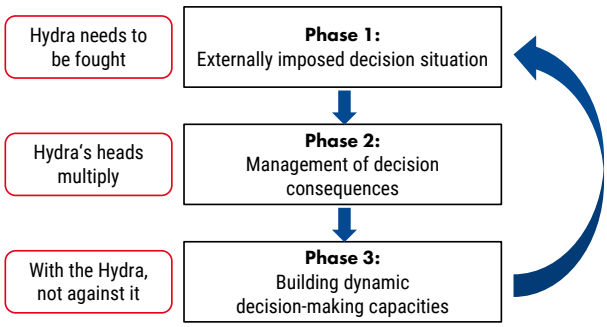

Figure 2. Phases in the acute crisis management

tainty" defined as "a lack of knowledge" (Osman & Verduga Palencia, 2019, p. 1) the organization has over the situation. As "involved participants" (Brinks & Ibert, 2021) decision-makers at all points in time have no omniscient view since they are bound to their respective perspectives and can only from there start making decisions. We believe that both types of uncertainty could not really be "reduced" during the observed course of the pandemic as well as subsequent crisis situations triggered by the Russian invasion into the Ukraine and climate impacts. Instead, decisions happen in full acceptance of uncertainty as being inherent to the situation, which again calls for further decisions, leading to the described cascades. The emerging inter-organizational networks from our findings build a space for this. Involved decision-makers give structure to their own operations and thus harmonize their decisions while the situation itself is still highly dynamic.

Resume

In this paper, we discussed how decision-making evolves against the background of the transgressing and overlapping nature of today's crisis phenomena, using crisis management and DDM approaches. Crisis was defined as moment of decision-making with characteristics of threat, urgency, and uncertainty (see Boin et al., 2018) which in the light of current "transboundary crises" (Ansell et al., 2010) or a "global polycrisis" (Homer-Dixon et al., 2022) requires collective action and leads to an involvement of various (organizational) actors. In this paper, we took the perspective of municipalities in Germany as the smallest entity with self-governing rights, and focused on their decision processes during the Covid-19 pandemic. Our analysis of qualitative expert interviews shows (1) how improvised inter-organizational networks emerged in order for the municipalities to coordinate the increased necessity for rapid decision-making; (2) how these networks began to take a "life of their own" where crisis management culture developed into "shadow decision systems" that exist in parallel to the formal organization; and (3) how, due to subsequent cases like climate impacts and those of the Russian invasion into the Ukraine, municipalities learned to sustain their dynamic decision capacities by applying the newly established crisis management structures to tackle arising problems. We discussed these findings against the background of DDM literature (e.g., Brehmer, 1992), which provided us with conceptions on the dynamics between decision-making and decision-context. This led us to reflect on the course of decision-making process by differentiating three more generalized crisis management phases. In Phase 1, actors are overwhelmed by a context they experience as having no control over, while in Phase 2 their own decision-making shows contextual consequences, though not only in an intended way. In Phase 3, the actors gain an integrated perspective where they understand both contextual and decision dynamics as mutually interdependent. Especially this third phase we identify in a build-up of dynamic decision-making capacity which allows the actors to proceed mindfully and keep up awareness of the still prevalent uncertainty.

As Osman and Verduga Palencia (2019) suggest, we see in this a necessity for decision research to not only focus on complexity, but on "dynamic uncertainty" which depicts a general characteristic of contemporary problems and particularly comes to the fore in transgressing crisis situations. Here, in the light of cascading dynamics, it is especially about "dynamic decision-making in (dynamically) uncertain environments" (Osman & Verduga Palencia, 2019, p. 2). With our empirical study we have shown a concrete case of how the decision-making evolves in such context which can provide grounds for further DDM research. Additionally, a social sciences approach to understanding organizational decision-making can widen the scope of the so far rather psychologically oriented DDM literature. Particularly against the background of today's crisis phenomena, it is not only about understanding a series of decisions (as one of the four DDM characteristics states; Brehmer, 1992, p. 212), but also about the multiple layering of decision-making that happens when various actors (such as nation states, federal states, municipalities, and many other organizations) are involved simultaneously. As our study shows, decision-making is influenced by the decision-making of *others*, which adds a social to the temporal

sphere of DDM. Social sciences can provide DDM literature with concepts of action and cognition as fundamentally collective social processes (see e.g., Brown et al., 2015). Also, crisis management research can add a body of literature to this and holds both methodologies for empirical research as well as established concepts of crisis to contribute to DDM research (for overviews, see Bundy et al., 2017; Hällgren et al., 2018).

Likewise, we see several aspects of how DDM approaches can contribute to current crisis management literature. Both Voss and Lorenz (2016) and Bonß (2021) describe a "third wave" of research on crisis and risk, where the focus on objective measures (first wave) and subjective measures (second wave) merge into a third, processual view. This third wave holds a more holistic, "integrative" concept of crisis and risk, and is thus able to tackle more adequately the complexity of today's crisis phenomena (see also Roux-Dufort, 2007). In DDM approaches we consider such an integrative conceptualization profoundly, but so far only implicitly realized. As DDM literature builds on the dynamical relationship between decision-context and decision-making, it can, as was shown above, provide accurate insights into the processual dynamics of a crisis. Decision-makers in crisis (here conceived as organizations) are confronted with an initial dynamical context, which poses "a problem which cannot even be precisely defined" (Osman & Verduga Palencia, 2019, p. 1) but which, in being perceived as threatening, triggers an urgent decision-making activity. This activity intends to control the uncertain context but also leads to unintended consequences which in turn jolt dynamics to the context, again imposing itself upon the actors (Thiétart & Forgues, 1997). With DDM, the integrative concept of crisis in our view takes the form of circular decision dynamics. Although the often used term "cascading disasters" addresses social dynamics in the context of extreme events, it may still imply a rather one-sided view where social systems (such as organizations) are overwhelmed by some external situation. With a DDM approach, however, we are able to shift the attention towards a more circular model of "cascading decision-making" that reflects on the active role social systems (decision-makers/organizations) play in the escalating dynamics. Using the mythical image of the Hydra, which simultaneously introduces a dynamic threat in itself *and* whose threat multiplies only by being fought, we attempt to make up for this idea and aim to inspire further crisis management research.

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