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Risk social contracts: Exploring responsibilities through the lens of citizens affected by flooding in Germany in 2021

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ABSTRACT

Citizen priorities, needs, and rights have been moving to the centre of 'good' risk management and governance in theory, but what is their role in practice? The disastrous impacts of the flooding event across western Europe in 2021 highlighted many gaps and challenges in flood risk governance (FRG) structures in Germany. To better understand these, this study explored responsibilities as perceived by citizens and compares these with legal-institutional social contracts. These perceptions of citizens were captured in an online survey in the affected regions. The results indicate that German FRG remains a predominantly top-down system with citizens being dependent on the functioning of the risk and emergency system. The results of the survey highlight the need for: 1) clarifying and co-defining roles and responsibilities in FRG and making them more transparent; 2) enhancing citizen active involvement in governance and deliberating interactions; 3) rebuilding trust; and 4) creating joint responsibilities between citizens and local authorities. Based on the findings of the study, it became apparent that research on citizen centred FRG is steps ahead of policy and practice. To enhance policy and practice, recommendations were developed to foster collaboration between citizens and local authorities to strengthen local FRG.

1. Introduction

The importance of citizen involvement in flood risk management and governance has been emphasised globally throughout the past decades, mirroring a broader localisation agenda within the resilience discourse. This shift away from a solely top-down management is supported by research [1], global policies (i.e., Sendai Framework (2015)), and at European level (EU Floods Directive 2007/60/EC), but also emerged as a lesson learnt from flooding events [2,3]. People or human-centred approaches to flood risk governance aim at complementing the top-down approach with a bottom-up initiative, moving towards decentralisation and sharing responsibilities [1,4].

In Germany, flood risk governance – the distribution of roles and responsibilities - is rooted in a top-down system which is increasingly decentralised, with responsibilities allocated to the federal states and municipalities [5]. The responsibilities of citizens, meanwhile, lie predominantly in the protection and flood damage prevention of their own private property. The law generally positions German citizens as receivers, without space for local agency or voice in active decision-making for flood risk management. The disastrous flooding event in Germany in July 2021 highlighted an underlying dependency of the general public on the 'emergency system', and also demonstrated the 'expectations of the public for a perfect system' [6]. Building upon these findings, this paper aims to gain a deeper understanding on the distribution of responsibilities as citizens perceive how they are.

From a policy perspective, the empowerment of citizens and communities through increasing engagement and responsibilities was already set as one of the principles of the Sendai Framework to build resilience and reduce disaster risk. In theory, the decentralisation in flood risk governance can foster the active involvement of the general public [7–9] which can widen citizens' risk knowledge and have positive impacts on their own resilience (and vice versa) [3]. Active involvement refers to public participation going beyond traditional consultations by, for instance, encouraging engagement in local actions (e.g., implementing flood mitigation measures), contributions in planning as well as in discussions around local problems and solutions [10]. The

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involvement of citizens is of immense value for understanding local needs [11], reducing potentially clashing expectations [7], and empowering citizens [6]. On the other hand, the willingness of citizens to get involved in governance may be limited due to the fact that citizens may not wish to gain more responsibilities that need to be realised and fulfilled [5], and there are a range of power dynamics and contextual social, political, economic, and other factors that either lower or enhance the participation of particular groups over others [12]. Hence, further research is required on the extent to which German citizens feel willing and able to participate in flood governance, within their legislated role in current flood risk legal-institutional frameworks.

At present, German legislation does not explicitly facilitate a multi-directional interaction between citizens and local authorities, although recent policy developments are moving in this direction: the freshly drafted climate adaptation law at federal level (Bundes-Klimaanpassungsgesetz (KAnG) (draft version of August 2023)) does not ascribe any obligations to citizens but supports the engagement of the general public in the setting of local goals and selecting measures to achieve these. Similarly, the federal resilience strategy (Deutsche Strategie zur Stärkung der Resilienz gegenüber Katastrophen (2022)) - the national adoption of the Sendai Framework - enhances the joint action which refers to multi-level and multi-sectoral dialogues and collaboration also including representative groups of the civil society. However, the engagement recommendations remain, in both, at a superficial level without concrete or practical application guidance.

In accordance with the motivation of the resilience strategy learning from past and on-going disasters to identify needs and ways forward to increase the resilience in Germany, this study aimed to explore flood risk governance during the 2021 flooding from the lens of citizens because previous studies indicated a great dependence of citizen on authorities [6]. Therefore, this study strived to explore flood risk management responsibilities as perceived and understood by citizens to identify potential gaps between 1) their perception of responsibilities in flood risk management and 2) the roles or responsibilities assigned to different actors via the legal-institutional discourse and policy instruments. Furthermore, it explores local willingness and felt agency to participate in flood management, and whether this correlates to gaps in expected responsibilities.

For this purpose, this paper draws on 'social contracts' [13] as a conceptual framework to explore the relations of trust and expectation between citizens and flood risk governance actors. The paper responds to calls for an expanded evidence base of how these *risk social contracts* are shaped by and operate within particular risk governance structures. To this end, an online survey was disseminated to capture citizens' understanding and expectations of responsibilities in risk governance as well as interactions between different actors. This study does not seek to allocate blame for the disastrous event, but rather aims to identify gaps in perceived or expected responsibility and understand how these arise, and hence to derive ways forward from the flooding experiences in 2021. To achieve this goal, themes around governance raised by citizens were distilled, analysed, and transformed into recommendations to support policy design and strengthen local risk governance in practice.

The paper opens with the conceptualisation of flood risk governance and connected theories in Section 2. Section 3 introduces the case study in Germany and the online survey, while Section 4 presents the results of the thematic analysis which are discussed in Section 5. Based on the discussion, Section 5.1 and 5.2 highlight key contributions and develop recommendations for policy and practice, respectively. Section 6 summarises the main outcomes of this study.

2. Flood risk governance

In this paper, the term flood risk governance (FRG) refers to the division and allocation of roles and responsibilities in flood risk management, and to the landscape of regulations and resources within which flood events are managed [14]. Governance encompasses decision and policy-making processes around flood risk management (FRM) [15], and aims 'to ensure the implementation of flood risk management strategies [through] a good organization' [16] while assuring 'accountability, participation, predictability and transparency' [17].

2.1. Decentralisation of responsibilities

Mainstream discourse on 'good' governance has encouraged the decentralisation of FRM roles and responsibilities to multiple public and private actors [1,4] and idealises a 'non-hierarchical form of decision-making' [18]. In contrast to earlier times when flooding was manged by a single entity [4], the decentralisation of FRG is now considered an important strategy of good governance due to the increased efficiency and democratic accountability it attempts to foster (i.e., decentralisation enhances knowledge sharing, cost reductions, the distribution of benefits, attuning to local contexts) [19,20]. However, the organisation among multiple levels can hamper the success of FRG if roles and responsibilities are not clearly assigned, rules are not set, resources or channels for accountability are lacking [5,14,20–22].

With the concept of shared responsibilities, citizens are gaining more responsibilities which commonly starts with redirecting the responsibility of protecting properties and houses to their owners [23] which was also the case in Germany. Despite this ascribed responsibility, the number of people taking up this responsibility remains low due to the cost burden, lacking knowledge, awareness, support, or the realisation of own responsibilities [6,23–25]. As a result, whilst there is provision in the German FRM for decentralised activity, citizens largely remain dependent on the guidance of authorities [6].

In contrast to the concept of shared responsibility, the concept of collective governance aims not at reallocating responsibilities but rather at establishing 'a governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process […] to make or implement public policy or manage public programs or assets' [26]. The concept is primarily building on social capital (i.e., on trust, common understanding, legitimacy, and the motivation for dialogue and commitment) [26,27].

2.2. Relationships in flood risk governance

By date, the growing responsibilities of citizens in FRG have already been reshaping the interactions between authorities and the public which can be categorised in [9]: 1) hierarchical interactions (top-down), 2) incentivised (bottom-up), or 3) deliberative (balanced). In contrast to traditional top-down interactions, bottom-up approaches have been proven to be more efficient, at least in situations where authorities are taking a guiding role [28]. Deliberative interactions aim to achieve 'multi-directional communication' [9] which entails the challenge of finding the "right' balance between bottom-up and top-down governance' [22]. Community-based initiatives such as flood action groups have been valuable in the process of balancing top-down and bottom-up interactions while also seeking to foster horizontal support [29,30]. They function as a mediator between citizens and local authorities whereas their actual engagement can be of different types i.e., contractual or cooperative [31].

Interactions between different actors rely on relations of trust which is an omnipresent value but is also fragile and can become a barrier to action. Trust builds on the perceived confidence in an institution, and an assurance in its intention, and abilities [32]. This perceived trust includes the expectations towards institutions [33]. However, trust is very dynamic and can change in response to different experiences [34]. For instance, past flooding experiences may impact local perception of the abilities of institutions and/or confidence in those abilities. If the expectations of citizens towards them are not met, trust may diminish and perceived social contracts may evolve [34,35]. The trust of citizens in authorities is of high importance, especially, in times of uncertainty or lack of personal knowledge or experience which necessitates citizens to

trust in FRG actors [36]. Diminishing trust can cause long-term challenges for citizen-authority relationships [37]. Whereas close and long-term relationships (e.g., through accountability, participation, transparency) tend to increase mutual trust [34,38], and help resolving existing tensions [36]. In turn, trust can foster the willingness of citizens to contribute to take and realise own responsibilities [36,39].

2.3. Social contracts

Social contracts manifest (in written or unwritten form) the roles and responsibilities of actors in alignment of the societies' goals e.g., for FRM. In this regard, it is increasingly recognised that social contracts are socially-politically constructed and therefore, are subjective, place and time-specific [40,41]. In the context of disaster risk reduction and climate change adaptation, three co-existing forms were defined [13]:

- *the legal-institutional*: describes the distribution of roles and responsibilities which are allocated in formal legislation and institutional frameworks;
- *the imagined*: how different actors' respective roles and responsibilities are perceived to be distributed which can refer to an imaginary of the status quo as it stands (i.e. how I understand things work), and an imaginary of how things should be (i.e. how I wish things would work);
- *the practiced*: this contract describes how FRM is actually executed, in terms of the embodied, performed actions, roles and responsibilities that are assumed by a particular actor/stakeholder.

In reality, all three forms can be differentiated or subjectively experienced/defined; for instance, 1) different institutions may assume a different distribution of responsibilities; 2) imagined social contracts are sensitive to socio-cultural, political, economic and other factors that shape lived everyday experience and subjective worldviews; and 3) practiced social contracts also are sensitive to dynamic and differentiated social relations that mean certain groups may perform certain roles/functions in certain situations, but not in others. It is important to understand to what extent these contracts are aligned with another (or not) because distance between imagined, practiced, and legal-institutional social contacts may indicate a mismatch between expectation and delivery (in terms of flood risk security), and/or responsibilities being differently understood between actors [42]. Such gaps are likely to impact negatively on trust and legitimacy of risk governance activities. Aiming for an inclusive co-governance of FRM, policy and practices can ensure the alignment between multiple or competing social contracts, and hence, between perceived and binding responsibilities [43,44].

With the aim of this study to explore responsibilities as perceived by citizens and to identify potential gaps between their perception and the legal-institutionalised responsibilities, the analysis will use the lens of the imagined and legal-institutional social contracts. Comparing these social contracts could also provide insights into how the legal and institutional framework influence the way people think about flood risk governance. Practiced social contracts are beyond the scope of the present study, although the lived, 'de facto' experience of flood risk management practices are recognised as important in the formulation and reformulation of risk social contracts.

3. Methodology

3.1. Case study: Flooding in Germany in 2021

3.1.1. The flooding event and its impacts

Flooding occurred in many areas across western Europe during July 2021. In Germany, the federal states North Rhine-Westphalia and Rhineland Palatinate were primarily affected by the low-pressure system 'Bernd', which stagnated over the area and neighbouring countries. The heavy precipitation followed a long wet early summer [45]. This severe precipitation led to fluvial and pluvial flooding in hilly areas and areas with saturated soils or high groundwater tables. Inundation was additionally linked to water reservoirs that are regulated by a dam [46,47].

The impact of the event was severe, in many places taking the lives of more than 180 people, while three times more were injured, and many more were displaced [47,48]. Despite a long history of flooding in Germany, this event in 2021 highlighted several remaining issues regarding flood risk management and governance in Germany, including in the following areas: 1) risk mapping and the need for impact-based forecasts [49]; 2) early warning and risk communication [6,47,50]; 3) the need for strengthening multi-level and multi-disciplinary collaboration [51,52]; 4) the development and practice of emergency plans and trainings [50]; and 5) the adequacy of relief and recovery support [50,53].

3.1.2. Risk governance in Germany

Flood risk governance in Germany has a decentralised structure, although decision-making remains largely top-down whereby the federal level provides general guidance and standards (aligned to the EU Floods Directive (2007)), the states are responsible for fluvial and coastal flood risk management, and the districts or municipalities manage pluvial flooding. The fact that the states are primarily responsible for fluvial flood risk management, a federal framework for flooding is not given and thus, leads to differences in management across different states [54]. In the following sections, the legal and institutional frameworks in Germany will be explored in more detail, providing an overview of the legal-institutional social contracts for FRG.

Legislative framework: Past major flooding events have shaped the legislative framework of the country. The main legislation is the Federal Water Act (Wasserhaushaltsgesetz (WHG)) which came into force in 1960 and provides guidance on the risk assessment, building regulations, and management of flood protection. The EU Floods Directive (2007) was adopted and integrated into the Federal Water Act in 2009 and further translated into state level legislation. With the addition of the first and second Omnibus Flood Control Act (2005 & 2017), flooding is supposed to be managed at catchment scale. The two acts were developed and integrated into existing water, building, and nature protection legislation. They aim for preventive flood management to reduce the impact of flooding. Following the flooding event in 2021, the Federal Government's Strategy for Strengthening Resilience to Disasters (2022) was published which represents the national implementation of the Sendai Framework (2015). In the context of climate change adaptation, the federal state North Rhine-Westphalia became a pioneer in the climate adaptation law which entered into force just a few days before the flooding event. The state-level law (Klimaanpassungsgesetz Nordrhein-Westfalen (KlAnG)) addresses inter alia the need for multi-sectoral collaboration and the engagement of citizens. By date, a draft law was developed for at federal level (Bundes-Klimaanpassungsgesetzes (KAnG)) focusing on enhancing adaptation at the municipality level, for instance, through the development of climate adaptation concepts. The law is planned to come into force towards the end of 2024. The civil protection and disaster management of the Federation (Zivilschutz- und Katastrophenhilfegesetz (ZSKG)) from 1997 describes the legislation around the protection of citizens in case of conflicts or disasters (e.g., warning of citizens).

Institutional framework: The responsibilities around flood risk management are decentralised: the German Meteorological Service (Deutscher Wetter Dienst (DWD)), which belongs to the Federal Ministry for Digital and Transport, is inter alia responsible for forecasting weather and issuing warnings according to the DWD Act. The Federal Office of Civil Protection and Disaster Assistance (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (BBK)) acts as a support to the states e.g., for issuing warnings (according to the ZSKG) and is hosting the national Modular Warning System (MoWaS). The 16 federal states are primarily responsible for issuing warnings to local authorities

(according to the ZSKG) and also offering flood information portals including i.e., risk maps and policies. Water authorities at state and at local level are primarily responsible for flood risk reduction measures [3]. While wastewater managers or companies at local level are always important actors in context of the management and maintenance of water infrastructures [50]. Local authorities themselves are the ones who are warning the public, coordinating preparedness, response, and evacuation actions [47]. Whereas fire brigades are usually the actor who coordinates the flood preparedness and response (supervised by local authorities [3]. Germany encompasses a large repository of volunteers in professional organisations i.e., Technisches Hilfswerk (THW) which counts as a primary actor in flood response [3,55]. The Bundeswehr supports response and rescue operations with their soldiers, reserve forces, and especially their equipment i.e., mobile bridges, or helicopters [56]. Communities can be involved in local decisions and action such as landscape planning and volunteered response during disasters [3]. Spontaneous volunteers are often involved in relief operations, but their inclusion in professional response and rescue operations is often facing challenges [55]. Affected citizens are, according to the WHG, responsible for the protection of their property (e.g., through the implementation of protections measures).

Risk financing: The federal government has previously provided funding for flood affected citizens to aid flood recovery, for instance, after the flood in 2013, 60% of the citizens received recovery aid funds [2]. This was (partly) terminated because now, citizens are responsible for their home and property by law [5]. As citizens are legally obliged to protect their properties and the government is not bound to provide flood recovery funding, citizens have less options but to consider insurance and the implementation of protective measures. Natural hazard insurance of houses in Germany follows a voluntary model although discussions are on-going to integrate a mandatory system. The number of insured houses has risen to 50% over the past two decades [57]. Citizens' willingness-to-pay for flood mitigation measures remains rather low with 50 Euros [24].

3.2. Online survey

An online survey was conducted targeting a wider spatial area. In contrast to other studies on this flooding event [47,58], this survey is developed primarily using open questions allowing citizens to express themselves, their experiences, and opinions - in other words, to give them a voice. The questions aimed at gaining an understanding of the citizens' perspectives on the flood event in the context of early warning, preparedness, and response, but also their opinion on arisen issues and possible solutions for the future as well as their idea on the division of responsibilities.

The survey was designed as an online survey in two languages (German and English) and was disseminated via social media channels such Facebook, LinkedIn, and Twitter but also through personal channels such as WhatsApp. In fact, Facebook groups a major channel during the dissemination due to a great number of responses from flood groups founded by citizens to coordinate the response and recovery. The survey was open for responses from participants (at the age of 18 years and older) between March and July 2022.

3.2.1. Responses

In total, the online survey reached 438 responses (German: 434; English: 4). Respondents represent all possible age groups that were invited to participate in the survey. The representativeness of the age groups compared to the German national demographic structures [59] indicates that the age group 25–54 is slightly overrepresented while the citizens at the age of 65 and older are slightly underrepresented. This is an expected limitation of the social media dissemination approach. The majority of the respondents (60.5%) were living in their own house at the time of the flood and 22.4% were living in a rental apartment. Other respondents were living in a rental house (6.6%), in their own apartment (4.3%), and 3.2% at their parent's or guardian's home. Geographically, 87.7% of the citizens were living in North Rhine-Westphalia and 11.6% in Rhineland-Palatinate covering in total 25 districts.

3.2.2. Data analysis

Pre-processing of the survey data included the translation of English responses into German and the correction of postcodes where needed. As a second step, municipality, district, and state names were added based on the post codes.

Closed questions were analysed using descriptive statistics while for the analysis of open questions, thematic analysis [60] was applied which allows the detection and contextualisation of patterns within the responses. The analysis was performed in four steps: 1) first familiarisation with the responses; 2) initial coding of the responses using NVivo (release 1.7.1) and Microsoft Excel; 3) themes were derived from the codes which were compared and related with another; and 5) these themes were reshuffled and merged to more overarching themes linked to risk governance and discussed with existing literature in the following Section 4.

4. Results

Two main themes emerged from the thematic analysis: 1) who flood-affected communities perceive as responsible for various tasks in FRG, which are compared to legal-institutional perspectives by adopting the framework of social contracts (Section 4.1); and 2) the willingness and eagerness of citizens to take action and to be more involved in local FRG (Section 4.2).

4.1. Social contracts

The imagined social contracts from the perspective of citizens showed similar visions throughout the surveyed areas. The analysis identifies the responsibilities that citizens ascribe to themselves and those they project onto authorities. Even though flood risk governance varies slightly across the municipalities and districts, most participants perceived common distributions of responsibilities of flood risk management actors.

4.1.1. Citizens' responsibilities

Many citizens see themselves as responsible for their property and to prepare it for potential hazards as well as responding to those. This perception corresponds to the legal-institutional social contract manifested in the German Federal Water Act (WHG § 5) stating that citizens are responsible for their private household and are ‘obliged to undertake appropriate actions that are reasonable and within one's means to reduce flood impacts and damage’ [25]. Moreover, this indicates that many citizens have expanded their responsibility which may be also tracible to the fact that the federal government is not obliged to provide disaster recovery funding. Nonetheless, only a few citizens stated that they have been implementing flood protection measures in advance or during the recovery phase, while a larger share of citizens mentioned that they did not implement any (before nor after the event) due to higher costs which is in line with earlier studies [24].

‘… ist eine Frage der Kosten.’
(In English: ‘… is a question of costs.’)

Just before and during the flooding event, many citizens took the responsibility of protecting their homes with short-term emergency measures i.e., saving valuable things by moving them upstairs, installing pumps, or responding to the water entering their home. Despite this legal obligation, some citizens mentioned that they did ‘nichts’ (in English: ‘nothing’). This inaction was reasoned by 1) the lack of or late warning left citizens no time to prepare for the approaching event and to protect their home; 2) some people did not know about how to behave or

to act which may be linked to the lack of guidance or hazard/risk knowledge, limited hazard imagination, or no prior experience of flooding; or 3) they felt powerless.

Recovery funds were offered to home and business owners, but the process was mentioned to be bureaucratic and time intense.

> *'Bürokratieabbau. Der Antrag auf Fluthilfe brauchte 4 Monate Bearbeitungszeit. Zum Schluss waren es 120 Seiten für 49.000€.'*
> *(In English: 'Reducing bureaucracy. The application for flood relief took 4 months to process. In the end it was 120 pages for €49,000.')*

Partly, even one year after the flooding, funding requests were not processed yet. The process and the long waiting time were expressed using language of frustration and partly showed notions of distrust in the system.

Additionally perceived responsibilities of citizens that were mentioned in the survey, but are not written in any law were the following:

- Observing the surrounding natural systems in order to detect changes that can turn into hazards. While the actual share of citizens who reported that they have been observing and being attentive to changes in their environment has been rather low.
- Being alert to warnings and being proactive in seeking information as well as taking warnings seriously.
- Raising awareness and learning about potential risks and risk areas. While the responses also showed that the awareness of risk areas was very low with close to 50% who stated that they were not aware of risk areas in their neighbourhood.
- Being part of the community by warning and helping others before, during, and after hazardous events as well as helping and educating each other on these topics.

> *'[…] ich stand bis zur Brust im Wasser um Leute da raus zu holen. Das würde ich wieder tun.' (In English: 'I stood up to my chest in water to get people out of there. I would do that again.')*

This social connectedness can be seen as inherent value of the population which saved many lives but also risked lives during the flooding event.

4.1.2. Authorities' responsibilities

Besides the responsibilities citizens indicated for themselves, they perceive that most responsibilities are in the hands of the authorities at municipality, state, and federal level. Despite the general view on roles and responsibilities (as outlined in Table 1), it became appeared that they are not clearly defined in many areas: it was often directly stated that it is necessary to clarify responsibilities ('Verantworlichkeit klären'). In addition, citizens used the phrase 'responsible person/institution' (German: Verantwortlicher/−en) or just 'they' which underlines the fact that it is unclear to them who the responsible person/party is.

Principally, citizens expect authorities to guide and support them through all disaster risk management phases. These perceived responsibilities of authorities are summarised in the following Table 1 and compared to legal-institutional manifested responsibilities.

Comparing the perceived responsibilities of citizens against the legal-institutional social contracts in Table 1, it was found that multiple perceived responsibilities are reflecting what is written in laws, while other areas of responsibility are not clearly defined in either. Those that are not clearly defined include:

- Citizens expect that risk awareness campaigns/communication falls to local authorities, and that authorities should motivate citizens to prepare for potential hazards. Respondents did not acknowledge that effective risk communication requires citizens to accept or be open-minded to these awareness raising actions.

Table 1
Imagined social contracts from the perspective of survey respondents, compared to legal-institutional social contracts.

Risk Management Phase	Imagined responsibilities of authorities (as perceived by citizens)	Legal-institutional responsibilities
Awareness raising	• raising awareness on potential risks (e.g., in schools) • coordination and enhancement of self-preparedness motivation of the population	Law about the civil protection and disaster management of the Federation (ZSKG) § 5 (1): the municipalities are responsible for developing, promoting and directing the self-protection of the population […] and companies against the particular dangers that threaten in the event of a defence.
Preparedness	• preparing disaster plans and practicing these	Laws at federal level (e.g. in NRW the BHKG § 3 (3)): with the participation of their fire brigade, the municipalities have to draw up and implement fire protection requirement plans and plans for the deployment of the public fire brigade; § 4 (3): the districts have to draw up plans for large-scale operations and disasters (disaster control plans); § 5 (1): the district governments draw up alarm and deployment plans for the nationwide coordinated aid in consultation with the authorities. The Federal Office of Civil Protection and Disaster Assistance (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (BBK)) offers guidance on individual/household emergency plan development.
Collaboration	• strengthening collaborations between different institutions	Hierarchical support from the government to the federal states to the districts and they support the municipalities (e.g., ZSKG § 18). The German Joint Information and Situation Centre (Gemeinsames Melde- und Lagezentrum (GMLZ)) supports the information sharing between the national and state level.
Risk reduction and mitigation	• designing and deploying risk reduction and climate change adaptation measures • maintaining existing water infrastructures • introducing stricter building regulations in retention areas	Water authorities at state and at local level are primarily responsible for flood risk reduction measures. Communities can be involved in local decisions and action such as landscape planning [3]. Wastewater managers or companies at local level are important actors in context of the management and maintenance of water infrastructures at all times [50]. According to the Federal Water Act (WHG) and the laws at federal level, inundation areas are protected from the construction of new buildings or extensions. (Exceptions may be discussed with the consent of the municipality.)
Early warning	• adequately warn the population on potential	The Modular Warning System (MoWaS) which was

(*continued on next page*)

Table 1 (*continued*)

Risk Management Phase	Imagined responsibilities of authorities (as perceived by citizens)	Legal-institutional responsibilities
	risks and hazards, especially, at local scale considering potential power outages and the elderly • clear and transparent communication • evacuation support • warning by the fire brigade	introduced in 2011 and is described as a multiplier system linked to various dissemination channels (online and analogue) (hosted by the BBK). The BBK is not directly responsible for the warning but is responsible for contributing to the warning to the public (§ 4 (3) ZSKG). The meteorological service (Deutscher Wetter Dienst (DWD)) forecasts weather and issues warnings. The 16 federal states primarily responsible for issuing warnings to local authorities (according to the ZSKG § 6) but also offering flood information portals including e.g., risk maps and policies. The municipalities together with the districts are the ones who are warning the public § 3 (1) BHKG. The fire brigades are mainly acting in response and support evacuation but also last-minute warning [3].
Emergency response	• coordination of volunteers • having an overview of the situation and conducting assessments for better disaster management • organising rescue operations, shelters with adequate care/supplies, and volunteers	According to the THWG law, the governmental non-profit organisation Technical Relief (Technisches Hilfswerk (THW)) is one of the primary actors in flood response. Fire brigades are often supervised by municipalities who coordinate flood preparedness and response. Communities can be involved in volunteered response during disasters [3].
Recovery	• provide fast and unbureaucratic financial support in the aftermath of the event and financial benefits for moving away to safer places • taking care of calls for donations • offering psychological support for affected people, occupational safety, and showing empathy to affected citizens	Officially, the government is not legally bound to provide flood recovery funding, therefore, citizens need to consider insurance. Discussions on whether insurance should be made compulsory are ongoing since several years [5]. Calls for donations are organised by various institutions e.g., district or municipality level, by aid agencies such as the red cross or Aktion Deutschland hilft but also by the diaconia. Psychological support is often offered by public and private practices and may be paid e.g., through health individual insurance.

- The preparation of disaster plans and practicing these is partly fulfilled by local and national authorities but primarily linked to fire hazards; while the practice of plans is not actively including the public (e.g., the national alarm day positioned citizens as the receptors of siren and cell broadcasts alarms but does not actively involve them in practices, for instance, in evacuation practice).
- By law, vertical collaboration and support in the federal system is prescribed but does not specifically focus on horizontal or multi-sector collaboration and communication. This is significant considering the diversity of actors involved in or who are impacted by risk and emergency management.
- The responsibilities around the inclusion and coordination of first-response volunteers recruited at short notice or assuming roles spontaneously are not clearly defined, which can lead to chaos during emergencies.
- Recovery funding is expected to be paid to affected citizens, however some citizens did not see it as their own responsibilities to insure their property.
- Citizens raised the point that authorities should take responsibility for providing psychological support or occupational safety for affected citizens. This role is not clearly set.

Looking at the distribution of responsibilities in the context of shared responsibilities, it appears that responsibilities are perceived to be spread between various actors including citizens. However, the allocation of responsibilities indicates a strict segregation between the responsibilities of citizens and the authorities. In other words, responsibilities are perceived to lie either within citizens or authorities, and only rarely as a *joint responsibility*.

4.1.3. Citizen-authority relationships

The survey responses did not provide a deep insight into interactions between citizens and authorities. In some cases, hierarchical (top-down) interactions were implied. Examples for this were when citizens wrote about expecting to receive help and information. However, hints towards bottom-up or deliberative interactions [9] could not be distilled from the responses.

Throughout the survey responses, respondents highlighted that their expectations of local authorities and the federal government were not met in many ways:

> *'Der Katastrophenschutz hat versagt.'*
> *(In English: 'The civil protection/disaster management has failed.')*

Such responses, suggesting the entire civil protection mechanism did not uphold their proper duties, lacking specificity about which abilities were actually expected from which arms or departments (often because it is not known who is specifically responsible for each different action). In contrast, the following response is more specific by stating that the person expected the responsible people should have taken the weather forecast serious:

> *'Die Verantwortlichen Personen haben die Vorhersage nicht ernst genommen.'*
> *(In English: 'Those responsible did not take the forecast seriously.')*

In particular, inadequate or poor management of the authorities and government (as expected by citizens) has been one major reason for declining trust and expectations. This primarily refers to issues around warning and information flows or lacking recovery support. Diminishing trust was demonstrated in statements showing lacking confidence in the intentions and capabilities of the authorities:

> *'Verlogenheit, Lügen, Schummeln.'*
> *(In English: 'Mendacity, lying, cheating.')*

> *'Von den Regierungen erwarte ich nach Covid-19 und dem Hochwasser nichts mehr.'*
> *(In English: 'I don't expect anything more from governments after Covid-19 and the floods.')*

Some expressed such low trust in authority, that it is better to not place trust in others (e.g., authorities), and rather take responsibility themselves:

> *'Kein Vertrauen in die Verantwortlichen.'*

(In English: 'No trust in those responsible.')

4.2. Willingness to engage

Several citizens reported involving themselves in emergency management and recovery actions, either through their volunteering organisation, calls for help in social media, but also through spontaneous volunteering (e.g. to support local fire brigades). In some areas, local Facebook groups were founded to help allocate help during and after the event. These groups were very active, for instance, in donating furniture, providing hands-on support to affected persons, and sharing personal experiences for psycho-social support. The survey responses indicate that a large amount of the recovery effort was primarily performed through local communities and people from outside willing to help. However, the coordination of spontaneous (eventually untrained) volunteers was not organised (efficiently) in some areas:

> *'…unkontrollierte Masse freiwilliger Helfer verstopfte die wenigen Straßen die frei waren; freiwillige Helfer bildeten eigene Substruktur, die eigenmächtig Entscheidungen traf, weil Behörden nicht präsent waren (z. B. eigenmächtige Sperrung von Straßen, eigenmächtige Einbahnstraßenregelung).'*
> *(In English: '…uncontrolled masses of volunteers clogged the few streets that were free; volunteers formed their own substructure that made decisions on their own initiative because authorities were not present (e.g., unauthorized closure of streets, arbitrary one-way street regulation).')*

Despite their loose organisation and the chaos of the situation, spontaneous volunteers were highly valued, and respondents highlighted a need for better volunteer coordination – for example, by establishing mixed teams of trained (i.e., members of the voluntary fire department) and spontaneous volunteers (citizens).

Overall, citizens demonstrated a high level of willingness to engage in local decision-making and actions around disasters risk management and climate change (see Fig. 1). About 70 of 438 participants prefer not to be engaged in local activities. Some citizens felt that they already volunteer in too many places (thus, more engagement would be too overwhelming), while others do not feel healthy enough or prefer to volunteer only spontaneously.

One theme that stood out was that individual citizens felt unable to initiate changes in FRM, and that the changes in policy and practice can only be initiated by local authorities or politicians. This felt lack of agency or influence was expressed, for instance, in the following quote:

> *'Bei dem letzten Hochwasser, sind die Bürger die Letzten, die etwas hätten tun können, sie sind die falschen Adressaten etwas zu verändern.'*
> *(In English: 'During the last flood, the citizens were the last ones who could have done something, they are the wrong recipients to change something.')*

The reasons for this could be limited or restricted access to resources [61], and indeed, it can be difficult for a citizen alone to foster a change in a community. One mechanism for leveraging change can be via local groups, such as flood action groups. One participant reported that they founded an initiative with citizens from their village and surrounding locations in the district of Aachen. It was mentioned that the Hochwasserschutzinitiative (flood protection initiative) has already achieved multi-directional interactions with relevant stakeholders and authorities, opening possibilities they felt for initiating a change in FRM practice:

> *'Wir haben mit vier betroffenen Orten, Hahn, Friesenrath, Sief und Kornelimünster eine Hochwasserschutzinitiative gegründet und eine bisher gute Kooperation mit der Stadt Aachen und den entsprechenden Fachbehörden.'*
> *(In English: 'We have founded a flood protection initiative with four affected towns, Hahn, Friesenrath, Sief and Kornelimünster, and have so far had good cooperation with the city of Aachen and the relevant specialist authorities.')*

5. Discussion and implications for policy and practice

This study explored the allocation and perception of responsibilities for risk governance before, during, and after the 2021 flooding event in Germany. Key lines of exploration include the (perceived) distribution of responsibilities of different actors, reflections on trust, local willingness to engage in local actions and decision-making, and links between these.

Flood risk governance in Germany is decentralised in the sense that roles and responsibilities of flood risk management are distributed to multiple actors and across scales [1,4]. In spite of this, a hierarchical structure [18] persists due to the fact that citizens are positioned and are perceiving themselves as the final receivers of risk management, including in the areas of risk communication, information dissemination, and help. This deep-rooted deference on formal institutions was reflected in the citizens' perspectives on the flood governance as most of them expect to be totally guided through the different flooding phases - from awareness raising to recovery.

Comparing the imagined and legal-institutional social contracts,

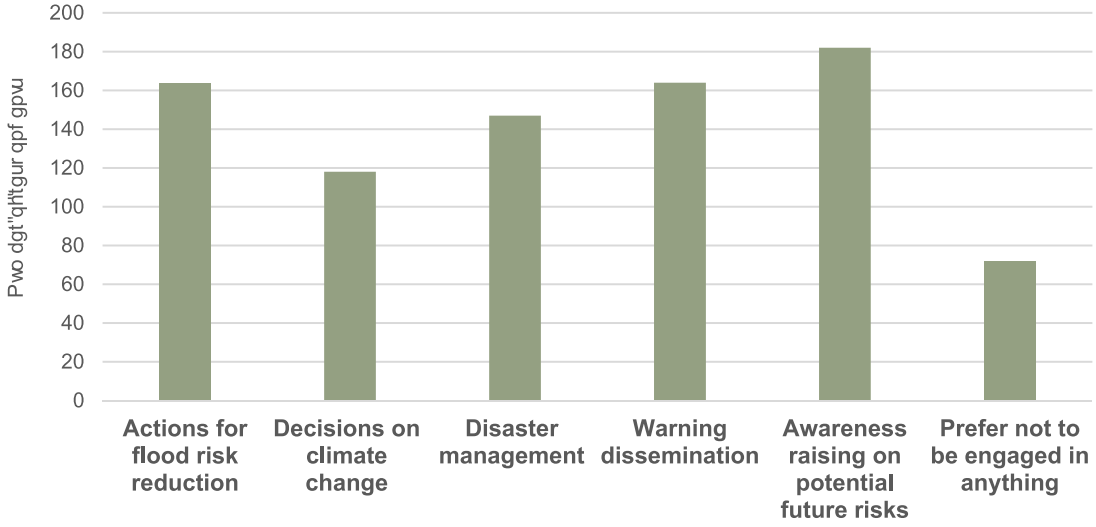

Fig. 1. Number of people willing to be more engaged in local decision-making and actions.

there are broad areas of alignment whilst there are also several aspects where roles and responsibilities need to be clarified. Overall, citizens had many expectations towards local authorities, volunteer organisations, and the state and federal government, whilst they ascribed less responsibilities to themselves. This indicates a great dependency of citizens on 'others' in cases of emergency. The survey responses highlighted the fact that citizens are often projecting responsibilities onto others while not being certain who the 'other' entity actually is. These unclarified responsibilities can be a barrier for flood risk governance [5,14,20–22].

As well as allocating most responsibilities to authorities, citizens also have high expectations regarding their management. This insight is comparable to the outcomes of study on different notions of responsibility in Germany [5]. However, the responses of this present survey showed that these expectations were not met in many ways, and this has affected citizens' trust in authorities. This extends earlier research on trust which finds that previous experiences can influence trust positively or negatively [34]. Trust is an important value for cooperation [32]; thus, trust needs to be rebuilt to enable interaction and collaboration between citizens and authorities.

The majority of citizens were aware of their own responsibility (set by law) of protecting their property and house from flooding, which was defined as a common first step towards shared responsibilities [23]. Nonetheless, the survey underlined that this responsibility is largely dependent on information and guidance by authorities. Overall, citizens understand this responsibility from a more reactive/defence perspective than implementing flood protection measures in advance. This was partly related to the costs of flood protection measures which has long been viewed as a key barrier to preparedness in Germany [24,25].

It can be concluded that actual multi-directional interaction [9] and close long-term relationships [39] between citizens and authorities would benefit FRG in multiple ways [3,5–7,11] and increase trust [38]. Citizen-authority interactions and collaboration are essential to align perceived social contracts, clarify roles and responsibilities, engage citizens, enhance multi-directional communication and collective decision-making, and lastly, to build trust [26,27].

The following subsections (5.1 and 5.2) will discuss the two major needs identified above by further proposing policy and practice recommendations.

5.1. Aligning perceived and legal-institutional social contracts

The comparison of social contracts has shown that there are several differences between the imagined and the legal-institutional ones, but also that some responsibilities are not clearly defined or allocated. Transparent and inclusive discussions on the distribution of responsibilities are important to move ahead in flood risk governance [5]. Therefore, we conclude that the co-production or co-development of a shared risk social contract with all actors, including citizens, is of high importance to ensure that different visions of fair or 'correct' FRG are aligned with one another, and that the distribution of rights and responsibilities is socially acceptable to all [9,42–44].

The current perceived distribution of responsibilities by survey respondents further indicated that responsibilities are shared between different actors but not jointly. In this regard, it is important to identify responsibilities that can foster, firstly, the collaboration between citizens and other FRG actors and, secondly, the sharing of responsibilities in the sense that multiple actors have joint responsibility [9,19].

Implications for policy: The survey responses highlighted that roles and responsibilities need to be freshly explored, defined, and manifested at local level involving the general public. This should include 1) clearly and transparently communicating existing roles and responsibilities; 2) identifying more gaps – roles and responsibilities that are perceived by citizens but are not clearly manifested (or vice versa); 3) elaborating joint responsibilities between different actors including the general public. These processes need to go beyond public involvement by approaching co-produced flood risk governance [9,10]. It is of importance to not only allocate certain responsibilities to actors but to agree (as far as possible) on the proposed arrangements to increase the willingness to take the responsibility [5].

It is recommended to establish local flood (or adaption) committees - comprising citizens, local citizen groups (e.g., flood action groups), and representatives from local FRG actors - which will foster collaboration whether horizontal, vertical, multi-sector, multi-disciplinary, or with citizens [5,9,29]. Community-based initiatives such as flood action groups can be valuable in the process of balancing relatively top-down and bottom-up interactions because they can function as a mediator between citizens and local authorities [29,31].

Implications for practice: In practical terms, there is a need to start or enhance civil dialogues to build consensus and applying participatory methods and tools to involve citizens to a greater and more impactful extent [10,11]. These dialogues may be more effective if initiated by the municipalities (or districts) to ensure the actual adoption of the dialogue outcomes in the future [26,27]. In the context of climate adaptation, it will be beneficial to perform this exercise with a multi-hazard and systemic risk lens [39]. Collaboration but also trust can be increased by creating joint responsibilities between citizens (groups) and local authorities [32,34,38]. In this regard, a few 'joint responsibilities' were identified within the survey that can function as starting points for collaboration between citizens and local authorities: 1) identification of local thresholds, observation of the environment, and communication between another on hazardous developments; 2) raising awareness and learning about potential risks within the community; 3) supporting the dissemination of official warnings and enhancing action taking within the community by building on their social interconnectedness.

5.2. Enhancing multi-directional interaction

In the context of co-developing or refining social contracts, one important aspect is multi-directional interaction (bottom-up and top-down) but also in a broader picture, the strengthening of this type of interaction between citizens and other actors was identified above as one major need [9,43]. Citizen's active involvement in different forms entails many proven advantages, but of course, it also requires expertise, time, and other resources [21]. The survey indicated that citizens remain greatly dependent on risk and emergency management systems which was also found in another study [6]. Multi-directional interaction would empower citizens, rebuild trust, raise awareness, and create ownership which can increase the willingness to take responsibilities [9,36,39]. Hence, the survey results highlighted the need for bridging the interface between authorities and citizens while participants showed a strong willingness to be engaged in local activities and decision-making.

Implications for policy: This flooding event reiterates the continued need for enhancing bottom-up approaches in flood risk management in Germany to gradually decrease the dependency of citizens on the infeasible idea of a perfect system and to build resilience. This requires greater involvement of citizen groups which may emerge through self-organisation (due to flooding experience) or are founded in alignment with existing laws [1,30]. On the other hand, it requires that municipalities are acknowledging these groups and are actively involving them in local decision-making and actions [27]. Legislation, strategies, and concepts need to emphasise the multi-directional interaction since citizens' participation, if mentioned, does not take a central role, yet [9].

Implications for practice: The need to bridge the interface between local authorities and citizens may be in different degrees across municipalities. In practical terms, multi-directional interaction refers to the idea that needs, decision-making, and actions can be developed in collaboration [9,10]. In fact, in several countries and also in a few areas in Germany, flood action groups were founded (commonly after flooding events), and these can function as a bridge between the citizens and the local authorities [31]. For instance, initiatives in the UK started

dialogues and collaboration with local authorities [29]. These groups can be a steppingstone for creating joint responsibilities such as engaging in awareness raising, implementing flood risk reduction measures, or in preparedness and response activities. However, for bottom-up initiatives, it can be difficult to be 'heard' by local authorities and be involved in decision-making [27]; thus, in the sense of collaborative governance [26], a first step is to enhance collaboration and rebuild trust which could be initiated from the side of local authorities.

6. Conclusion

This study's overarching aim was to examine how citizens perceived the adequacy of flood risk governance before, during, and after the devastating flooding event in Germany in July 2021. It has focused, specifically, on citizens' subjective visions of how roles and responsibilities for FRG are or should be allocated. In this regard, the study compared the alignment (or not) of the perceptions with formal legal-institutional risk governance structures. For this purpose, a semi-structured survey was disseminated via social media in flood affected areas. For the analysis of survey responses, this study applied the lens of social contracts. The analysis showed that the distribution of responsibilities in flood risk governance are partly differently imagined by citizens as they are legally-institutionally manifested. In addition, responsibilities show signs of segregation – meaning that there are no joint responsibilities between citizens and other actors. Overall, the difference in imagined and legal-institutional social contracts showed a remaining high dependency of citizens on other flood risk governance actors and a functioning system. Moreover, citizens expectations towards flood governance actors and the fact that they were not completely met before, during, and after the event, has cause the decrease of citizens' trust in authorities. Reflecting on the findings above, two major needs around flood risk governance were distilled: co-developing social contracts and enhancing multi-directional interaction.

This study indicates that research on governance structures and citizen involvement remains several steps ahead of policy and practice implementation. Yet, in support of the policy and practice implications provides, more research is needed on social contracts in practice, for instance, how can social contracts efficiently and satisfyingly be co-developed between citizens and local authorities. In addition, more research is needed on effective multi-directional interaction between local groups and authorities at different levels and how trust can be rebuilt in the German context and existing governance structure.

The adoption of the social contracts lens was important to understand differences between perceptions and the legal-institutional frame. To gain a fuller picture, it will be important to compare these results with the practiced social contracts as they could eventually provide more insights into why citizens perceive roles and responsibilities the way they do. Furthermore, using a semi-structured survey was useful for gathering a broad range of different responsibilities. However, considering that citizens have varying perceptions on responsibilities, the survey design did not allow to distil whether all imagined social contracts of the citizens are widely in alignment. Finally, the survey dissemination strategy of using social media channels might have influence the participants group in terms of age, living status, and eventually the level of flood awareness and self-responsibility.

Ethical approval

The online survey was approved by the ethical committee of the University of Reading on 14th February 2022.

CRediT authorship contribution statement

Joy Ommer: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Sophie Blackburn:** Conceptualization, Supervision, Writing – review & editing. **Milan Kalas:** Conceptualization, Supervision, Writing – review & editing. **Jess Neumann:** Conceptualization, Supervision. **Hannah L. Cloke:** Conceptualization, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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