

OUT OF NOWHERE? INTERORGANIZATIONAL ASSEMBLAGE AS THE ANSWER TO A FOOD-BORNE DISEASE OUTBREAK

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Abstract

The ad hoc formation of interorganizational relationships and networks remains a black box for management scholars. We address this phenomenon by investigating interorganizational responses to an extreme event. Hence, we explore how interorganizational constellations of previously unconnected actors formed in response to the large-scale outbreak of enterohemorrhagic *Escherichia coli* (EHEC) in Germany in 2011, which killed 53 people and affected over 4,000. We present a preliminary model of interorganizational assemblage and offer propositions that highlight the conditions under which the development of collaborations across organizations is made possible in face of crises.

Keywords: interorganizational assemblage; network; crisis; disaster; emergency; disease outbreak.

Acknowledgements: We are especially grateful to the numerous practitioners who participated in this study and shared their knowledge with us. We also thank the reviewers and attendants to the 37th Workshop of the WK Organisation in Jena, Germany, and Keith Provan, for all their comments and insights on earlier versions of this paper. Last but not least, we would like to thank Carolin Auschra for her commitment and assistance during data collection.

Published in: Schmalenbach Business Review 66 (3) 2014, pp. 385-414.

1 INTRODUCTION

Throughout history, organizations of different kinds have been confronted with disasters and other sorts of lesser emergencies or crises. In such unexpected situations, research that uses a network perspective usually focuses on interorganizational rescue and/or relief efforts. These efforts benefit from established (if not institutionalized) frameworks, and on coordinating mechanisms of public networks and interorganizational procedures (Bigley and Roberts 2001; Moynihan 2009; Robinson, Berrett, and Stone 2006; Waugh and Streib 2006; Waugh and Sylves 2002). Hence, researchers (Moynihan 2009; Waugh and Sylves 2002) frequently assume the existence of interorganizational relations (IORs). Thus, the focus is on how managers reactivate specific forms of IORs and/or modify them in such a way as to be useful in unexpected situations. Common examples are the definition and implementation of standard operating procedures (SOPs) among agencies or the use of the incident command systems (ICS) that bind organizations together and prepare them for potential collaborations (Bigley and Roberts 2001; Moynihan 2009).

While these studies have advanced our understanding of why and how organizations prepare collectively for managing crises, or even catastrophes, this stream of research ignores the question of how newly generated interorganizational constellations actually take shape in the face of unexpected

and harmful situations. This gap is surprising if we consider that the insights have been gathered by research that uses a complex adaptive system approach, one which stresses the necessity for self-organization, communication, and coordination across previously unconnected public agencies (Comfort 1994a, b, 2002a, 2007; Kapucu 2006a, b). In fact, in such crisis situations, actors who are not known to each other often need to coordinate their activities very fast, but must do so with a limited knowledge of each other's skills, capabilities, motivations, and communication practices (auf der Heide 1989; Mitchell 2006; Moynihan 2005; Robinson et al. 2006). Thus, initiating IORs and networks – a form of governance that has remained largely unexplored from a management perspective (Isett, Mergel, LeRoux, Mischen, and Rethemeyer 2011) – becomes imperative if management is to face the challenges imposed by crisis situations. Although such instances have been observed and documented, research remains conspicuously silent about the actual origin of IORs, i.e., the very process (rather than occurrence) of starting a relationship and forming initial ties. Hence, to guide and explore this multifaceted phenomenon, we ask the following research questions:

How do managers assemble new dyadic IORs or more complex interorganizational networks during crises? Against this background, what are the barriers to this interorganizational ad hoc coordination, and what makes it possible to overcome these barriers?

We address these questions by using an in-depth case study of IORs' formation among both previously unconnected and already connected actors in response to the large-scale outbreak of an unknown strain of enterohemorrhagic *Escherichia coli* (EHEC) in Germany in 2011. We describe the conditions that fostered the collaboration among previously unconnected actors (e.g., local hospitals and federal and state ministries) that made it possible for them to confront the situation. Thus, in this paper we contribute not only to the literature on ad hoc interorganizational coordination that deals with crises and other unexpected events from the perspective of public management (e.g., Benini 1999; Bigley and Roberts 2001; Comfort 1994a; Moynihan 2008; Waugh and Streib 2006), but also to the still scarce research on early-tie formation in IORs and networks (e.g., Isett et al. 2011; Kenis and Knoke 2002; Provan and Kenis 2008). Therefore, we introduce the concept of interorganizational assemblages (IOAs). We offer a preliminary framework showing how public managers, in an attempt to come to terms with emerging and/or future crises, assemble new dyadic or more complex IORs. Thus, we address a crucial question that has remained largely neglected in network studies generally (Isett et al. 2011; Provan, Fish, and Sydow 2007; Provan and Kenis 2008).

We structure our paper as follows. In Section 2 we provide the theoretical background for our paper. We position our study in the research on organizations dealing with emergencies, disasters, and other unpleasant sur-

prises. In particular, we focus on the research on interorganizational responses to such events. In Section 3 we present our research and methods, thus setting the stage for the EHEC outbreak in Germany in 2011 and delineating our case-study approach. In Section 4 we present data showing how the different public agencies engaged in IOA while trying to cope with uncertainty in the EHEC outbreak. In Section 5 we discuss our observations by introducing a preliminary model of IOA that offers propositions for future research. Section 6 concludes.

2 THEORETICAL BACKGROUND

2.1 How do IORs form in the face of crisis?

The question of the formation of IORs and networks has been puzzling scholars for decades (Bardach 1998, 2001; Kenis and Knoke 2002; Krueger, Riccucci, and Suwanmala 2010; Van de Ven 1976). Here, we comprehend an IOR as a link between two or more organizations that are formally independent legal entities, regardless of whether the link itself is governed in a market, hierarchical, or hybrid mode. (For recent overviews, see Provan et al. 2007; Wachhaus 2012.) Although many studies have looked into why formal IORs emerge (Isett et al. 2011; O'Toole 1997; Provan and Lemaire 2012), the process by which these dyadic and more complex networks of IORs, in particular the collaborative ties (Ring and Van de Ven 1994), initially form, and through which their governance actually emerges remains largely

unexplored (Provan and Kenis 2008). This critic also holds true particularly for informal and ad hoc networks such as task forces, coalitions, and committees (see Goldstein, 2012). In point of fact, "...despite the preponderance of these informal networks, the gap between research and practice is wider for informal networks than formal networks [resulting in] very little advancement of our understanding" (Isett et al. 2011, 165).

We address this gap by looking into ad hoc interorganizational responses to crises. Such extreme events illustrate wickedly demanding problems for management (Van Bueren, Klijn, and Koppenjan 2003) that need to be addressed by highly adaptive constellations of organizations, in particular public agencies, "... because the problem and/or the solution is either unknown, inconsistent, or frequently changing" (Provan and Lemaire 2012, 641). In point of fact, using a complex adaptive systems approach, a significant body of research has studied interorganizational responses to disasters and extreme events, thus focusing on issues of self-organization, resilience, or interorganizational learning (e.g., Comfort 1994a, b, 2002a, 2007). These studies show that organizations engage in collaborative work, and that in their attempt to deal with crises such as oil spills or earthquakes some of these organizations are interacting with one another for the first time. Research from an adaptive systems perspective tends to concentrate on the ad hoc nature of these relations but remains silent about the actual process of tie formation (e.g., Comfort 1994a, b, 2007). Further, a focus on the system

level contributes to the creation of a sense of a clean state with respect to the history and social context in which the organizations are building new relations (Robinson et al. 2006). By contrast, a second stream of research pays significant attention to tie formation and crises by using a more explicit relational or network perspective (Kapucu, Augustin, and Garayev 2009; Kapucu, Arslan, and Collins 2010; McGuire and Silvia 2010; Moynihan 2008, 2009; Waugh and Streib 2006). These studies focus on preparedness through cooperation, and stress their empirical relevance for scholarship on networks in general (Agranoff and McGuire 2001; Isett et al. 2011; Moynihan 2008, 2009; Provan and Kenis 2008). Nevertheless, research from a network perspective tends to ignore the ad hoc dimension in the formation of ties.

Against this background, disasters and emergencies provide us with a rare opportunity to observe how organizations spontaneously coordinate their actions to come to terms with unexpected phenomena (Comfort 1994a; Moynihan 2005). In extreme cases, public agencies may even face the need to assemble new ties on the fly with organizations to which they were not previously connected and which sometimes have little or no experience with how to face crises on their own, let alone in a collaborative fashion (auf der Heide 1989; Clarke and Short 1993; Mitchell 2006; Robinson et al. 2006).

When looking at scholarship on interorganizational responses to disasters, the aforementioned critique addressed by Isett et al. (2011) holds true.

In contrast to studies that use the complex adaptive systems approach (Comfort 1994a, b), issues on the genesis of collaborations in situations of unpreparedness are seldom tackled by studies that use the relational or network perspective. In point of fact, existing and well-maintained networks and interorganizational collaborations often make it easier for network scholars to conduct research and observations on their genesis. For Bardach (1998), who provides an early critique of this bias, collaboration across agencies often emerges ad hoc due to an unforeseen crisis. In such a situation, spontaneous interactions across organizations need to exhibit and make use of several collaborative capacities that enable temporary leadership in the form of “craftsmanship”. The respective “craftsmen” spontaneously revert to what is at hand. This approach may not at first seem to be well-suited to solving the crisis, but craftsmen have the ability to make the best use of the “raw materials”.

However, quite often, accounts of interorganizational responses to disasters rely on existing networks and/or partnerships, thus benefiting from prior experiences, formal action frameworks, or mandates. For example, Bigley and Roberts (2001) consider the supporting role of the ICS as a provider of shared frames of thinking for fire departments involved in interventions. Similarly, Moynihan (2008) highlights the role of installing an ICS in the reduction of strategic and institutional uncertainties for a case quite close to our inquiry, the Newcastle Disease outbreak, which bears a close resemblance to

the EHEC outbreak. In his study, Moynihan stresses a number of barriers that prevent effective learning during the crisis, among which is a lack of an ICS (cf. also Müller-Seitz and Macpherson in press). In another study Moynihan (2009) highlights the centralization of network governance in crises and the challenges of coordinating across agencies in the absence of hierarchical structures. He documents how ICS offer a framework to face crises. However, differences in the members' cognitive and normative orientations remain, resulting in differing ways of responding to a crisis (cf. also Robinson et al. 2006). Kapucu et al. (2009) take a similar approach on the Emergency Management Assistance Compact, as does Mitchell (2006) on the role of information technologies in the construction of a shared hazard response strategy in the European Union. Such studies either stress situations of failure and the need to better coordinate matters, or else they report on the role of existing coordination structures.

By stressing the need for blueprints in coordination and preparedness, these works have advanced our knowledge of the way public agencies plan and design structural innovations for cooperation and coordination (Comfort 2007; Kapucu 2008). Despite these advances, our understanding of interorganizational responses to crises, which focuses on the process of starting ad hoc ties across organizations in the absence of preparedness and established structures for interorganizational coordination, remains underdeveloped.

2.2 Interorganizational Assemblage in the Face of Crises

We develop exploratory, context-sensitive insights about the ad hoc formation of IORs. To achieve this goal we not only perform an in-depth case study on the EHEC outbreak in Germany, but also rely on and develop further the concept of assemblages (Ong 2004; Ong and Collier 2005). We define an *assemblage* as representing the unstable and unstructured interplay of different political rationalities, institutions, and actors, “i.e., a milieu of transformation that is also for the analyst, a space of problematization” (Ong 2007). These constellations emerge from instabilities and conflicts, and therefore do not feature stable relations among their elements (Collier 2006). Building on this notion, Ong (2004) points to the example of global responses to emergencies. Informed by complexity theory and set against the backdrop of the Severe Acute Respiratory Syndrome (SARS) outbreak, Ong defines global assemblages as:

“... [the] mobilization of significant connections among diverse elements that have open-ended effects on the meaning of individual and social life ... the focus on assemblage reveals how actors ... define and respond by assembling diverse resources in a contingent and provisional manner, with varying effects on emerging forms of modern ways of living” (Ong 2004, 81).

We regard this definition as particularly appropriate, because it sensitizes researchers and managers to the possibility of linking, during an emergency, previously unrelated actors and the resources and knowledge they control, while keeping an analytical eye on the contextual influences at play and their influence on the dynamics of social construction that surround the crisis (Beunza and Stark 2003). Moreover, the notion of assemblage emphasizes the necessity to identify the tools and procedures at hand in relation to the crisis, and to assemble them ad hoc as the actor works towards an appropriate solution. These are aspects that must be considered when facing large-scale crises in a collaborative fashion (cf. also Bardach 1998, 2001). Hence, focusing on the way dyadic IORs or more complex networks form initially in the face of crises, we introduce the notion of inter-organizational assemblages (IOAs), so that we can also focus on the very early phase of tie-formation or, more precisely, collaboration. If organizations do not benefit from established IORs, then collaborative efforts can hardly take place without assembling organizations first.

The notion of IOAs makes it possible for us to be sensitive to the multiplexity of the relations among organizations. Multiplexity has long been considered an attribute of IORs, considering, for example, professional and private ties in a similar relation, or the dual flows of technical information and staff between two or more organizations (Kenis and Knoke 2002). However, multiplexity is primarily defined mathematically (cf. Wasserman and Faust

1994), thus ignoring the more often than not subtle interplay between different forms of ties or flows in the formation process of IORs, although they also seem to matter in the formation of dyadic or more complex IORs that form to confront unexpected events such as the outbreak of a disease.

3 RESEARCH SETTING AND METHODS

3.1 A Brief Sketch of the EHEC Outbreak

Food-borne disease outbreaks represent unforeseen and harmful events that have a potentially severe societal impact. Further, such outbreaks frequently require close, immediate interactions across organizations within the fields of food control and health affairs (e.g., Moynihan 2008). Such events can go so far as to cause deaths among consumers, and are often followed by severe financial consequences for the retailers, producers, and other organizations involved. Just such an outbreak offered us the unique opportunity for an in-depth case study. For this study we use an interpretative research method that makes it possible for us to capture the measures from the respondents' perspective (Yin 2009).

Due to the disease's geographical concentration in northern Germany, we restrict our analysis to the German public administrations, which dealt with uncertainty by forming IORs on an ad hoc basis. Leading actors on a national level were the Federal Ministries of Health and of Food, Agriculture, and Consumer Protection, and the public agencies associated with these

ministries. At the regional level, each of the German states (Länder) has agencies that deal with the same issues as the federal ministries, in effect mirroring the structure for all 16 states. At the community level, local human and veterinary health authorities, hospitals, medical practitioners, and national reference laboratories deal with human health-related issues.

In our case study, although the managers were aware of each other's institutions (e.g. due to their professional affiliations and education), and although informal ties probably did exist, the genesis of an interorganizational constellation took place in the total absence of an overarching framework. For the purposes of our study, we benefited from sheer serendipity, as we were able to track some real-time data. Furthermore, we were able to follow new theory-building leads (Miles and Huberman 1994); at the same time, we established access to key persons in the respective fields to ensure timely and accurate data collection and analysis.

EHEC is a bacterium present in the intestines of warm-blooded animals. Although most strains are benevolent, some can cause severe food poisoning to humans, which is accompanied, in rare cases, by hemolytic-uremic syndrome (HUS), a syndrome that is characterized by anemia and kidney failure. EHEC infections are frequently (about 800 cases per year) reported in Germany. In sharp contrast, between May and July 2011, a novel strain of EHEC affected a total of 3,842 patients in the north of Germany

(2,987 infected with EHEC and 855 with HUS), causing 53 fatalities, mostly around the city of Hamburg. In “normal” years, this same period of time would see the occurrence of only 231 cases in the whole country (218 EHEC cases and 13 HUS). Although a potential first case could date back to May 1, 2011, on May 8, 2011, the first patient was officially diagnosed with HUS and with what is now known as the EHEC strain O104. From May 8 on, the number of patients with both EHEC and HUS increased dramatically, reaching its climax on May 21 and 22. From then on, the number of patients decreased quickly at first, then more slowly. Retrospectively, the outbreak was declared over on July 5. In the meantime, substantial damage had occurred, highlighting the societal and economic relevance of the chosen setting.

3.2 Data Collection and Data Analysis

By mainly using the technique of semi-structured interviewing and the analysis of archival and press information, we collected two kinds of data: retrospective data concerning the way in which actors had prepared for unexpected outbreaks and unknown diseases in the past as well as during the current outbreak, and real-time data relating to the way the actors were coping with this uncertainty in the present. The two kinds of data made it possible for us to track the changes over time.

We collected retrospective data relating to EHEC and HUS incidents in Germany from 2000. By doing so we avoided a distortion of our results due

to heightened media attention and publicity-oriented activities by the affected actors during the latest outbreak. Such an ex-post reconstruction by means of primarily archival data is considered adequate for understanding how actors collaborated over time (Harding, Fox, and Mehta 2002). This widely used strategy also helps to contrast it with the way respondents reconstruct the past when they have to confront past situations in the course of real-time data collection (cf. Stallings 2002 for an overview). We use these data sources (see Table I for an overview) for triangulation purposes, thus heightening the validity of our findings (Yin 2009).

[Table 1 about here]

First, to collect retrospective data to track the way key actors handled the outbreak, we used independent press and broadcast coverage. Second, to understand how the organizations dealt with the outbreak by collaborating with each other, we analyzed organizational data on the key actors.

For triangulation purposes, we used the following sources of real-time data: first, we tracked the independent press and other broadcasting coverage of the outbreak continually (the same sources used in the retrospective data collection). Second, we conducted 43 interviews with key respondents from different organizations affected by and/or involved in the disease outbreak. Thus, we have avoided biases in the interpretations of the outbreak (cf. Table 2). We oriented the semi-structured interviews towards an inter-

view guideline that consisted of open-ended questions and follow-up as well as clarifying questions. Our goal was to solicit exploratory information about the way IORs were generated and reproduced to face the outbreak. Hence, we divided each interview roughly into the following four central themes: we asked who the key actors were prior to, during, and after the outbreak; what challenges they faced; how the public agencies/managers tackled the outbreak; and finally, how and under what conditions did public agencies/managers engage with unknown and familiar actors. The total length of the transcribed interview passages is 25 hours and 55 minutes. This approach has been used by similar analyses (e.g., Kreps et al. 1994) and serves to account for the subjective experiences and assessments of the persons involved and how they are tied to the respective organizations. To heighten the accuracy and consistency of our interpretation of the interviews, we used tandem interviewing in 27 of the 43 interviews.

[Table 2 about here]

Third, we collected data from seven conferences and workshops in the fields of human and veterinary medicine related to the outbreak. We used material from participants' observation of these events, including presentation slides, Q&As, and announcements around the respective venues. We strengthened the validity of our claims both by attending these conferences and by using formal interviews, informal conversations, and other textual and/or visual da-

ta (e.g., roster listings, conference slides). Thus, we were able to conduct impromptu interviews, which we did not transcribe. As suggested by Yin (2009), to capture most of the impressions adequately we took extensive notes at each event and discussed these results within 24 hours after the visit.

Data analysis did not occur in a linear fashion, but instead took the approximate form of the following three stages: in the first stage, we stored all data collected in a case-study database to heighten reliability (Yin 2009). Periodic rereading and preparing of protocols (e.g., for the different interorganizational collaborations across time) subsequently formed a basis for comprehending the way organizational actors assembled. Stage two consisted of writing up a condensed description of how organizations from different contexts (e.g., from the political or medical fields) addressed the outbreak. The research team discussed the resulting detailed descriptions and used them to sensitize each member of the team to the way in which uncertainty is practiced on an (inter)organizational level.

[Table 3 about here]

In stage three, we condensed the empirical data by combining all the information into a joint analysis. In this context, to check the reliability of the coding framework one team member and one research assistant served as co-analysts. We consider this step to be very helpful, because co-analysts are

able to identify new themes or point out ambiguities. The team could later resolve these points by means of re-entering the field, thus heightening the data's validity. The final data structure emerged with coding at the level of a text unit, which we defined as a sentence or sequence of sentences conveying a coherent point. Initial coding resulted in first-order categories offered in vivo by informants. At first, we placed some text units in multiple categories to allow for a rich interpretation of data. In what followed we constructed mutually exclusive, second-order themes and grouped them hierarchically. Doing so led to the collapse of our first-order categories (e.g., no existing and existing ties, non-directed ties) into second-order themes (e.g., pre-crisis conditions) that represented more abstract and researcher-induced interpretations. At first we grouped these themes according to the different actors, but we soon realized that this categorization did not allow us to come up with more robust, overarching ways in which organizations assembled to grapple with the outbreak. Thereafter, the second-order themes were subsumed under third-order themes that in effect represent the four building blocks (pre-crisis conditions, barriers, common frame of reference and post-crisis conditions) that constitute the overarching concept of IOA presented in this study. Appendixes 1a — 1d provide further samples of statements from the field for each category.

To conclude our analysis and to ensure that we had not misinterpreted their views during the analytical process, we presented our findings to one of

the leaders of the task force. This final validity check further guaranteed the robustness of our analysis.

4 OBSERVATIONS: IOR FORMATION DURING THE GERMAN E.COLI OUTBREAK IN 2011

4.1 Existing and Missing Collaborative IORs Prior to the Outbreak

As shown in Figure 1, prior to the outbreak, the organizations primarily involved on a national level were the Federal Ministry of Health and the Food, Agriculture and Consumer Protection. Both ministries collaborate sporadically, but in effect remain separate entities with their own hierarchical structures that extend from the national to the local level. Moreover, each ministry is associated with government research institutions that are largely operating only within their own environments, although each draws on its past experiences with a variety of disease outbreaks. The Ministry of Health collaborates with the Robert Koch Institute (RKI) as its key research institution; the Ministry of Food, Agriculture, and Consumer Protection draws primarily on the competences of the Federal Institute of Risk Assessment (BfR) and the Federal Office of Consumer Protection and Food Safety (BVL). There is occasional cooperation when a disease outbreak affects the areas of responsibility of both ministries and their research institutions, in particular between veterinary controls and human health medicine when there are cases of animal diseases. For example, this has been the case during occasional out-

breaks over the last years with incidences of swine or bird flu (RKI 2011). In point of fact, the different nature of these earlier outbreaks, particularly from a medical perspective, led to formal, and especially to informal, ties that could be renewed for related purposes. However, these ties are usually not relevant for future outbreaks (often, food-borne ones), because, given the varying epidemiological natures of the diseases, their cradles and their vehicle, different competences are needed.

[Figure 1 about here]

As noted above, at the regional level, each of the 16 German federal states has agencies that deal with the same issues as the federal ministries. Although collaboration is infrequent across ministries and their research institutions, there is very little collaboration on the regional level. However, there are annual gatherings at which the representatives meet their counterparts from the fellow states to discuss general concerns in their areas of responsibility. Thus, we were told, ministries from the German states can rarely, if ever, draw on experiences of collaboration across state ministries. At the local level, local health authorities, hospitals, medical practitioners, and national reference laboratories deal with human-health-related issues independently. Local veterinary offices and food inspectors deal with animal health issues related to the Ministry of Food, Agriculture, and Consumer Protection. Although these actors are, not least of all because of their profes-

sional education, aware of the relevant institutions at the regional and national levels, their activities are usually only related to either local diseases and outbreaks or local food inspection and traceability.

4.2 During the Outbreak I – Barriers to Interorganizational Collaboration and Coordination

Our observations suggest that there are three major barriers to interorganizational coordination: first, there is a lack of established, collaborative, or networked IORs that could help to bridge local, state, and federal levels of government, and also include links to other organizations that are indispensable for dealing with an epidemic; there is little or no preparedness for cases necessitating cross-agency collaborations. Second, the bureaucratic heritage of the agencies in charge of coping with the outbreak and their tendency to rely on the well-established operating procedures that have been developed to deal with known and expected issues makes it difficult to develop ad hoc coordination and the appropriate IORs. Third, the uncertainty surrounding the unknown source of the epidemic and the difficulty in isolating its cradle (i.e. the lack of understanding of the nature of the problem) further contributes to these difficulties.

The absence of established IORs. This lacuna represents a key challenge to developing ad hoc collaborations, since there were no lines of responsibilities on how to cooperate across organizations when confronting

situations such as the EHEC outbreak. This challenge was twofold. First, although organizational actors were aware of each other due to their professional experience or expertise (for instance, public managers affiliated with the RKI knew very well not only of the existence, but also of the responsibilities, of the BfR), these managers, despite being potential “boundary spanners” (Adams 1980), were not expecting to collaborate with institutions from fields in which they had not collaborated previously. Second, the different public agencies were accustomed to operating primarily in their area of expertise and their (quasi) hierarchies of authority; that is, either dealing with human-medicine issues by working in the Federal Ministry of Health arena or coping with animal health problems that came under the aegis of the Federal Ministry of Food, Agriculture, and Consumer Protection. This NOUN often led to unnecessary competition across public agencies. Interviewees frequently pointed out that the very unpreparedness necessarily inherent in unknown disease outbreaks does not render previous collaborations irrelevant per se, but necessitates new ones. Hence, the nature of collaborations did not fit the outbreak, and in particular, there was no cognitive or normative framework to draw on to handle the outbreak collaboratively across public agencies from different levels of analysis. In addition, we received complaints that the existing IORs were neither flexible nor adaptable enough to address the multiple problems that crossed functional areas and organizational boundaries. For example, during one of our visits to the RKI, a pro-

gram specialist told us that before the EHEC outbreak, he and his team would never have expected to work with nephrologists, even though he was aware of their activities and professional associations and the fact that EHEC/HUS provokes renal failures. In a similar fashion, another respondent declared: “I never expected to work with the RKI”. In fact, one of our informants told us:

“Nobody really took the initiative [i.e., to engage in collaboration]. Nobody knew whom he or she was missing. I mean, really the health professional doesn’t know whom he needs from the side of food safety. He will say: yes someone around there probably knows about this. But who is that person? And how do you get in touch; you can’t know all that”.

Moreover, this lack of interorganizational preparedness was aggravated by a lack of support by technological systems or regulatory frameworks. For example, the hospitals, overcrowded with EHEC- or HUS-infected patients and needing to share capacity, had to develop and use especially innovative collaborative work with other hospitals across the country. This ad hoc arrangement did not benefit from any shared structures; existing ones were even perceived as detrimental. This situation provoked the launch of a professional mailing list that came into being through one serendipitous email that a clinical researcher had addressed to all members. Upon receipt of the

email, the list was filled with similar queries. After the epidemic, in a podium discussion geared towards re-examining the crisis after to the outbreak, the director of Germany's leading university hospital, the Berlin-based Charité, declared:

“We delegated part of our nursing staff, with a quality you would strive for like gold dust; they went to Schleswig-Holstein. It all worked out fine, without a minister or a politician from the opposition to tell us what to do, because it was here and there. This means that we are able to do so [...]. We are individually responsible for such solutions”.

Bureaucratic traditions. The deeply rooted background and traditions of the administrations in charge did not allow for ad hoc collaboration and coordination. Thus, such practices represented a key challenge for initiating ad hoc coordination across bureaucratic organizations in general and public agencies in particular. Public agencies are used to tackling tasks separately, not least concerning the regulated communication processes they have to follow. This habit not only pertains to the public agencies as such, but also to the federal ministries and their separate hierarchical structures, all the way down to the local levels. Two aspects played a significant role in this area: first, the reliance on bureaucratic processes inherited from the past, which were not created to specifically address unexpected crises such as the outbreak of an unknown disease; and second, the multiplicity of actors as en-

actment of the decentralized system of federal governance took place. For instance, vis-à-vis bureaucratic processes inherited from the past, a key medical practitioner complained to us about how the state health agencies stuck to their rules concerning communicating about EHEC- or HUS-infected patients in their vicinity (for more on communication channels see also Berthod et al. 2012). The public managers at the federal and regional levels, unaware that an outbreak was unfolding, relied on the procedures that coped with “normal” conditions. This situation led to critical delays across local, state, and federal agencies, and resulted in the comparatively late and often criticized slow response of the federal ministries and their research institutions. These federal agencies, the RKI and the BfR, are especially focused on cutting edge research (RKI 2011). However, as is common in a bureaucratically regulated system, these agencies cannot jump into an outbreak on their own: they must be assigned to do so by their respective ministries. Their ongoing task is to be prepared for yet another unexpected disease outbreak. As a consequence, their capacity for speedy reaction is perceived as significantly reduced.

The multiplicity of actors due to the decentralized federal system further hindered this preparedness in the first place due to the lack of formal and informal interorganizational coordination on the local, state and federal levels of action. The two ministries primarily in charge of such outbreaks each coordinate public actions via their two federal agencies, the RKI and the BfR

respectively. At the state level, the decentralized nature of the governmental system in Germany, a federal republic of 16 states, played a significant role in hindering preparedness. This situation meant there were much duplication of responsibilities and duties, with numerous agencies in charge of the same affairs at both the state and federal levels. This aspect was critical, and created difficulties since it meant that the federal agencies received the necessary information comparatively late. In compliance with formal regulations, medical doctors to the local and state health authorities first faxed the notification requirement for people infected by EHEC. It could take up to two weeks before this data was transmitted to the federal level. For example, the agency for health and consumer protection in Hamburg first invited the RKI to assist them on May 19, 18 days after the official start of the epidemic. And two unfortunate circumstances contributed to the worsening of this situation: first, two national holidays that took place during the EHEC outbreak further slowed the process, and second, both the medical practitioners and the local health agencies often sent their information by post, not electronically, causing a further delay of at least one day.

The process as such further provoked a blurring in terms of responsibilities across the numerous agencies involved, thus creating a situation particularly difficult for organizations that were used to sticking closely to intra-organizational administrative rules rather than relying on the interorganizational exchange of expertise as the usual mode of action.

The procedure (RKI 2011) starts with the clear responsibility of the local medical practitioner, who must report any EHEC or HUS case to the local health agency (in general one per district) within 24 hours. The local health agency then compiles and treats the data according to specific sets of disease definitions developed by the RKI. The local agencies eventually undertake their own investigations. They must report this data and their activities to the RKI within the next three working days of the following week at the latest. The state health and food authorities, who are informed via the municipal administrations, are then supposed to coordinate these activities and to provide a link between the work of the local agencies in the field and the state government. At the same time the RKI examines the cases and starts its investigations. During the EHEC outbreak, this situation not only brought about the ad hoc genesis of collaborations between RKI, state, and local food and health agencies (RKI 2011, 15), but also between the RKI, the nation-wide dispersed research laboratories, each of which focused on a single disease, and the two federal ministries, the BfR, or the BVL. One expert told us:

“It appeared that there was no central player in this issue. This means we had a lot of players whose competences probably played a part [...] it is probably true that the RKI and its director were the most visible in terms of public opinion [...] but for me, it was a very diffuse pic-

ture and it was a big problem that public opinion could not recognize any clear responsibility.”

Having neither ties among organizations and public managers nor an overall legal cognitive and normative framework meant that genesis of collaborations across agencies was of necessity spontaneous and organic. This fact was especially true in the process of forming collaborative IORs. For instance, one medical practitioner mentioned that he contacted the Federal Ministry of Health by phone, a ministry with which he had had no previous contact, to directly contact a person in charge of approving research grants. He needed to get immediate approval for testing a drug that had previously been approved for another disease and that could have been relevant to cure the new disease. However, the practitioner noted that this process proved difficult:

“I called the Federal Ministry of Health myself, where the doorman greeted me, saying ‘Well, I don’t know either, well, there was someone else calling beforehand’ and that was an interesting odyssey that took a couple of hours until I had a competent person on the phone. In effect it was a combination of ... well let’s put it this way, if you’ve worked for a university hospital, you have a basic education in guerrilla warfare, and you were able to truly capitalize on that.”

Extreme uncertainties regarding the epidemic. Because this was an as yet unknown form of EHEC, the hospitals and the RKI had to confront severe degrees of uncertainty. This situation implied three interrelated challenges. First, these organizations had to identify the source of the epidemic, i.e., what food was transmitting the germs. Second, hospitals and the RKI had to determine what implications this source could have in terms of potential propagation, and also the as yet unknown strain of the EHEC and what implications it could have in terms of potential for recovery and mortality. Third, the institutions had to develop adequate methods of treatment, i.e., what were the potential outcomes, the chance of success, risk of ineffectiveness, etc. This was in effect a science- and technology-related barrier that had to be solved by the public institutions dedicated to research on epidemics on the one hand, and on food safety on the other. However, the puzzle also had to be addressed by the hospitals and medical departments in universities, all of which represented organizations that function predominantly in isolation but whose activities related to the outbreak. It was obvious that to overcome the emergency, there needed to be clarification on who needed to collaborate with whom, in what form, and to what extent. However, this need for clarification created a paradoxical situation, as the needs for collaboration could only be established in the process of identifying the source of the outbreak, which was difficult, given the uncertainty surrounding its causes. As one of our interviewees admitted:

“We had never experienced such a crisis with such dimensions. And when in the past something happened from the chemical side, well then the trouble came from one product. And there, one had normal traceability measures which one knew. It had never been something like people dying because of it (...) and this is something one needs to understand, that we were not prepared for that.”

Indeed, the outbreak was unusual in many ways. The strain was new and so was its epidemiology. This outbreak was the largest ever-reported in Germany. With respect to HUS, this was by far the largest reported worldwide (Karch 2011). Compared to typical HUS cases, the patients concerned with this outbreak were outliers.¹ There was great uncertainty about the way the disease could unfold, where it was coming from, how it was being spread and when it started, since patients with EHEC-related symptoms (but related to different strains) are regularly being taken care of. As one medical practitioner recalled:

“Let’s say after just a week, a certain kind of habituation effect occurred. And from that a certain result was uncertainty. That’s typical of a crisis [...] uncertainty related to the [organizational] actors, or

¹ Normally, HUS is considered a pediatric problem. Yet only 2% of the patients of 2011 were under five years old. Also, the number of women concerned was unusually high, so that some specialists went so far as to consider bouquets of flowers as potential vehicles for the disease.

the consumers, probably even the public-sector employees, as I assume that no one wanted to make a mistake.”

4.3 During the Outbreak II – Overcoming Barriers

Obviously, the political, societal, and economic importance of the problem, the technical and expertise challenge for the scientific community, plus the usual time pressure typical of such crises, all contributed to overcoming the barriers. For example, in the first days of the outbreak, the hospitals and medical practitioners, as well as local health authorities around Hamburg and their staff, were among the first to assemble IORs around EHEC. They confronted a sudden and increasing number of patients with HUS symptoms, no clear trigger, and no treatment. As noted above, the federal health agencies and their affiliated laboratories then stepped in to take control of the emergency, and tried to assert their own legitimacy (and capability) and dragooning experts and non-public actors into the investigative process. But the relevance and appeal of the problem alone was not sufficient to coordinate activities or to deal with the unexpected in a reasonably effective way. What actually initialized IOAs was the flexibility enabled by the great uncertainty surrounding the outbreak combined with the relevance and appeal of the problem. Organizations and their managers made use of that leeway by depending on three factors that were linked. However, here we present these links separately for analytical purposes, the potential organizational ac-

tors' gains, past experiences in related contexts, and IT-based infrastructures.

Actors' Gain. The various organizational actors used the temporary leeway that resulted from the outbreak, primarily those whose work is usually governed by bureaucratic rules and procedures. For example, the doctors who, in face of the crisis, experienced greater degrees of freedom for treating the patients than they had under ordinary circumstances, were able to ease or even skip the usual administrative work, because of the critical need to act fast under intense time pressure to save patients. They greatly appreciated this aspect of the crisis was:

“It was satisfactory because we really had no firm rules left, well, few studies that could help, and, secondly, because all the other things like administration in the hospital were overruled. The medical doctors could decide on their own once again, because otherwise you always get interference from people who think they understand the hospital system.”

This aspect was based on more than just the humanistic and iconic mission of medical doctors working for relief and rescue; ambition also played a significant role. The practitioners in charge of the patients had a keen interest in playing a role in resolving the outbreak. One medical doctor noted:

“You don’t get such a chance, to put it this way, to [...] gain awareness, twice [and the doctors] were all eager to publish the first results; they [the doctors] are still arguing today about who was the first to publish.”

This situation was also a way for technicians and scientists to take revenge on the administrations. Here, the urgency in face of the general feeling of uncertainty made formal rules and procedures a superfluous burden for medical doctors, one that could be overcome eventually. This phenomenon was particularly strong in the context of cooperation among hospitals. One medical doctor told us that:

“I could take nurses from other hospitals, even a chief medical doctor from another hospital; anything was possible. Normally, everything needs at least six months before a change is made in the structure. One cannot decide on one’s own. Especially with regard to organizing, structuring: you could do anything, as you thought best. Suddenly, they had respect for it.”

However, this attitude should not be interpreted too literally. Although fighting the crisis was undeniably the shared goal of the newly created IOA, each organizational actor obviously had different goals in mind, thus creating a large potential for conflicts on the one hand, but also for mutual control. A senior official told us that:

“It was not like he [i.e., one of the leading scientists working on EHEC] got undisputed support. Because, obviously, there were different camps. The BfR has its own interests, the RKI has its own interests and unfortunately the interests get partly mixed, the scientific interests, and the, hm ... civil protection. Scholars have a scientific interest first. But the RKI or the BfR should have as their single interest a need to help people, and sometimes all this got mixed. But this is difficult. Because they need specific ways to kick things off, specific procedures and, hm (...) this is difficult.”

Past Experiences. Drawing on past experiences in related crisis contexts, and at the same time adapting transferable practices, occurred when state and federal agencies decided to bundle resources by creating a task force to further investigate the issue and identify the source of EHEC. Inspired by previous challenges during the bird and swine flu epidemics, the composition of the task force was a way to centralize communication and bundle ideas, propositions, and analytical efforts. In the case of EHEC, it encompassed experts from the RKI, the BVL, the BfR, from the human and veterinary health-related state authorities concerned, and from the European Food Safety Authority (EFSA). Since there was the question of finding a solution to deal with the outbreak, the discussions quickly revealed the need to bundle different sources of expertise, knowledge, and capabilities. These discussions attracted people with experience in task forces and crisis man-

agement groups in different fields, all of whom were then instrumental in operationalizing this emerging strategy. From the formation of the interorganizational task force onwards, activities were divided among its members, along an improvised mind map that focused the attention of all the public managers involved on one leading question: “What do we want to know about an outbreak-cluster?” (BVL 2001). The RKI became the entity in charge of identifying the source from the patients’ perspective, e.g., asking, “What did you eat last Thursday?” as well as determining alternative and perhaps forgotten exposure to products that could carry the disease. The rest of the task force would work towards inspecting food production and distribution processes based on the clues provided by the RKI. The benefit of the task force was the maximization of resources and insights and their flexibility in coming together across organizational boundaries without the relational depth of conventional project-based structures. A senior official told us that:

“Therefore, there was someone, a sort of liaison officer in the task force, representing the RKI issues. But there were also all the delivery pathways, to the understanding of which we could not contribute. And in such critical situations those people who know better are also needed here [at the RKI]. They can’t sit around with the task force the whole day, where our expertise is only needed for only a 10-

minute discussion. So all these people suddenly had to be everywhere at once.”

To more deeply examine clues, members of the RKI suggested a new method to deal with the uncertainty related to the specific EHEC strain. This novel approach was inspired by a criminal investigation technique, the use of what is called a recipe-based restaurant cohort study. RKI researchers made pictures of numerous dishes served by one restaurant where an intriguingly high number of patients had become ill. The researchers showed the pictures to the patients and compared their answers with a full list of the dishes’ ingredients, provided by the cook. This method made the retrospective detection of the source much easier: bean sprouts spread over the salads seemed to play a part. The sprouts were delivered by an organic farm in Germany, which had imported the seeds of fenugreek from Egypt. To find this out, the scientific staff at BfR gave the new task force database information on patients’ exposure and food deliveries. By doing so, they were able to superpose data and coordinate their joint analysis over the different state boundaries and thus identify clusters of infections (RKI 2011).

IT Infrastructure. Another structural component combined to assemble new IORs and to cope with the emergency was the IT infrastructure. By using IT, medical practitioners and hospital managers were able to refine their

way of communicating with each other by exchanging information regularly via online forums and databases. They could use either the technological structures that were already at hand and recombine them in new ways, as noted above with respect to the mailing lists and the exchange of capacity, or create new ones from scratch. For instance, a medical doctor launched the idea of sharing anonymous data on patients and centralizing the data in a register for comparative purposes. After a previous outbreak of bird flu, this same practitioner had tried to publish his results in top-tier scientific journals. However, he was severely criticized by reviewers, who complained that he had not made his database systematically comparable with data from other countries. He built on this experience and launched a new cooperative tool that would link actors across the country and ease medical research on the new strain:

“...from the moment when the first cases [of EHEC] were reported and it became obvious that there would be many more, I told myself while the publication [the one not yet published and related to bird flu] was still sitting on my desk: ‘Well, this time there’ll be a register, yes, this won’t happen to me again.’”

In a related occurrence, representatives of the federal and state health and food authorities who were included in a task force experienced how technology, functioning as a new bundle of tools available to the agencies at

hand, could bridge unrelated actors and support the formation of IORs. For example, software and a dedicated database were developed during the process with the help of experts from the EFSA, and subsequently optimized to function collaboratively. This program made it possible for actors to analyze the flows of food and related data, such as delivery bills, but also restaurant menus and recipes, in the critical time period. Different organizations in the field had collected this data and needed to centralize it across states. The scientific staff of the BVL analyzed the data and thus was able to trace the chains. In this process, missing data was easily identified and ordered from the local authorities. For example, the state food and consumer protection authority in charge of the sector of organic farming compiled visual representations of the business relations of every farm. This collaboration proved essential for the identification of subsequent critical junctures (BVL 2011, 5).

[Figure 2 about here]

4.4 After the Outbreak – Learning and Institutionalizing?

After the RKI had declared the outbreak over on July 27, interviewees argued that the handling of this outbreak was different from previous ones. Apart from strengthening existing ties and opening up new ones with new partners (see Figure 2 for an overview), one of the positive side effects of the outbreak was that it eased communication within and across organizations. This eased communication holds particularly true for the informal con-

tacts between managers from different institutions. Here, one interviewee who had worked in the U.S. for a long time told us that:

“The communication has become more like in the U.S.; now [after the outbreak] you pick up the phone more easily [to talk to colleagues] and this also triggers other unconventional forms of handling such outbreaks.”

In our observations, other instances that resulted in similar good effects included the institutionalization of the task force as a permanent interorganizational tool, thus making it possible for agencies to be better prepared for future EHEC outbreaks. Medical experts have argued that if there are future outbreaks, it is likely that actors will again use IT tools such as joint databases to compare cases across their various organizations, and will make arrangements for joint telephone conferences and work sessions to coordinate their activities. Until the EHEC outbreak, this practice was (and still is) uncommon, not only for this particular outbreak, but for disease outbreaks in general. In sharp contrast, the task force as an interorganizational form is on its way to being officially recognized as the correct tool for gathering together human health professionals, food safety professionals, and expert laboratories on an ad hoc basis.

In the autumn of 2012, the experience gained during the EHEC case was put to good use in a case of infected strawberries that had been distrib-

uted in the cafeterias of German schools. Although this case did not cause any fatalities and was easier to define than was the EHEC (only one company was responsible for the food deliveries at the schools), the organizations quickly drew on the task force as an interorganizational form to determine the skills and knowledge needed for the job, the actors who would be responsible, and a joint action plan and hypotheses to work on. Thus, the task force is considered a valuable device for organizing work on an ad hoc basis, and obviating the need to create new, overarching bureaucracies or establishing a centralized form of governance in the hands of one administration. Although one organization is in charge of making the first phone calls, this responsibility does not take the form of a governance role. As one of our informants told us, when considering the recent case of infected strawberries:

“It worked out fine [i.e. the task force]. It was appropriately quick. There were mistakes too, sure; it’s always a part of it and nothing has ever worked without mistakes. There are always some kinds of problems in there. But it was way better than during the EHEC outbreak. It was quicker, the mechanism has worked out; really: lessons have been learned.”

5 DISCUSSION: TOWARDS A MODEL OF INTERORGANIZATIONAL ASSEMBLAGE

In future emergencies such as the outbreak of EHEC in Germany 2011, numerous organizational actors will most likely again collaborate for a joint purpose. Despite a substantial lack of prior ties, such collaboration does not come out of nowhere. Instead, it is made possible with the help of existing experiences, procedures, and structures, which themselves contribute, in a dramatic duality, to sustaining other barriers to cooperation. What plays a critical role is the managers' ability to perform new interorganizational assemblages (Ong 2004; Ong and Collier 2005). With "assemblage" we mean two or more previously unconnected organizations collaborating on an ad hoc basis while temporarily being called upon to tackle a crisis. Assemblages emerge when managers who, because of their professional expertise or simply by their general education, might have been aware of other public agencies and other organizations but who were not in contact with each other organizationally. Moreover, IOAs revert to differing established intra- and particularly interorganizational structures (in prior research, for instance ICS; cf. Bigley and Roberts 2001; Moynihan 2009) that are enacted and put into practice in a modified form in order to tackle the unforeseen challenges ahead. As one respondent noted, these are the "checklists [and] platforms of expertise" already in place, but they need to be turned into a tailor-made solution with regard to the respective crisis" (here, the disease outbreak).

[Figure 3 about here]

Generalizing from our observations, we suggest a preliminary model of IOAs as shown in Figure 3. This model roughly differentiates between the phases prior to, during, and after the crisis. In this model IOAs and IORs are distinguished from each other, as IOAs are, by definition, a process and IORs are a state. IORs are not only a likely outcome of IOA but have to be reproduced with the help of interorganizational practices in order to be maintained. The fact that IOAs comprise the inclusion of ties that are newly generated in an ad hoc fashion in the course of the crisis is highlighted in Figure 3 by the black shaded forms that relate solely to IOAs. The white forms relate to existing IORs. The grey shaded space depicts the actual core of the IOA process. It relates to both IOAs and IORs, and highlights the need to adapt the new ties to the already established IORs, with the possible or even likely outcome of gaining not only more ties that are better adapted to managing the crisis at hand, but also to more multiplex ties (Wasserman and Faust 1994).

Our explorative study has shown that in the pre-crisis phase, there were numerous existing ties across organizations, including public agencies. However, these ties, either took the form of maintained IORs (e.g., when actors collaborated in the form of a network dyad or even a whole network, such as the national reference laboratories) or latent ties (e.g., in which ac-

tors had previously collaborated with each other, but were not currently doing so; see, e.g., Bigley and Roberts 2001; Robinson et al. 2006). In addition, and this is key to our concept of IOAs in the pre-crisis phase, there were also many organizational actors who were previously unconnected to each other. In some cases (among hospitals, state agencies and federal ministries), the ties existed but were not related to foodborne disease outbreaks. Organizations that for this particular purpose were unconnected were pulled into the center of the nascent IOA when they became aware of each other by looking for complementarity in activities and capabilities. In some cases, organizations were even mandated to collaborate with each other once the crisis started. In contrast to Provan and Kenis' predictions (2008) on network governance, in this case the absence of centralized network governance and of consensus on a goal prior to the crisis did not prevent the organizations from successfully building ad hoc ties that would eventually address the crisis. Robinson et al. (2006) note that the need to collaborate did not start from mutual ignorance. Instead, prior to the crisis, the nonexistence of IORs was based on the lack of operative needs. For example, the consumer protection authorities had never needed to collaborate with health and emergency services. These arguments lead us to the following proposition:

Proposition 1: *A crisis makes the lack of relevant ties apparent, especially among heterogeneous organizational actors.*

This approach represents a key difference with previous studies of inter-organizational answers to emergencies, such as Bigley and Roberts' (2001) and Moynihan's (2009) studies of ICS. Because forms of ICS were applied in situations that involved great uncertainty, the organizations previously affected by an unforeseen event were able to coordinate their activities along at least partially pre-established lines. This preparedness results from a shared awareness among actors and appropriate measures that have been derived from the ICS framework (Bigley and Roberts 2001; Moynihan 2009). In contrast, the concept of IOA incorporates organizations that were previously unconnected. Thus, we contribute to the literature on network formation in general and on ad hoc initial tie formation in particular (e.g., Bardach 2001) by proposing that tie and network formation may rely to a significant extent on ad hoc governance that is sensitive to operative needs. In particular, our study shows, and our model reflects, that in the absence of actual relationships, tie formation or even the creation of whole networks may emerge from a basic awareness of organizational actors and their potential complementarity in operative terms.

However, specific forms of intra- and interorganizational barriers might hinder this process. During a crisis, actors need to overcome these barriers, which they may do by relying on or even constructing a common frame of reference, a process that is enabled and fostered by the need to react quickly to alleviate the detrimental effects of the crisis. This puts considerable time

pressure on the organizational actors (Boin, 't Hart, Stern, and Sundelius 2005; Grzymala-Busse 2011). The undisputed need to act and the time compression are closely connected to increasing room to maneuver; that is, organizational actors seize the opportunity to make use of the range of options at hand. Because of the crisis, their scope is widened temporarily to an uncommonly substantial extent. Actors use this leeway as they try to gain benefits, draw on past experiences, and learn (for more on learning from extreme events see Müller-Seitz and Macpherson in press).

Hence, we contribute to the study of interorganizational networks in general and of the ad hoc genesis of collaborative IORs in particular, not least in the field of public management. In addition to other studies of emerging interorganizational networks, such as that by Gulati and Gargiulo (1999) and Kenis and Knoke (2002), our research shows that the genesis of collaborative ties does not necessarily rely on established ties, but may well occur ad hoc, based on other kinds of structures (see also Phillips, Lawrence, and Hardy 2000; Levina and Orlikowski 2009). The previously existing field, comprised of latent and activated ties, was highly structured. This structuration contributed to making inexistent ties more difficult to build on an ad hoc basis, and made it imperative for agents, and indeed whole organizations, to work creatively on new interorganizational solutions. In the field of public management this knowledge is already well established. In particular, Comfort (1994a, 2002b; see also Kapucu 2006a, b) shows how organiza-

tions, both private and public, collaborated, some of them interacting with one another for the first time, in their attempt to deal with the Pittsburgh oil spill of 1988. Comfort's approach builds on biological allegories of social systems, and hence, on ideas of natural selection and evolution (Kauffman 1993). However, such a perspective abstracts somewhat from the perceptions, cognitions, and the professional background that organizational actors have and the sensemaking processes in which they engage (see also Comfort 2007). In point of fact, in Comfort (2002b) the major driver for inter-organizational action depends here "...on the extent and effectiveness of information and communication processes operating within the interorganizational system, and the ensuing capacity to foster collective learning and adaptation" (Comfort 2002b: 101). This approach is somewhat similar to Bardach's views (1998, 2001) on the emergence of interagency collaboration as a process of "platforming", which he defines as practices that result in building up an interorganizational collaborative capacity. Although we agree with the relevance of exogenous events as sources of membership, and with information and communication as means for sensemaking in extreme events, we suggest that this approach tends to ignore embeddedness into different geographical or professional contexts (see in a similar vein Robinson et al. 2006). Such contexts include vested interests and the power to act, thus producing an image of interorganizational constellations from a bird's-eye view that, in addition, appears at least partially functional. This

shortcoming emerges mostly because, to observe its overall genesis, adaptive system dynamics research looks at connections across actors at the system level of analysis functioning and evolution, thus diminishing its theoretical sensitivity to actual organizational action and the social context in which public managers engage in tie or network formation.

Research on networks that is more interpretive is sensitive towards the role of structures of signification and legitimation and of resources of domination (Giddens 1984). Driven by in-depth qualitative analyses (Morçöl and Wachhaus 2009), it has already pointed at contextual issues such as collective rationalities and conflicting interests (e.g. Davies 2011), or idiosyncratic culture and values (e.g. Hay and Richards 2000; Moynihan and Pandey 2008; Weiss 1987). For example, Provan and Milward (1991) test how pressures in terms of norms, values and expectations issued by the specific institutional environment may act as drivers for tie formation and network involvement among public administrations. In a similar vein, O'Toole and Meier (2004) note that most studies tend to depoliticize the network as a phenomenon, thus avoiding "...the likelihood that, rather than being neutral producers of collective goods ... network managers respond to the stronger and more politically powerful elements of their surroundings" (2004, 681). Being sensitive to actors and contexts, as well as to structures, which they enact and reproduce (Giddens, 1984), to understand tie formation, or even the

genesis of complex networks, represents an important component of our IOA conception.

Hence, we submit that ties will vary in their multiplexity (Wasserman and Faust 1994) prior to a crisis. On the one hand, these ties can be uniplex (e.g., a professional relationship based on joint data analysis); on the other hand, in the sense of Kenis and Knoke (2002), they might create a collaborative relationship that is multiplex in terms of modalities, e.g., an actual exchange of staff between two agencies to explore possibilities for joint projects and an actual collaboration in the joint analysis of specific data. The nature of this multiplexity is likely to vary, depending on the professional and/or jurisdictional background.

As an example we cited the medical practitioners in hospitals, who, during the outbreak, were more likely to engage with fellow colleagues and use the existing IT infrastructures. When ad hoc formation is called for, actors tend to seize all the possibilities at hand in an explorative way in order to identify the modalities that are best scalable (also for intentionally inducing uncertainty, see Müller-Seitz, 2014). This diversity of possibilities is easier to identify in the individual actors' professional fields, fostering shared cognitions and norms that actors can draw on strategically to initiate working together (Kellogg 2011). For example, it was clear to medical practitioners that the RKI needed to be part of the game. But in contrast, the need to involve

consumer protection authorities was not that clear. Generalizing from the literature and our own empirical observations suggests the following proposition:

Proposition 2: *Organizational actors who share a common frame of reference are more likely to overcome barriers to forming ad hoc ties.*

The post-crisis conditions differ from the pre-crisis conditions in one critical point that is essential for IOAs: ties for coping with crises have not only been reproduced, but either IOA-relevant ties have also been initially formed between previously unconnected actors or else non-directed ties have been adapted to a new purpose (Robinson et al. 2006; in a similar vein, Bardach 1998). Thus, we suggest that such unforeseen events have a positive side effect, in that IOAs offer fruitful ground for future exchanges. For our study, respondents repeatedly told us that they were now able to revert to a broader interpersonal and interorganizational network because the EHEC outbreak put them in touch with previously unknown persons. In this connection, both our interviewees and previous research on IORs lead us to propose as follows for the post-crisis situation:

Proposition 3a: *During a crisis, organizational actors can draw on both newly established ties and reproduced ties that feed into existing latent or manifest ties for the next pre-crisis situation.*

Alternatively, tie termination might occur. This closure might either be the result of intentional tie lopping (e.g., as public agencies reorganize their activities) or happen unintentionally as ties dissolve (e.g., as a manager retires). Interviewees confirmed both types of tie terminations a year after the outbreak occurred. Hence, we propose the following:

Proposition 3b: *Tie termination results in a lack of interorganizational relations in the subsequent pre-crisis situation, which has to be compensated for by IOAs in the face of the next crisis.*

6 CONCLUSIONS AND LIMITATIONS

In this study we answer the question of how organizational actors form IORs on an ad hoc basis, and how they coordinate their activities to cope with crises, eventually even constructing whole networks that are more complex. The case of the EHEC outbreak in Germany in 2011 provides us with an empirical setting to analyze how this took place despite important barriers to interorganizational collaboration. Thus, we inform previous research in two ways. First, by introducing our model of interorganizational assemblage, we direct attention to how actors face crises by means of initiating ties and relying on existing dyads or networks of IORs. Second, we inform organization and network theory on how relations form among organizational agents that did not have prior ties that were relevant to dealing with the problem at hand.

Although we believe that our findings are at least partially generalizable to other cases, our study's contribution is limited by our method. At least three distinct limitations merit attention. First, because it was occasionally difficult to differentiate individual from organizational efforts in the data, quite often, what was initially an individual initiative was presented as an organizational strategy. Organizations did so as a way to rationalize ex post the conduct of the whole organization. In some instances, we were able to find this out during interviews, but not always. To bypass this limitation, we believe it is necessary to collect more ethnographic data. This data would make it possible for researchers to grasp in situ, and during the action, who did what and under what circumstances.

This suggestion leads us to a second limitation: participant observation is difficult to achieve in this highly contested field, but might be worth pursuing (Harding et al. 2002; Homan 2003). Such an approach might result in finer-grained data from actors in the face of such an outbreak (see Moynihan 2009; Stallings 2002). Although our method of data collection is common in research on unexpected events, this lack of data is often deemed an inevitable shortcoming (Stallings 2002) that needs to be acknowledged. Finally, a social network analysis of the actors involved in the different existing and emerging working relationships might have helped us to better comprehend how existing relationships impact the formation of new ones, and especially the development of practices that are used in the course of inter-

organizational assemblages (Kapucu 2006a). We attempted both strategies in order to allow for triangulation in our method, but due to severe legal restrictions imposed by the public prosecution authorities and to the difficulties for informants to truly assess, ex post, the depth of a former relation once stronger ties had been established, we were not able to obtain either observational or network data.

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Table 1: Field documents

<i>Type of document</i>	<i>Documents analyzed</i>
Professional journals, trade magazines	Ärzte Zeitung online (aerztezeitung.de), Bundesgesundheitsblatt, Lancet, Medizinreport
International organizations	Eurobarometer, Eurosurveillance.org, WHO (euro.who.int)
Non-governmental organizations	foodwatch, Greenpeace, National Consumer Council
Online media	bbc.co.uk, bloomberg.com, idw-online.de, ndr.de
Press releases by public authorities	Federal public authorities (hamburg.de/bgv; lgl.bayern.de; umwelt.nrw.de; mlr-baden-wuerttemberg.de), Federal Institute for Risk Assessment (bfr.bund.de), Federal Office of Consumer Protection and Food Safety (bvl.bund.de), German government (bundesregierung.de), European Parliament, European Council
Robert Koch Institute	Epidemiological Bulletins (1997-2011), Infection epidemiological yearbooks (2001-2009), press releases
Daily press (print and online versions)	Spiegel, Die Zeit, Frankfurter Allgemeine Zeitung, Handelsblatt, Science, sueddeutsche.de, tagesschau.de, Wirtschaftswoche
Others	lebensmittelzeitung.net, uke.de

Table 2: Interview data

<i>Type</i>	<i>Function</i>	<i>Number of interviews</i>
Research institution	Veterinary public health (6), human medicine (5), prevention and investigation of food-borne disease outbreaks (2) and organizational behavior / strategy (3)	16
Hospital	Medical practitioners (10), head of 'nephrology' unit (1)	11
Food producer	CEO (2), Director of regulatory affairs (1), manager of quality management (1)	4
Non-governmental organizations	Task force rapid response (3), farming and genetically modified food (1), globalization issues (1)	5
Local state agency	Coordinator of zoonotic diseases (1), Health care department (2)	3
For-profit organizations	Managing director trade association (1), laboratory manager (1)	2
Media	Head 'Newsroom' (1), head 'health care' (1)	2
<i>Sum</i>		43

Figure 1: Pre-EHEC outbreak collaborative structure.

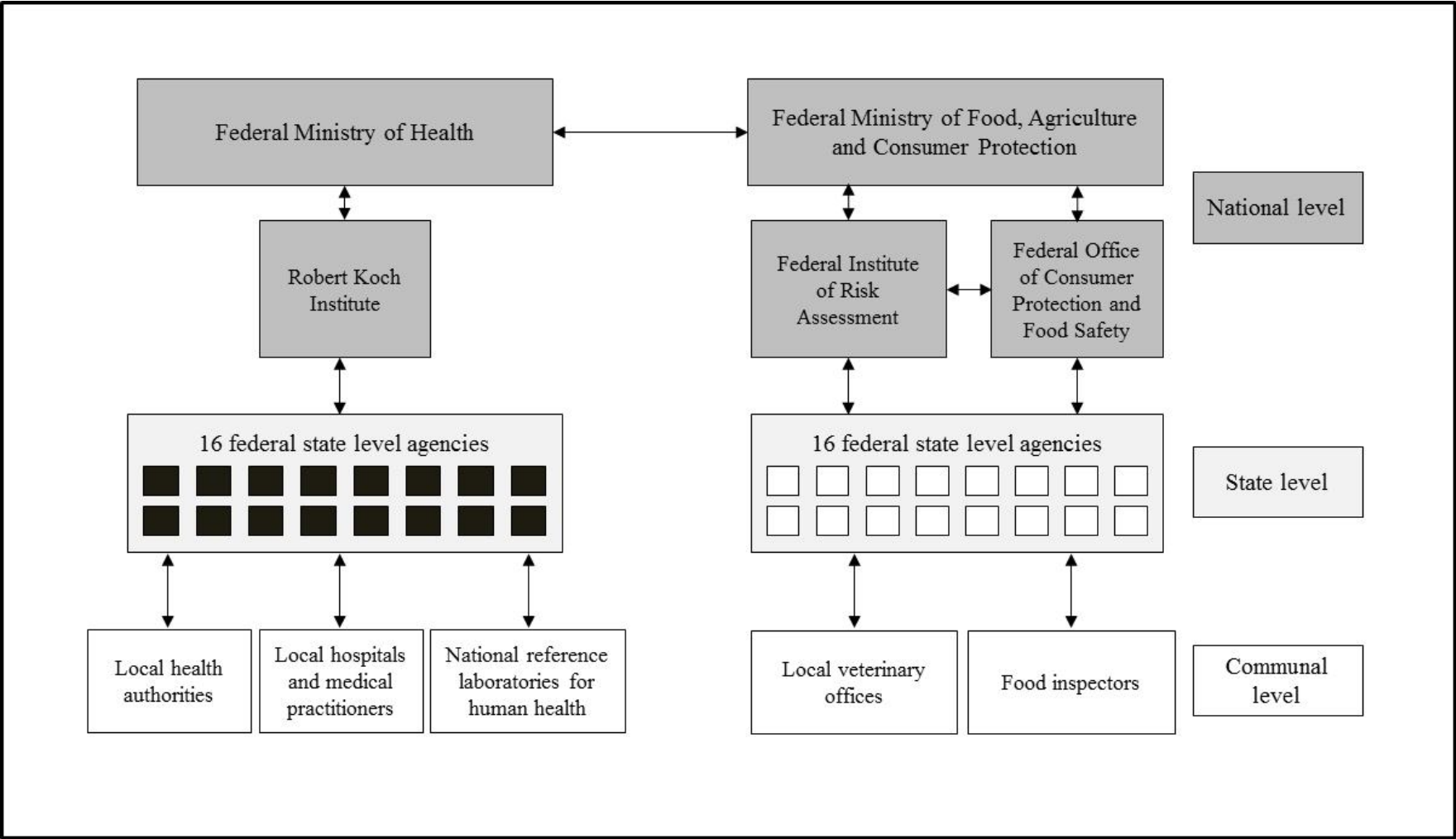


Figure 2: Post-EHEC outbreak collaborative structure.

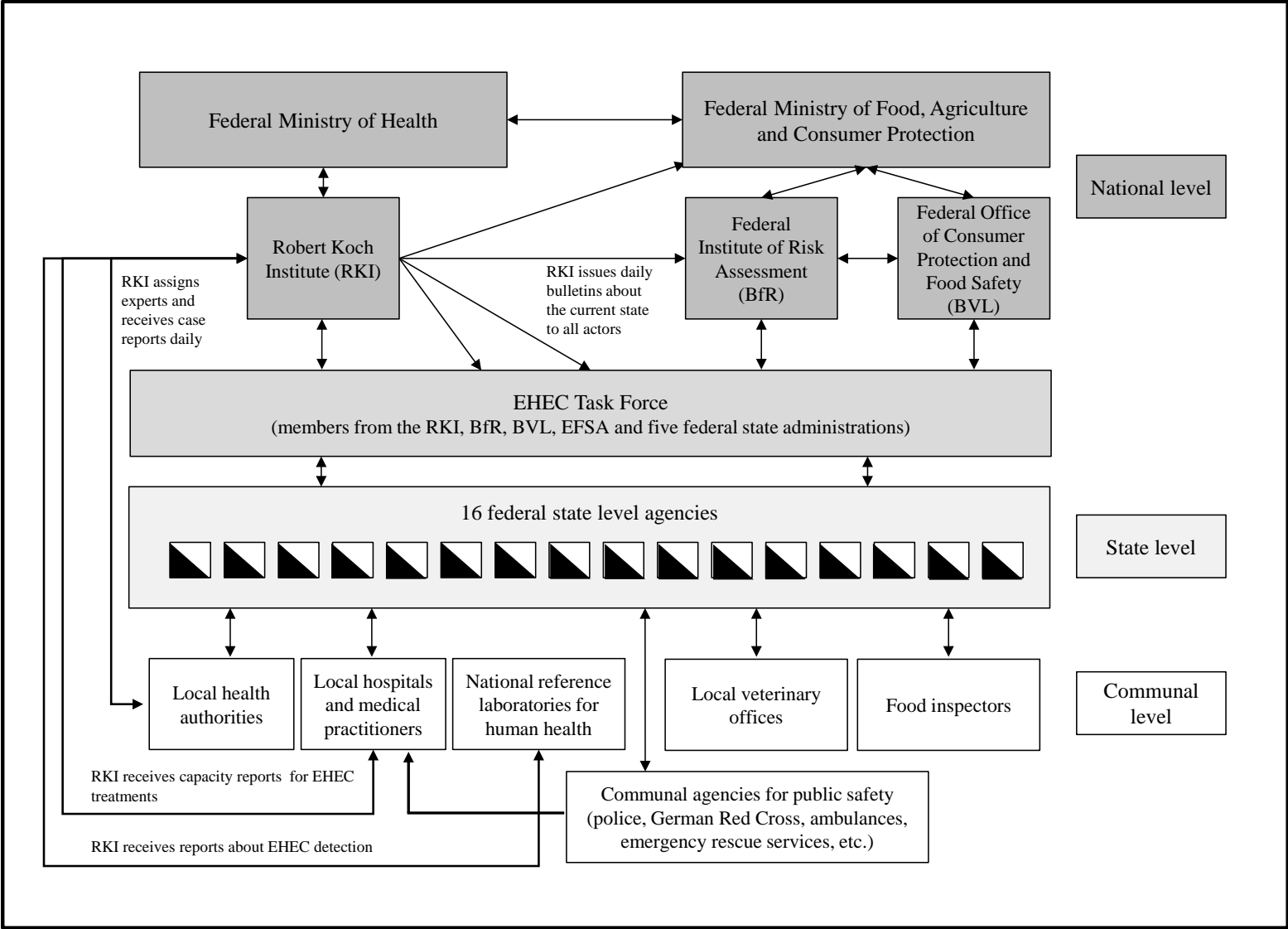


Figure 3: A preliminary model of interorganizational assemblage.

