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Lukas Thiele, Andree Pruin

## Does large-scale digital collaboration contribute to crisis management? An analysis of projects from the #WirVsVirus hackathon implemented in Germany during the COVID-19 pandemic

### Abstract

In recent years, collaborative approaches to crisis management involving citizens have gained increasing attention. One example is the #WirVsVirus hackathon, which was conducted in response to the COVID-19 pandemic and had over 28,000 participants. Because research on large-scale, digital collaboration in crisis situations is scarce, consequences of their use in crisis management remain unclear. This article relies on the open governance paradigm as a lens for studying two projects emerging from the hackathon. Based on nine qualitative expert interviews, we ask how digital open governance affects governance capacity and legitimacy in crisis management. Our findings suggest that digital open governance can contribute to governance capacity and legitimacy, as it mobilises large, diverse groups of citizens to quickly develop citizen-centric, ready-to-use solutions for crisis-related problems. However, we also identified potential problems, including risks regarding legitimacy and accountability, difficulties with scalable solutions, and questionable long-term impacts.

**Keywords:** open governance, crisis management, capacity, legitimacy, hackathon

### Zusammenfassung

*Digitale Massenkollaboration als Teil von staatlichem Krisenmanagement? Eine Analyse von Projekten aus dem #WirVsVirus-Hackathon in Deutschland*

Kollaborative, partizipative Instrumente zur Krisenbekämpfung haben in den letzten Jahren zunehmend an Aufmerksamkeit gewonnen. Ein Beispiel hierfür ist der #WirVsVirus-Hackathon, der als Reaktion auf die COVID-19-Pandemie durchgeführt wurde und über 28.000 Teilnehmer:innen erreichte. Bislang wurden die Auswirkungen solcher groß angelegter, kollaborativer Ansätze zur Krisenbewältigung auf staatliches Krisenmanagement nur selten untersucht. Diese Studie analysiert den Hackathon und die daraus entstandenen Projekte aus der Perspektive des Open Governance-Paradigmas. Auf Grundlage von neun Experteninterviews untersuchen wir, wie sich digitale Open Governance auf die Regierungsfähigkeit und Legitimität in Krisenzeiten auswirkt. Unsere Analyse zeigt, dass digitale Open Governance zur Leistungsfähigkeit und Legitimität staatlichen Handelns in Krisenzeiten beitragen kann, da solche Projekte eine breite und diverse Teilnehmerschaft mobilisieren und in kurzer Zeit bürgerzentrierte, nutzbare Lösungen für krisenbezogene Probleme entwickeln können. Dem stehen allerdings Zweifel an der langfristigen Beständigkeit der Projekte, ihrer Skalierbarkeit, sowie Risiken hinsichtlich der Legitimität und Rechenschaftspflicht entgegen.

**Schlagworte:** Open Governance, Krisenmanagement, Staatliche Leistungsfähigkeit, Legitimität, Hackathon

## 1 Introduction

The COVID-19 pandemic demonstrated the crucial importance of crisis management for politics and public administration. Especially regarding crises as complex, uncertain, and transboundary, as the COVID-19 pandemic has been, scholars have emphasized the importance of a well-functioning crisis management system that can ensure *both* government capacity *and* governance legitimacy (Christensen, Laegreid & Rykkja, 2016). Scholars have discussed a broad range of measures for crisis response, including the design of effective institutions, the need for organizational leadership, and balancing long-term risks and short-term needs (Boin & Lodge, 2016; Mazzucato & Kattel, 2020; Quarantelli, 2006). One aspect of crisis management that has recently received scholarly attention is the role of collaborative approaches to enable citizens to participate in crisis management (French, 2011; Stark & Taylor, 2014). Collaborative approaches may help overcome problems linked to crisis management of bureaucratic organizations, such as lack of expertise, lack of resources for improvisation, or organizational barriers that hinder fast development of technologies. This has been a normative claim, while empirical studies on this issue are rare. Hence, it is unclear how collaborative approaches in crisis management affect governance capacity and legitimacy.

This article examines consequences of the use of collaborative approaches for governance capacity and legitimacy in crisis management in relation to a case in the context of the COVID-19 pandemic. We argue that the #WirVsVirus hackathon (which translates to “We versus Virus” in English), conducted under the auspices of the German government in March 2020, is a prime example for a collaborative approach to crisis management. The hackathon was aimed at developing digital solutions for challenges that arose during the crisis and reached over 28,000 participants (tech4Germany et al., 2020). Following the event, several support programs were initiated, which enabled a variety of projects to implement their solutions.

This study applies the open governance (OG) paradigm proposed by Albert Meijer, Miriam Lips and Kaiping Chen (2019) as a lens for analyzing collaborative approaches to crisis management. The authors describe OG arrangements as “new innovative forms of collective action aimed at solving complex public policy issues, contributing to public knowledge” (Meijer, Lips & Chen, 2019, p. 1). A key feature of this paradigm is its notion of government as a platform: The state provides a platform for collaboration of networks of individuals (Meijer, Lips & Chen, 2019, p. 7). We argue that OG is well suited to grasp the character of the #WirVsVirus hackathon as a collaborative approach to crisis management. Based on this conceptualization, we aim to answer the following research questions:

*Do open governance arrangements contribute to governance capacity and legitimacy in crisis management? And which characteristics and features of open governance arrangements can be identified as relevant factors affecting crisis management?*

To answer these questions, we examine two projects developed during the #WirVsVirus hackathon where solutions were implemented together with public sector organizations. The analysis is based on evidence from nine semi-structured interviews conducted with project participants, administrative executives collaborating with the projects, and organizers of the hackathon. Additionally, we conducted a web content analysis.

By applying the OG paradigm, we aim to contribute to two strands of literature: First, our article adds to literature on crisis management through the study of potential impacts and risks of collaborative approaches for governance capacity and legitimacy. We claim governance as a platform can be considered an additional coordination mechanism to complement governance in times of crisis. Second, this study adds insights to the literature on OG by applying the concept to crisis management. Our findings show OG arrangements can contribute to governance capacity and legitimacy during a crisis and describe possible drawbacks and risks.

The paper proceeds as follows. First, we describe the #WirVsVirus hackathon. Second, our definitions of crisis management, governance capacity and governance legitimacy are introduced. Then, the theoretical implications of the OG paradigm and potential consequences of the use of OG arrangements in crisis management are discussed. Subsequently, the methodological approach of the article is addressed. In the analysis, we present evidence on two hackathon projects and how they affect governance capacity and legitimacy. Finally, we draw conclusions and discuss directions for future research.

## 2 The #WirVsVirus hackathon: Large-scale, digital collaboration to tackle COVID-19-related problems

The #WirVsVirus hackathon differed from conventional hackathons, which mostly aim to solve problems on a small scale in face-to-face settings and are planned long ahead of the event (Kamariotou & Kitsios, 2018). Rather, the #WirVsVirus hackathon is a prime example of the phenomena described by Meijer, Lips and Chen (2019). More than 28,500 people participated in the digital hackathon. Seven non-profit organizations organized the event in a remarkably short period of time. Five days passed from drafting a concept sketch to the onboarding of the participants. The day after the submission of the project outline, the Federal Chancellery took over the patronage of the hackathon (tech4Germany et al., 2020).

The event was open to anyone interested. Participants self-selected challenges curated by the organizers, such as “governmental challenges” or “medical care”. Based on these topics, participants assembled into project teams to develop solutions to problems caused by the COVID-19 pandemic. Participants could inform themselves about the challenges on Airtable (virtual collaboration software) and join channels related to these challenges on Slack (virtual communication software). Most project teams started working together on the first evening of the hackathon, so the team formation process can be described as spontaneous and, concerning the large number of challenges and channels, rather coincidental. At the end of the hackathon weekend, the organizers selected 197 ideas for the “shortlist” and honored twenty of them according to five criteria: social value, innovation, feasibility and scalability, idea stage (progress), and comprehensibility.

Following the hackathon, four support programs were created. We focus on projects supported by the program “Solution Builder”, as these projects were considered to have the highest potential and urgency. This program includes three pillars of support: First, the teams received professional help by a coach (a “solution lead”), who worked

with the team for eight weeks. Second, corporations offered their support as “venture partners”. With their professional expertise, the program aimed at increasing implementation capacities. Third, the program facilitated access to professional networks and further support options offered within the other support programs of the hackathon (tech4Germany et al., 2020).

### 3 Analytical framework

#### 3.1 Crisis management, governance capacity, governance legitimacy

In traditional crisis research, there is an understanding of crises as singular, threatening events. Today, scholars understand crises as potentially long-lasting processes and try to grasp the full context of conditions, characteristics, and consequences (Quarantelli, 2006). Thus, the term *crisis management* includes “steps that help to identify potential crisis signals or indicators, planning strategies, response coordination, and recovery plans” (Wang, Hutchins & Garavan, 2009, p. 22). A crisis is characterized as something that happens “out of the ordinary” (Boin & Lagadec, 2000) and cannot be addressed with well-prepared tools. Therefore, it is not appropriate to insist on fixed structures, routines, and rules in the dynamic environment of a crisis (Crozier, 1967). Instead, scholars have argued organizations need to build capacities that allow for flexibility and include external stakeholders to prevent, solve, and grow from a crisis (Bundy, Pfarrer, Short & Coombs, 2017, p. 1664), pointing to the two key challenges of crisis management: governance capacity and legitimacy (Christensen, Laegreid & Rykkja, 2016, p. 887).

Governance capacity refers to “formal structural and procedural features of the governmental administrative apparatus but also informal elements, that is, how these features work in practice” (Christensen, Laegreid & Rykkja, 2016, p. 888). According to Martin Lodge and Kai Wegrich (2014) and Tom Christensen, Per Laegreid and Lise Rykkja (2016), four types of governance capacity can be distinguished. *Coordination capacity* refers to the steering of joint action by “bringing together and aligning organizations from different backgrounds” (Lodge & Wegrich, 2014, p. 13). *Analytical capacity* is linked to “analyzing information and providing advice as well as risk and vulnerability assessments” (Christensen, Laegreid & Rykkja, 2016, p. 888). *Regulatory capacity* describes issues of state control, surveillance, and accountability (Lodge & Wegrich, 2014, p. 11 f.). *Delivery capacity* is about “handling the crisis, exercising power, and providing public services in practice” (Christensen, Laegreid & Rykkja, 2016, p. 888).

Regarding governance legitimacy, Christensen, Laegreid and Rykkja (2016) refer to the distinction established by Fritz Scharpf (2002) and Vivien Schmidt (2013) between input legitimacy, throughput legitimacy and output legitimacy. Christensen, Laegreid and Rykkja (2016, p. 888) understand governance legitimacy primarily as “citizens’ perceptions of whether the actions of public authorities are desirable, correct, or appropriate”, emphasizing the importance of output legitimacy. While this understanding points to the pivotal necessity of citizens’ trust in crisis management, we argue this focus falls short in terms of the participatory and processual nature of legiti-

macy. Discussions of community resilience show that input legitimacy of crisis management requires citizen participation, e.g., by using partnerships or meaningful citizen influence on policy formulation (Aldrich, 2012; Stark & Taylor, 2014). According to this literature, citizen participation can increase a community's resilience to threats, which enables citizens to support but not replace governments in crisis response and recovery dynamics (Stark & Taylor, 2014, p. 301). In addition to the need for openness of decision-making processes for citizens' input, other aspects of throughput legitimacy are relevant to crisis management, particularly the accountability and transparency of crisis intervention decisions (Boin & 't Hart, 2003; Hood, 2002). In summary, we refer to *input legitimacy* as the extent and representativeness of participation in crisis management. *Throughput legitimacy* is linked to the openness, transparency, and accountability of decision-making processes. *Output legitimacy* is about the (perception of) effectiveness of policies, means, and measures (Christensen, Laegreid & Rykkja, 2016; Schmidt, 2013).

### 3.2 Open governance in times of crisis: Theoretical implications and propositions

Scholars and practitioners have been working with the Open Government concept for several years. Despite the concept-inherent principles of open decision-making and public service delivery to external actors, the government as an “enabling” actor is still at the heart of these arrangements. For example, governments make data openly available or initiate e-participation processes. Recently, however, scholars have observed the increasing importance of non-state actors and community-led governance arrangements. Under the term “open governance”, they discuss new paradigms in which private actors implement norms, rules, and solutions with limited involvement of government organisations (Meijer, Lips & Chen, 2019; Park, Longo & Johnston, 2019; Linders 2012). While comprehensive concepts to explain these phenomena are scarce, Meijer, Lips and Chen (2019) provided a convincing approach suitable to contextualise the #WirVsVirus hackathon, which took place online and in (mass) interaction primarily between citizens.

Meijer, Lips and Chen (2019, p. 1) define OG arrangements as “new innovative forms of collective action aimed at solving complex public policy issues, contributing to public knowledge, or replacing traditional forms of public service provision”. The authors emphasize the pop-up character of large-scale, individualized collaboration enhanced by information and communication technologies. The state recedes into the background, providing a *platform* through which many citizens collaborate. Thus, platforms become an additional form of interaction, supplementing governance via hierarchy, market, or networks (Meijer, Lips & Chen, 2019, p. 8). According to Meijer, Lips and Chen (2019), one area of application for OG is crisis management. As an example, they refer to the self-organization of citizens to exchange information and goods via social media after natural disasters. These arrangements can support public institutions because they mobilize diverse, distributed information, expertise, and workforce in a short time.

According to Meijer, Lips and Chen (2019), OG formats share five central characteristics: (I) digital altruism, (II) radical openness, (III) crowdsourced deliberation, (IV)

citizen-centricity and (V) connected intelligence. The authors define (I) *digital altruism* as “engagement in the commons to create public value”. However, besides the willingness to engage, participation also requires access to decision-making processes. Thus, OG is based on the notion of radical openness. (II) *Radical openness* refers to radical accessibility of public data and the opening of the policy-making process to a large number of citizens, fostering collaboration that is diverse in terms of social background, equal and openly accessible (Meijer, Lips & Chen, 2019, p. 5). In the context of crisis management, digital altruism and radical openness would lead to participatory and inclusive processes. Hence, the following proposition can be formulated:

*P1: Open governance increases the input legitimacy of crisis management.*

OG may also contribute to the *analytical capacity* of governance, as it is an additional instrument to gather information. The information produced by OG may be used to identify new, previously unknown problems or hint to novel, innovative technologies and approaches to well-known problems. The expertise of diverse groups of citizens, acting as experts with different professional and social backgrounds (Meijer, Lips & Chen, 2019, p. 5) can lead to insights that are closer to the demands of citizens. Thus,

*P2: Open governance increases analytical capacities in crisis management.*

Radical openness entails the involvement of participants throughout the decision-making process. Meijer, Lips and Chen (2019, p. 7) emphasize the role of (III) *crowd-sourced deliberation*, i. e. participation that is diverse and equal within collaborations. Radical openness and crowdsourced deliberation may foster *throughput legitimacy*, which is connected to the transparency, inclusiveness, and openness of governance processes (Schmidt, 2013, p. 6). Hence,

*P3: Open governance increases the throughput legitimacy of crisis management.*

(IV) *Citizen-centricity* points to the importance of interactions and networks between citizens, rather than between citizens and governments. Instead, governments provide a platform through which citizens collaborate to solve problems and provide public services. The “government as a platform” connects information seekers with information holders (Meijer, Lips & Chen, 2019, p. 6).

(V) *Connected intelligence* refers to organizing collaboration between actors without organizational leadership. Instead, a platform connects intelligence to enable large-scale, linked, and distributed collaboration. Regarding *coordination capacity*, OG brings together a large number of disparate actors to engage in joint action, characterized by “the power of organizing without organizational leadership” (Meijer, Lips & Chen, 2019, p. 6). Moreover, OG is not affected by common limitations to coordination capacity, such as bureaucratic jurisdictions or decentralization (Lodge & Wegrich, 2014, p. 13), facilitating self-organization and may foster efficient collaboration. Thus,

*P4: Open governance increases coordination capacities in crisis management.*

Enabled by the diverse expertise of participants, OG may offer crisis-related solutions that complement the existing services of public sector organizations faster than public authorities can (Meijer, Lips & Chen, 2019, pp. 4 ff.). Hence,

*P5: Open governance increases delivery capacities in crisis management.*

Complexity in decision making increases due to the large number of actors involved and the strong emphasis on self-organization (Meijer, Lips & Chen, 2019, p. 6). Moreover, the common lack of formal agreements and contracts between OG arrangements and public sector organizations bears a risk: Public sector organizations responsible for public services cannot be held accountable when these services are produced in OG arrangements. This lack of formal agreements reinforces agency-problems, as public sector organizations might avoid taking the blame for public services they “received” from an OG arrangement. Thus,

*P6: Open governance decreases regulatory capacities in crisis management.*

Closely linked to *delivery capacity*, Meijer, Lips and Chen (2019, p. 7) assume solutions developed in open, transparent and participatory processes may help improve the legitimacy of public sector outcomes and decision-making, and encourage entrepreneurship. Hence,

*P7: Open governance increases the output legitimacy of crisis management.*

Meijer, Lips and Chen (2019) do not want OG to be understood as normatively desirable or as a recommendation. Rather, they argue OG is a theoretical framework for empirically observable phenomena and point to possible downsides of OG arrangements. Based on co-creation literature (Steen, Brandsen & Verschuere, 2018), they argue OG could be a smokescreen for minimising the responsibility and accountability of governments (Meijer, Lips & Chen, 2019, p. 8). Governments could neglect their obligation to provide public services by referring to the commitment of civil society. Moreover, if OG fails, it may not be clear who is responsible for the failure, and there is no guarantee that co-produced services can be provided continuously. OG may also tie up resources in the public sector, which can only be justified if the quality of services improves significantly. Furthermore, there is ample evidence that it is primarily citizens with superior social and cultural capital who dominate participation processes, which raises questions concerning the input-legitimacy of OG.

The #WirVsVirus hackathon reveals many characteristics of OG. The event was open to anyone interested and capable of using digital media to collaborate, enabling many citizens to participate in problem definition and solution-finding processes (radical openness). Although the hackathon took place under the auspices of the government, the organization and the development of solutions to crisis phenomena was citizen-centered and took place mostly without the participation of public organizations (citizen centricity). Instead, the government supported the platform, ideationally and financially, through which citizens could work together on solutions, usually without a clear hierarchy (connected intelligence). Citizens participated voluntarily and with the primary incentive of creating public value. Also, the organization of the hackathon was voluntary and partly took place in the organizers’ free time (digital altruism) (tech4Germany et al., 2020).

## 4 Case selection and methodology

We analyze the implementation of two projects that emerged from the #WirVsVirus Hackathon. To evaluate whether the hackathon as a specific case of digital OG con-



tributes to governance capacity and legitimacy in crisis management, we conducted interviews with project participants and their partners in public sector organizations. Moreover, we interviewed organizers of the hackathon. This approach allows us to evaluate the projects individually and complement these findings with assessments relating to the hackathon itself. Accordingly, the hackathon and the projects are treated as an interconnected construct that we analyze in conjunction. This approach is especially useful for the examination of governance legitimacy because judgements by media or citizens related to representativeness or transparency, will seldom be linked to individual projects, but to the hackathon as the superordinate event. Moreover, this approach allows us to relate evidence of the projects to evidence of interviews with the organizers to critically examine our findings from the projects.

The case selection for the projects is based on two criteria. First, we focus on projects included in the support program “Solution Builder” to ensure the projects entered the phase of implementation. Second, we selected projects that directly aimed to support crisis management in the public sector and implemented these solutions together with public sector organizations. This case selection reflects our understanding of crisis management as a governance challenge for public sector organizations. Accordingly, citizen participation through OG arrangements can adequately support but not replace governments in crisis management (Stark & Taylor, 2014, p. 301). Thus, our selected cases are not representative of projects of the #WirVsVirus Hackathon. Out of ten projects within the “Solution Builder”, we selected the two projects matching our criteria: (1) “U:DO”, which deals with the facilitation of the process for reduced working hours compensation in collaboration with the Federal Employment Agency (BA), and (2) “quarano”, a project providing a software for digital documentation of COVID-19 infection cases and contact persons for health authorities in collaboration with the health office of the city of Mannheim (hereinafter referred to as “health office”).

This study is designed as a theory-guided case study conducting “plausibility probes”, allowing us “to sharpen a hypothesis or theory, [...] or to explore the suitability of a particular case as a vehicle for testing a theory” (Levy, 2008, p. 6). We aim to sharpen the propositions presented earlier by examining the hackathon and its specific outputs as a case of OG in crisis management. The data was primarily obtained through nine semi-structured interviews that have been conducted during October and November 2020. The interview partners reflect three groups of people who participated in the hackathon and the implementation phase (see *Table 1*):

*Table 1:* Interviewees

Org1	Organizers of the hackathon
Org2	
Par1	Participants of the projects “U:DO” and “quarano”
Par2	
Par3	
Par4	
Gov1	Civil servants who collaborated with the projects during implementation
Gov2	
Gov3	Ministerial bureaucrat responsible for the federal financial support program

*Source:* Own illustration.

The selection of different groups of interviewees allows us to examine various aspects of OG arrangements related to governance capacity and legitimacy in crisis management; however, based on this evidence, output legitimacy cannot be assessed adequately. To assess output legitimacy, it would be appropriate to additionally interview citizens who have been using these services. We decided to exclude citizens using the services due to data access restrictions in the case of “quarano”. To ensure comparability between the two cases, we decided to exclude the user perspective and focus on assessments of project participants and public sector employees. Thus, our interpretations regarding output legitimacy could be prone to bias and should be regarded as partial insights.

The interview questionnaires were structured in two parts: The first part aimed to capture individual motivations, organizational processes, and the role of external administrative actors, reflecting the core characteristics of OG. The second part addressed the projects’ characteristics and features potentially affecting governance capacity and legitimacy in crisis management. In addition to the interviews, documents and websites were analyzed in desk research to ensure triangulation (Denzin, 2012). We focused on two types of evidence. First, we used information provided by the organizers of the hackathon to complement evidence from the interviews with further insights. For this purpose, we used the #WirVsVirus website and a handbook provided by the organizers (tech4Germany et al., 2020). Second, we conducted a systematic web research on media articles concerning the hackathon, as media coverage is an important aspect for legitimacy in crisis management (Quiring & Weber, 2012, p. 296)

## 5 Analysis

### 5.1 The #WirVsVirus-projects and governance capacity

#### *Coordination capacity*

With up to 30 people participating, both project teams analyzed were relatively small. The teams formed task groups with different focuses, such as content creation, software development, or public relations. During the implementation phase, each team met virtually in weekly team calls and discussed further steps. Both teams described these processes to be non-hierarchical (Par1-4). According to the project teams, internal collaboration worked efficiently and without bigger controversies, pointing to well-functioning mechanisms of self-organization. This non-hierarchical, collaborative approach ties in with the OG principle of connected intelligence (Meijer, Lips & Chen, 2019, pp. 6 f.).

A second aspect is linked to the collaboration between the project teams and public sector organizations. Due to continuous feedback loops and regular meetings, both the project teams and the staff of the public sector organizations described the collaboration process as generally well-functioning (Par1; Par2; Par4; Gov1; Gov2). The interviews also revealed barriers to effective collaboration. For instance, one team reported that it was problematic to communicate with their public sector partners because the organization was not allowed to use the same software (Par3).

The project teams developed solutions faster than public sector organizations would have been able to do. Two of the interview partners stated that the respective

public sector organization decided to implement the project because it was the quickest option to tackle an immediate problem (Par4; Gov1). Hence, the projects contributed to a short-term increase of coordination capacity, which has important implications for general findings on coordination capacity in crisis management because rapid adjustments to problems caused by crises are a pivotal problem for bureaucratic organizations (Ansell, Sørensen & Torfing, 2020, p. 4). The positive effects of the projects on coordination capacity in crisis management support proposition P4: Our evidence suggests OG arrangements may increase coordination capacities in crisis management by providing channels for self-organized and non-hierarchical collaboration focusing on the fast development of solutions.

### *Analytical capacity*

Regarding analytical capacity, the hackathon projects had some obvious positive effects. The various professional backgrounds of participants were an enormous source of expertise, which helped in identifying additional problems and challenges. The projects functioned as “idea generators” (Org2) for crisis-related challenges. Many #WirVsVirus projects were characterized by a problem-oriented approach that put governmental and societal challenges at the heart of the process and aimed to produce quick solutions (Org2; Gov3). These solutions were usually provisional but often led to an implementation process after the hackathon (Gov3). Our interviews revealed that these positive effects were dependent on project-specific factors. One condition is the level of experience and multidisciplinary of the actors involved. Both teams stated their teams were very experienced and multidisciplinary (Par1-4). Moreover, many team members had access to high-ranking governmental and non-governmental actors through private or professional contacts (Par2; Par4).

“U:DO” and “quarano” both reported that their solutions matched immediate needs of the public sector organizations (Par2; Par4). In the case of “U:DO”, the project provided a ready-to-use solution for citizens to apply for reduced-hours compensation at a time when the number of such requests peaked. The software for contact tracing developed by “quarano” came when the number of reported infections increased sharply. The health office decided to implement the software because it promised a fast solution to support contact tracing efficiently (Gov2). Both projects thus contributed to the analytical capacities of these two public sector organizations by introducing new solutions and providing expertise in software development.

These findings support P2: OG arrangements may have positive effects on analytical capacity; however, our results suggest that these effects are dependent on the composition of the project team and their access to public sector organizations as a collaborating partner.

### *Regulatory capacity*

Regarding regulatory capacity, we found public sector organizations partly avoided contracts or formal agreements with hackathon projects. In the case of “U:DO”, both the project team and the BA decided to avoid a formal relationship, allowing the project team to keep their specific approach, building on voluntary work in the team members’ leisure time (Par3; Par4). The BA abstained from integrating the project into their own complex organization because this would have been likely to slow down imple-

mentation (Par4). In the case of “quarano”, the two parties first collaborated informally and later formalized their relationship. According to one interviewee, this informal relationship was beneficial for project development because the project team “could just do their thing” (Gov2). Thus, the lack or postponement of formal agreements had advantages for the projects and the public sector organizations.

Some project interviewees assumed there would not be a long-term relationship between the projects and the respective public sector organizations (Par2-4). Our findings suggest problems related to regulatory capacity may be the reason for this assumption. According to one organizer, many public sector organizations avoid formal agreements with OG arrangements because they are difficult to implement in existing bureaucratic structures. Barriers could be legal considerations and limitations of existing software architectures (Org1). Moreover, issues of accountability seem to prohibit formal agreements for long-term relationships, as the consequences of potential errors or failures by OG arrangements for public sector organizations are unclear (Org1). Hence, the cooperation with OG arrangements in crisis management may be problematic for the regulatory capacities of public sector organizations (P6).

### *Delivery capacity*

Overall, the quality of the tools was perceived as positive by interviewees from public sector organizations. For example, all applications submitted to the BA via “U:DO” were free of mistakes and comprehensive (Gov1). For “quarano”, the data quality of contact tracking was described as high (Gov2). However, in both cases, the number of users was relatively low (Gov1; Gov2). An analysis of the BA concluded that about 15% of all applications could be generated by “U:DO” (Gov1), but at the time of the interviews, the number was significantly below this target (Par3; Par4). “Quarano” was helpful as a tool for tracking contacts but not a decisive factor for contact tracing management; the deployment of Bundeswehr (German military) soldiers to support civil servants was described as more important (Gov2).

Furthermore, the projects had problems with scaling their solutions and acquiring new partners. Many authorities did not see the necessity or advantages of implementing a digital solution (Par1; Par2). Two participants suspected that health authorities waited for instructions from higher levels of government to avoid the risk of being held responsible for dysfunctional solutions (Par1; Par2). This finding ties in with research concerning agency problems (Lodge & Wegrich, 2014, p. 12), suggesting public sector organizations might avoid taking the blame for public services they did not develop themselves. Another reason for the lack of diffusion of the solutions is that simultaneously developed software from other actors stand in competition to those of the hackathon, e. g. the contact tracing management software “SORMAS” in the case of “quarano” (Par1).

Another factor limiting the impact of the OG arrangements on delivery capacity was the lack of a guarantee that software solutions would be maintained long-term (Par1). This concern was confirmed by several interviewees. The sustainability of the services is threatened because participants lose interest or motivation (Par2; Par3). In the case of continuous cooperation between government and civil society, actors often react with *partnership fatigue* (Huxham & Vangen, 2013), resulting in a short life-span of social innovations. This would be problematic because the quality of public services might decrease over time.

Overall, the project teams managed to develop functional solutions to problems caused by the COVID-19 pandemic. However, the solutions are hardly scalable nor sustainable due to characteristics of the public sector and decreasing motivation by project participants. Thus, the impact of OG arrangements on delivery capacity in crisis management is limited, contradicting our assumption (see P5). Our evidence suggests it is more appropriate to presume short-term positive effects of OG arrangements on delivery capacity, but no sustainable long-term contributions.

## 5.2 The #WirVsVirus projects and governance legitimacy

### *Input legitimacy*

Most hackathon participants we interviewed participated because of the feeling of helplessness in the face of a threatening situation. The hackathon gave them a feeling of self-efficacy (Org1; Par1; Par3; Par4), pointing to digital altruism, described by Meijer, Lips and Chen (2019, pp. 6 f.). This direct involvement of citizens sharing a collective feeling of contributing to a common good contributes to the input legitimacy of crisis-related solutions.

The interviewees stated that their teams consisted mostly of experts from the fields of IT, software development, communication, and management consulting. Thus, the team composition was similar to start-ups; only few participants were in other professions, e. g. medics or lawyers (Org1; Par1-4; Gov1; Gov2). Many participants were highly qualified experts, supporting evidence suggesting that citizens with high levels of social and cultural capital dominate participation processes (van Eijk & Steen, 2014). Given the high level of cognitive resources and expertise required, this finding is hardly surprising. Jennifer Dodge (2013) argues that public organizations tend to demand high standards of expertise and technical knowledge for participation. However, this composition of participants harms the representativeness and the democratic character of such formats, reinforcing existing inequalities and strengthening privileges (Steen, Brandsen & Verschuere, 2018, pp. 287 f.).

In this context, the hackathons' organizers have been accused of a lack of diversity in terms of their jury members. For example, participants in a hackathon project that addressed (Covid-specific) anti-Asian racism criticized that the jury for the funding programs consisted almost exclusively of white people (Stuetz & Kure-Wu, 2020). This lack of diversity is crucial from a democratic viewpoint, since although problem and solution formulation was potentially accessible to many people, ultimately only jury members appointed by the organizers decided on the projects funded, thus favoring their perspective over the perspectives of participants (for an in-depth discussion on this issue see Berg, Clute-Simon, Freudl, Rakowski & Thiel, 2021). Furthermore there were biases regarding the gender and age of the hackathon participants. According to the organizers, 61% of the participants were men; 20.3% of participants were under the age of 25; and 23.3 % were over 45 years old (tech4Germany et al., 2020). Thus, young people were strongly overrepresented and older people underrepresented. Hence, the increase of input legitimacy through OG arrangements developed at the hackathon appears to be limited due to the overrepresentation of citizens with superior social and cultural capital and the lack of diversity in terms of jury members and participants' demographics, suggesting proposition P1 should be reformulated: OG does not

necessarily increase the input legitimacy of crisis management due to a lack of representativeness of participants.

### *Throughput legitimacy*

Indicators for assessing the throughput legitimacy of governance are the openness of the process, accountability, and transparency (Schmidt, 2013). Regarding openness, the collaboration between the projects “U:DO” and “quarano” and public authorities was made possible because of the legitimacy gained through the German government’s patronage of the hackathon and the prestige gained through the “Solution Builder” support program (Org1; Par1; Par2; Gov1; Gov3). Apart from that, two participants stated their professional contacts facilitated access to decision makers in public sector organizations (Par3; Par4; Gov1). Thus, access to decision makers may be easier with access to pre-existing private and professional networks. Regarding the process itself, both teams conducted regular meetings with staff from the respective public sector organizations (Par1-4; Gov1; Gov2). The civil servants responsible confirmed that the work was carried out in an uncomplicated and professional manner (Gov1; Gov2). The collaboration was described as “unusually [...] agile for the public sector” (Gov2; Par3; Par4), but also as “very persistent” or “exhausting” (Par1; Par2).

The collaboration between “U:DO” and the BA was not contractual. This type of project cannot be held accountable in the event of potential failure. The provision of public services that cannot be sanctioned escapes public scrutiny and raises questions about legitimacy (Huxham & Vangen, 2013). In the absence of contractual commitment, collaboration and decision-making processes are not transparent to the public, which decreases the throughput legitimacy of crisis management.

Overall, the results show that, while access to public sector organizations is often limited, collaborations are equal, open, and relatively flexible. However, collaborations not contractually normed may escape certain public control mechanisms and raise questions about legitimacy (P3).

### *Output legitimacy*

Our understanding of output legitimacy entails two aspects: first, the effectiveness of policies, means and measures, and, second, citizens’ perceptions of it. Regarding the first aspect, we pointed out that, although the solutions provided by the projects examined can help citizens and public sector organizations cope with crisis-related phenomena, they have a relatively small impact on problem solving and are poorly scalable.

Due to the design of this study, we cannot make concluding statements regarding the second aspect, i. e. about how citizens evaluate the projects “U:DO” and “quarano” and their results; however, participants stated that they received positive feedback from users of their tools and its functionalities and overall helpfulness (Par1-4). While this evidence is not sufficient to determine the output legitimacy of these two projects, it can be regarded as a starting point for further studies incorporating a user perspective.

The organizers assessed the results of the whole hackathon as “above average” (Org1), especially since hackathons generally do not deliver viable solutions (Kamariotou & Kitsios, 2018). Instead, hackathons serve to initiate and maintain professional networks. The organizers stated that, according to an accompanying survey, the participants’ trust in the federal government had increased after the hackathon (Org2). Be-

sides, many respondents assume positive effects on the external perception of the German Federal Government (Org1; Org2). In addition to the critical press coverage already mentioned, several favorable reports about the hackathon were published in online media, newspapers, and television, which may have had a (limited) positive impact on the perception of the federal government's crisis management (e.g. Frankfurter Allgemeine Zeitung, 2020; Deutsche Welle, 2020). Overall, there were relatively small but presumably positive effects on the output legitimacy of crisis management (P7).

## 6 Conclusion

This article discussed how OG arrangements may contribute to governance capacity and legitimacy in crisis management. We presented the case of the #WirVsVirus hackathon as a prime example reflecting the core elements of the OG paradigm, as described by Meijer, Lips and Chen (2019). Based on a qualitative case study design, we analyzed two projects developed during the #WirVsVirus hackathon.

Our analysis suggests that OG arrangements can contribute to governance capacity and legitimacy in crisis management in several ways: First, OG arrangements allow for effective collaboration in a team and with public sector partners, increasing the coordination capacity in crisis management. Second, OG arrangements provide an additional channel for identifying and solving crisis-related problems and support public sector organizations, thereby increasing the analytical capacity in crisis management. Third, OG arrangements are capable of quickly developing solutions to problems and thereby support governments' delivery capacity in crisis management. Fourth, by providing channels for equal and open collaboration between many citizens, OG arrangements can contribute to the input and throughput legitimacy of crisis management.

Our analysis also reveals problems and challenges linked to the use of OG arrangements in crisis management, which are connected to their characteristics and features. In the cases analyzed here, public sector organizations avoided formal contracts with OG arrangements due to legal, organizational, and technical uncertainties and connected fears that long-term relationships may have negative effects on their regulatory capacities. It seems that, often, characteristics and logics of public sector organizations are too different from those of OG arrangements and thus hinder the diffusion of solutions developed by OG arrangements. We found that solutions developed by OG arrangements are hardly scalable, and because teams lose motivation over time, solutions are not sustainable. This limits potential positive effects on delivery capacity. Lastly, we found that effects of OG arrangements on input legitimacy are mixed because people with high social and cultural capital are overrepresented in such arrangements.

The #WirVsVirus hackathon reflects the hallmarks of open governance, namely digital altruism, (radical) openness, crowdsourced deliberation, citizen-centeredness, and networked intelligence. Nevertheless, the OG arrangements studied have mixed implications for crisis management. Similarly, Meijer, Lips and Chen (2019) point out that OG arrangements do not have solely positive effects on governance in times of crisis. In this context, we emphasize the importance of a critical view on open governance features. Moreover, the hackathon must be assessed against the background of the uniqueness of the COVID-19 pandemic: It cannot be assumed that other, less severe crises could mobilize a similar number of citizens with similar expertise.

Finally, the limitations of this study should be acknowledged and the avenues for further research indicated. *First*, our case selection reflects a small fraction of the large number of projects developed during the #WirVsVirus hackathon. Thus, this article does not provide general findings on effects of the hackathon. *Second*, our findings on governance legitimacy do not reflect the whole spectrum of this concept. Due to our research design, we neglected the perceptions of citizens. We argue that this limitation is less problematic for the assessment of input and throughput legitimacy but a restriction for our findings on output legitimacy because our evidence conveys a partial image that may be prone to bias. *Third*, our article does not represent a final evaluation of the projects' effects on crisis management. While the projects themselves are mostly completed, their services are still being used. We identify two main strands for further research: First, the #WirVsVirus hackathon and its projects should be analyzed more intensively, since there are multiple aspects which we did not discuss in this article. Second, more insights on the use of OG arrangements in crisis management are needed to elaborate on the advantages and disadvantages of such approaches in times of crisis.

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