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Solidarity in transboundary flood risk management: A view from the Dutch North Rhine–Westphalian catchment area

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Climate change is putting pressure on water systems, and its effects transcend man-made boundaries, making cooperation across territorial borders essential. The governance of transboundary flood risk management calls for solidarity among riparians, as climate change will make river basins more prone to flooding. ‘Solidarity’ means that individuals act to support members of a particular community to which they belong. Recently, the solidarity principle has become institutionalized due to its formalization in the EU Floods Directive. However, it is not clear what solidarity means in the upstream–downstream practices of transboundary flood risk management. Understanding the meaning of solidarity is important for the development of cross-border climate adaptation governance. This article discusses the conceptualization of the solidarity principle and explores its meaning for international cooperation in the Dutch North Rhine–Westphalian border region. Our critical case study reveals that although all actors understand the importance of solidarity, they interpret it differently, often based on self-interest related to their position in the catchment. The formal inclusion of the solidarity principle in the Floods Directive can best be seen as a step in the continuous development of transboundary flood risk governance, as no striking changes in practice have been identified after its formalization.

Policy relevance

As climate change increasingly puts pressure on river basins and other shared resources, cross-border cooperation and solidarity are seen as increasingly important. This article discusses the meaning of solidarity in practice and reveals how this normative principle may contribute to transboundary climate adaptation governance. Understanding its meaning is important for future cross-border climate adaptation governance.

Keywords: climate adaptation; Dutch North Rhine–Westphalian border region; flood risk management; solidarity principle; transboundary governance

1. Introduction

Climate change is expected to cause a greater variety in precipitation patterns and to affect river discharges (Eriksen & O’Brien, 2007; Glenk & Fischer, 2010; IPCC, 2007; Kabat & Van Schaik, 2003; Te Linde, 2011). This increases the probability of river flooding as well as the occurrence of droughts (Dukhovny & Ziganshina, 2011; Glenk & Fischer, 2010). While mitigation of climate change is still

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being negotiated, experts and policy makers for water management have directed their attention towards the need to implement adaptation measures (Glenk & Fischer, 2010; Kuik et al., 2008). This requires international cooperation, because water is not confined by man-made boundaries (Jongman et al., 2014). The integration of transboundary flood risk governance in climate policies is deemed necessary to improve the resilience of socio-ecological systems in times of climate change.

Transboundary flood risk management is a complex issue, with multiple dimensions. This article investigates the importance of solidarity between riparian states, because the effects of climate change will put pressure on river systems and the impacts will not be distributed equally among societies. Solidarity is required, as water governance will often be more effective and efficient if achieved collectively instead of individually. It is not accidental that solidarity is one of the underlying principles of the recently established EU Floods Directive (2007/60/EC). The question, however, is what solidarity actually means in the practice of cross-border flood risk management.

In practice, several examples of solidarity can be found. International agreements like the Benelux regulation for free fish migration (1996, revised in 2009), the Rhine Action Programme, and the Rhine 2020 and Salmon 2020 Agreement, for instance, require solidarity among riparian states in order to improve fish migration and water quality (Benelux, 1996, 2009; ICPR, 1987, 2001). A concrete example of solidarity is the opening up of the Haringvliet sluices by the Netherlands to allow fish migration from the North Sea to upstream spawning grounds, despite the fact that opening these sluices results in salt intrusion, which further endangers the freshwater quality in the Netherlands. Upstream countries, in turn, had to create spawning grounds by enlarging flood zones. Both are clear examples of countries acting in the river basin's collective interest.

Several scholars have studied the meaning of solidarity in other contexts, or from a theoretical perspective (e.g. Bayertz, 1999; Hammerström, 2005; Komter, 2005). However, the meaning of this principle for transboundary flood risk management is under-researched. This article aims to derive a better understanding of its meaning in practice, which is important for future cross-border flood risk and climate adaptation governance, as well as for the governance of other shared resources.

The next section outlines our research approach. Following this is a discussion of the relevant literature on the solidarity principle and the contents of the Floods Directive, as well as our research assumptions. The next section elaborates on the meaning of the solidarity principle for cooperation in the Dutch North Rhine–Westphalian Rhine basin, and the article ends with some concluding remarks.

2. Research approach

In this section, the research approach will be outlined step by step. We first discuss the conceptualization of the solidarity principle in the relevant literature and analyse the contents of the EU Floods Directive. Our research assumptions were developed based on these analyses, in which we specify what solidarity could *ideally* mean for the practice of transboundary flood risk management. We used the Policy Arrangement Approach (PAA) to structure our ideal-typical expectations (Van Eerd, Wiering, & Dieperink, 2014; Wiering & Arts, 2006; Wiering & Crabbé, 2006). A policy arrangement can be defined as 'temporary stabilization of the content and organization of a particular policy domain' (Arts & Leroy, 2006). The PAA distinguishes four interlinked dimensions of such arrangements: discourses, actors and coalitions, resources, and power and rules of the game (Arts & Leroy,

2006; Arts, Leroy, & Van Tatenhove, 2006; Liefferink, 2006; Van Tatenhove, Arts, & Leroy, 2000). For each of these dimensions research assumptions will be developed.

Our ideal-typical research expectations were explored empirically by means of a critical case study (Flyvbjerg, 2006). Cross-border cooperation in the Dutch North Rhine–Westphalian catchment was chosen as a single case of analysis. This area is one of the most densely populated, industrialized, and economically important delta regions in Europe. North Rhine–Westphalia, one of the 16 German states, is geographically comparable to the Netherlands and has its own competences to address flood risk management (Becker, Aerts, & Huitema, 2007; Greiving, 2008). The Rhine crosses this area on its way from the Alps to the North Sea. Nowadays, the Rhine is a combined rainfall-melt water river. However, climate change may alter it into a rainfall-dominated river. As a result, flood risks are expected to increase (Te Linde, 2011), as the 1993 and 1995 high waters have shown (Wiering & Arts, 2006). In the Dutch–German border region, multiple actors on both sides of the border, at different governmental levels, are concerned with flood risk management issues (Figure 1) (Van Eerd, Wiering, & Meijerink, 2014). This region is especially interesting as it has a long history of cross-border cooperation (Becker, Aerts, & Huitema, 2014; Krysanova et al., 2010; Lindemann, 2008; Mostert, 2009; Wieriks & Schulte-Wülwer-Leidig, 1997) and is a frontrunner in the EU in this respect. Indeed, several multilateral and bilateral cross-border organizations deal with flood risk management, amongst other things (see Figure 1). Other than these institutionalized forms of cooperation,

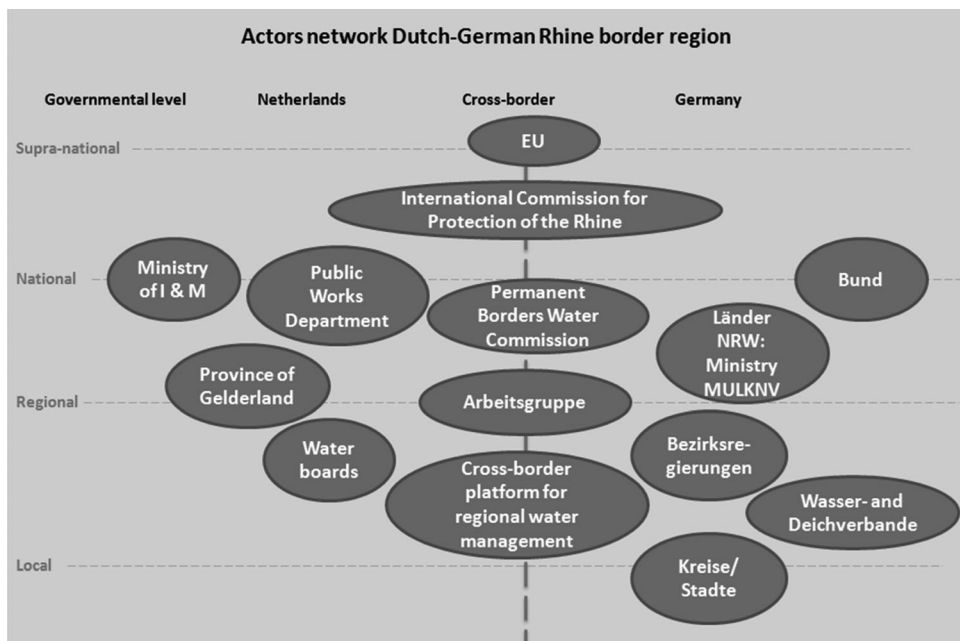


Figure 1 Actors and platforms concerned with flood risk management in the Dutch–German Rhine border region

Notes: EU, European Union; I&M, Infrastructure and Environment; MULKNV, Climate Protection, Environment, Agriculture and Nature conservation.

more ad hoc forms of cooperation occur, for instance between the German Deichverband Bislich–Landesgrenze and the Dutch regional water authority Rijn en IJssel (Friedrich, 2014; Menn, 2013; Renner, 2013; Rose, 2013).

Multiple scholars have identified this region as a successful collaboration regime (e.g. Bernauer & Moser, 1996; Dieperink, 1998; Lindemann, 2008), so we considered it a critical case for exploring the meaning of the solidarity principle in practice. If no indications of solidarity can be found in this region, it will be highly unlikely that we will find them in other cases.

Data were collected via document analysis (e.g. policy documents, legal texts, and secondary literature) and through 22 semi-structured interviews with key actors regarding the Floods Directive's solidarity principle and transboundary governance.¹ Interview transcripts were checked by the interviewees. Interpretative observation and participation were also undertaken to gain in-depth insights into the meaning of solidarity in the practice of cross-border water management (e.g. by organizing two workshops with Dutch and German experts², by visiting the High Water Conference of the Dutch–German High Water Working Group (Arbeitsgruppe)³, and by participating in a working group meeting of the International Commission for Protection of the Rhine (ICPR)⁴). Data were analysed by applying qualitative interpretive methods (Yanow, 2006, 2012). More specifically, a critical discourse analysis was conducted, as described by Fairclough (2003a, 2003b) and Hajer (1995), allowing an in-depth study of the meaning of solidarity within written and spoken language. We deductively determined keywords related to solidarity, which were coded in the transcripts, observation memos, and documents. Results of this empirical discourse analysis are presented for each of the PAA dimensions and summarized in Table 1.

3. The solidarity principle: a conceptual clarification

Normative principles can be defined as 'written or unwritten ideals relating to policy expressed in either measures or goals that can vary in their interpretation over time and place'. They can be conceptualized as being located between very concrete preferences and beliefs, and very fundamental and abstract values (De Sadeleer, 2005; Fulton, Manfredi, & Lipscomb, 1996; Jans & Vedder, 2008; Lee, 2005). Sometimes, principles predominantly form the background of a policy decision, while occasionally they are a more explicit rationale for a programme or actions. Principles guide and to some extent channel actions that are normally unregulated or not fully regulated. They can provide the basis for statutory rules, regulations, and instruments (Van Rijswick & Havekes, 2012), as well as jurisprudence, which is specified in Article 38 of the Statute of the International Court of Justice (International Court of Justice, 2014). Understanding such guiding principles is significant, if we are willing to understand how policies are created and supported (Glenk & Fischer, 2010).

A principle differs markedly from a formal rule, as the latter refers to a norm that directly provides rights or imposes duties on the subject of the law, while a principle, in contrast, initially represents an ideal of reason or justice (Harbo, 2010). A principle has to be acted upon and interpreted, yet its interpretation is never obvious; agents are relatively free in their understanding, which can also change over time and place (Van Rijswick & Salet, 2010; Verschuuren, 1995). A principle can be influential via framing and cognitive logic, and seeks to alter domestic beliefs, discourses, and expectations, which indirectly causes domestic, institutional adjustments (Knill & Lehmkuhl, 1999, 2002; Knill & Lenschow, 2005a, 2005b; López Santana, 2006; Radaelli, 2004).

In the academic literature the solidarity principle has different meanings. Although there is no binding definition, it is an important concept in daily societal practices. It reflects the affective bonds that individuals experience with another actor in the community (Hammerström, 2005), and it has its roots in Roman law, referring to the unlimited liability of individual members within a family or community to pay common debts (Bayertz, 1999). In the 19th century, the meaning of solidarity went beyond family ties in order to support larger communities. The key idea of solidarity is that risks and burdens that group members face or carry should be shared by the group as a whole (Dawson & Verweij, 2012; Mostert, 2015). Solidarity became institutionalized, for instance in the context of the welfare state (Bayertz, 1999; Komter, 2005). Keessen et al. (submitted) argue that the core of the principle has remained the same over time and is composed of three central elements: (1) solidarity occurs within some sort of community, (2) there is a positive and moral duty to assist, and (3) this takes place for the common benefit and interest (Bayertz, 1999). Somehow the responsibility of one is taken over by – or at least is linked to – the responsibility of others. Van Oorschot and Komter (1998) conclude that the distinctive features of societal solidarity are communal interests (shared utility) and a shared identity and feelings. Keessen et al. (submitted) distinguish between solidarity as a voluntary commitment and institutionalized solidarity, changing its initial voluntary and reciprocal nature. In the case of a voluntary commitment, group members act unilaterally or asymmetrically as they consider it a moral duty to do so (Goudswaard, 2005). Insurance systems are an example of institutionalized solidarity, whereby risks are shared among the community with financial transfers to members who have suffered damage. Institutionalized solidarity is closely related to the principle of equity, addressing the redistribution of resources in a temporal, geographic, and economic dimension, or a combination of all three (Cook & Tauschinsky, 2008; Williams, 2003). Solidarity in an upstream–downstream setting is also associated with the principle of ‘good neighbourliness’. The latter implies that riparian states cooperate and do not cause substantial harm to one another’s territories (Driessen & Van Rijswijk, 2011). The motives and discourses that lie behind solidarity can vary; there can be (latent) reciprocity in solidary relations, while on the other hand self-interest appears to remain relevant (Bayertz, 1999). This raises the following questions: What are the motives connected to the meaning of solidarity in a transboundary context? Is this characterized by reciprocity, altruism, equity, and fairness, or is solidary behaviour in practice based on instrumental rationality and self-interest? Do riparians act together – for themselves?

4. Possible implications of the solidarity principle in the EU Floods Directive

The solidarity principle is explicitly mentioned both in the preamble and in Article 7.4 of the European Floods Directive (2007) (FD). The FD is intended to harmonize the assessment and management of flood risks in the European Community, in order to reduce the adverse consequences of flooding. The FD introduces a three-stage approach following a six-year implementation cycle: member states are required to (1) carry out a preliminary flood risk assessment; (2) produce flood risk and hazard maps for the identified potential risk areas; and (3) establish flood risk management plans for those areas (Directive, 2007/60/EC; Hagemeyer-Klose & Wagner, 2009; Hartmann & Spit, 2015; Hörmandinger, 2010; Rijksoverheid, 2010; Van Eerd, Dieperink, & Wiering, 2013). According to Article 7.4 of the FD, it is prohibited to pass flood risks to other riparians: ‘In the interests of solidarity, flood risk

management plans established in one Member State, shall not include measures which, by their extent and impact, significantly increase flood risks upstream or downstream' (Directive, 2007/60/EC, p. 31). Thus, member states cannot take any measure that increases risks in other countries, unless those measures are coordinated. On top of that, member states should seek for a fair sharing of responsibilities and for the application of measures for the common benefit as stressed in the preamble of the FD (Directive, 2007/60/EC, p.28). These considerations of solidarity in the FD do not have the status of hard law, but can be seen as a normative, no-harm principle. They aim to influence member states' policies by defining a desired situation or ideal process (Dworkin, 1986; Knill & Lenschow, 2005b).

If we apply the central elements of solidarity as stated by Keessen et al. (submitted) to the case discussed in this article, we see that (1) the transboundary community consists of the riparians in the Rhine basin, and more specifically the Dutch and North Rhine–Westphalian border region. According

TABLE 1 Research assumptions regarding the ideal-typical meaning of the solidarity principle for transboundary flood risk management in the Dutch North Rhine–Westphalian catchment

Dimensions	The ideal-typical meaning of the solidarity principle for transboundary flood risk management	Empirical findings
Discourses	1. All actors within the catchment see themselves as part of the transboundary community, they have a feeling of moral duty to collaborate and they act according to the common benefit.	+ / –
	2. Solidarity is framed as both the (non-)shifting of negative (increasing flood risks) and positive (decreasing flood risks) effects of flood risk management measures, considering both up- and downstream regions.	+ / –
	3. The formalization of solidarity in the FD leads to a harmonization of the principle's interpretation.	–
	4. Flood risk management based on solidarity is motivated by principles such as fairness and equity, instead of acting according to self-interest and instrumental rationality.	–
Actors and coalitions	5. Multiple types of actor will join and establish international collaboration structures.	+ / –
	6. Collaboration between actors goes a step further than information exchange and knowledge generation (e.g. a common framing of solution and problem definitions, joint objectives, development of common plans, strategies and programmes for flood risk management).	+ / –
Rules of the game	7. The solidarity principle is mentioned in national and international, formal and informal rules of the game of riparians and international collaboration platforms in a basin.	+ / –
	8. The formalization of solidarity in the FD stimulates cross-border cooperation.	–
	9. Actors take flood risk management on the other side of the border into consideration during the implementation of the FD's requirements.	+
Resources and Power	10. Financial exchanges for flood risk management are established between up- and downstream regions.	–

Notes: + and – indicate whether our research findings do or do not support an assumption, and + / – implies that only partial support is found).

to the second element (2), the FD states that it is the moral duty of all riparians in one basin to not pass on flood risks, to inform each other, and to collaborate across borders, and with regard to the third element (3) the common benefit is that flood risks are managed more effectively and efficiently when achieved collectively, and that flood risks will decrease for the whole Rhine community.

Thus, in an ideal-typical situation, the formal inclusion of solidarity in the FD can be expected to act as a leverage for cross-border cooperation in river basins. This principle will overcome the passing of negative effects of flood risk management measures that would increase flood risks in other regions, and will stimulate the passing of measures with positive effects (e.g. measures that reduce water discharge levels downstream or upstream). Increasing alignment and coordination between member states is expected, creating a greater mutual understanding and more collaboration with regard to flood risk management, which could eventually lead to the joint development of flood risk management in a river catchment. It can (again, in an ideal-typical situation) be expected that the principle of solidarity will, in the long run, result in a harmonization of flood risk arrangements between member states, which will further ease transboundary flood risk governance.

In terms of the PAA, principles are expected to influence the discourse dimension of a policy arrangement, and changes in this discourse dimension could eventually lead to changes in the policy arrangement's actors, rules, and resources dimensions, as the four dimensions are intertwined. Thus, solidarity is expected to change flood risk management discourses, which will trigger changes in the other dimensions. [Table 1](#) lists our ideal-typical assumptions and also indicates whether our case study results confirm or reject the assumptions. We will clarify and explain these results in the following sections for each of the PAA dimensions.

5. Congruence in discourses?

For the discourse dimension we assume that, in an ideal-typical situation and in line with the central elements stated by Keessen et al., (1) all actors within the catchment see themselves and each other as part of the transboundary community, (2) they have a feeling of moral duty to collaborate, and (3) they act for the common benefit. Moreover, we expect that the formalization of solidarity in the FD will lead to more harmonization of the discourse amongst riparians. And we presume that flood risk management will be triggered by principles such as equity and fairness, instead of solidarity based on instrumental rationality and self-interest. Our case study shows that, in practice, all actors are aware of the need for solidarity, but views of flood risk management and safety differ among downstream- and upstream-located actors (Van Eerd, Wiering, & Dieperink, 2014), just as perceptions of solidarity do. Furthermore, it appears that 'the majority of riparians act according to this principle, because – one way or the other – solidary behaviour is in their own interest as well' (Linsen, 2013).

In general, Dutch actors' interpretation of the solidarity principle in this case is: 'it is necessary that countries consider each other's interests in flood risk management'. For the Dutch, this means primarily that 'upstream countries are required to consider the interests of downstream countries'. Thus, the Dutch interpretation of solidarity focuses merely on the prevention of the passing of negative effects across borders, as in the no-harm principle. Some quotes from Dutch key actors include 'upstream countries should not do things that could harm the Dutch' (Dekker, 2013), 'solidarity means the adoption of changes in the water system, from which neighbours shouldn't suffer' (Vreugdenhil, 2013), and

'above all, it means the non-shifting of problems' (Kors, 2013). This interpretation is obviously rooted in the downstream location of the Netherlands in a delta region, being also one of the reasons for the Dutch initiation of the FD (Buiteveld, 2013; Dekker, 2013; Kors, 2013; Van den Berg & Slager, 2012; Van de Glind, 2009).

North Rhine–Westphalian actors understand and respect the Dutch interest in solidarity and are actually aware of its urgency. Yet, if we look closer, they perceive this principle more comprehensively. In this region, solidarity is interpreted as more generally the non-passing of negative effects to other countries (both upstream and downstream), as well as the passing of positive effects (Busschüter, 2013; Jekel, 2013; Menn, 2013; Rose, 2013). Some illustrating quotes from German actors are that 'we cannot pass damage to others within the same catchment' (Busschüter, 2013), 'we shouldn't choose measures that negatively affect the Netherlands' (Menn, 2013), and 'flood risk management should in the end be in the interest of all countries involved in a river basin' (Jekel, 2013).

Actors involved with international collaboration in the Rhine basin perceive solidarity as the fundamental principle triggering the Rhine's successful collaboration, as 'acting according to the solidarity principle is inherent to cooperation in the Rhine basin' (Busschüter, 2013) and 'this principle is part of our [the ICPR's] daily work' (Schmid-Breton, 2013). In comparison to the domestic framing in this case, actors at the Rhine basin level also consider the non-passing of negative effects and the sharing of positive effects with other regions. However, they add to this the establishment of (collective) actions that are in the interest of the whole basin. In the Rhine basin, solidarity is no new concept, as it was already applied in practice before establishment of the FD (Benthlehm, 2013). The latter explains the relatively easy implementation of the FD for both regions (Jekel, 2013; Van Eerd, Dieperink, & Wiering, 2015), as it builds upon existing domestic and international beliefs and discourses. The interpretation of solidarity in the Rhine basin and the successful collaboration programmes even inspired the EU during the FD's formulation process (Dekker, 2013).

6. Cooperation between actors and coalitions

For the second dimension of the PAA (actors and coalitions), we assumed that, ideally, solidarity among riparians will become manifest if multiple actors cooperate in international institutions. Within those platforms, again from an ideal perspective, collaboration has no boundaries and concerns both knowledge and information generation and exchange, as well as the formulation and implementation of joint flood risk management objectives, plans, and projects.

In the Dutch–German border region, multiple bilateral and multilateral cross-border platforms exist (Figure 1). However, the formal addition of solidarity to the FD did not lead to changes in this transboundary organizational structure, as the FD's responsibilities are allocated amongst existing (groups of) actors. Within those organizations, cross-border cooperation still consists merely of knowledge generation and information exchange (Broseliske & Buiteveld, 2014; Busschüter, 2014; Lammeresen, 2014; Onnink & Mol, 2014; Van Roode, 2014), which was already the focal point during the early years of collaboration. One of the first practical examples of the institutionalized exchange of information was the establishment of a monitoring network for water quality by the ICPR along the whole basin in 1953 (Dieperink, 2000). Gradually, the frequency and intensity of information flows across borders increased, and the role of practitioners and experts became more important for

international river basin management (Bernauer, 2002; Schmid-Breton, 2013). Later, the ICPR's monitoring system became more comprehensive, including the monitoring of water levels, connected to a forecasting and warning system for both water quality and quantity issues. In addition, the ICPR coordinates retention measures at the system level (ICPR, 2012, 2013; Jekel, 2013; Schmid-Breton, 2013). Furthermore, their role has widened to include the joint development of programmes, plans, and strategies (e.g. the Action Plan on Flood Defence of 1998 and the Rhine 2020 programme of 2001) (Becker et al., 2014; Wieriks, 2014; Wieriks & Schulte-Wülwer-Leidig, 1997), which can be seen as a next step for transboundary governance. However, the Arbeitsgruppe (a Dutch–German bilateral working group on flood issues) still focuses only primarily on information exchange between Dutch and German actors, as well as executing joint research projects and drawing up evacuation plans (Arbeitsgruppe Hochwasser, 2013; Lammersen, 2004, 2013; Overmars, 2013).

Thus, collaboration is well developed, and some examples were found of joint flood risk management, yet the locus of cross-border cooperation is still the exchange and generation of information across borders, in part because further collaborative steps often conflict with principles such as sovereignty. One example we found is the transboundary dyke ring 48, which is situated in both Dutch (70%) and German territory (30%), yet 90% of the flood risk lies in the Netherlands (Silva, Kuijper, Huber, & Schüttrumpf, 2009). The standardization of dykes, modelling methods, and visions on flood risk management and safety differ between the two countries, and actors are not even fully aware of water management plans on the other side of the border. As German weirs in this dyke ring are more fragile – in 2011 about 0.5 km of Dutch weirs and 15 km of German weirs did not meet standards – and the risk mainly lies in the Dutch region, solidarity here is not applied to the fullest extent (Bosch, 2014; Graafsma, 2014; Provincie Gelderland, 2011; Silva et al., 2009). Currently, the Arbeitsgruppe is analysing the difficulties of standardization in this dyke ring.

7. Rules of the game

Regarding the rules of the game dimension, again in an ideal-typical situation, domestic rules of the game for all riparians refer explicitly to solidarity as a principle, just as do the rules of the game of international collaboration platforms. In addition, solidarity will be considered by all actors involved during implementation of the FD's requirements. This stimulates cross-border cooperation in practice. In the present case, both in the Netherlands and North Rhine–Westphalia, the FD (and inherently also the solidarity principle) is transposed in the national water legislation, and solidarity is reconsidered in the rules of the game on both sides of the border.

For example, in the Dutch water plan (2009–2015), solidarity is explicitly mentioned as one of the basic values for water management, with regard to both financing and the non-passing of flood risks to other regions. However, the prime focus is on solidarity within the Netherlands (Rijksoverheid, 2009, pp. 5, 16, 263). In the Dutch 'Room for the River' programme – a spatial planning key decision – solidarity is not explicitly mentioned. Yet its measures, which aim to reduce flood risks in the Netherlands by lowering water levels in the rivers and improving flood flow, will also have positive effects upstream. When all actions are implemented, reductions of water levels will have an impact as far as the German city of Wesel – 40 km from the Dutch border (Deltares, 2008; Kors, 2013; Kroekenstoel & Lammersen, 2005; Lammersen, 2004; Rijksoverheid, 2014; Ruimte voor de Rivier, 2006, 2014).

Another example is that the Dutch consider streams in their FD's maps and plans, which are identified by German experts as potential risk areas. This is done to overcome the inequalities of maps on the border, even though Dutch experts do not identify those streams as prone to risks (Atsma, 2011; Ministerie V&W, 2010; Van den Berg, 2013).

By contrast, examples can also be found of the Dutch considering solidarity in a limited way. For instance, international solidarity is not explicitly referred to in the Dutch Deltaprogramme – a key element in Dutch climate adaptation policies that focuses mainly on water safety, freshwater supply, and the climate-proofing of urbanized areas (Deltaprogramma, 2013, 2015). This programme applies a national focus, starting at the point where the rivers enter the Netherlands. For example, plans are based on assumed discharge levels at Lobith. These discharge levels are not confirmed by German actors, who are developing their own climate change adaptation programme and think differently about the Deltaprogramme's long-term perspective. Progress of the Deltaprogramme has been discussed on international platforms (e.g. the Arbeitsgruppe and ICPR), yet no alignment or cooperation has taken place. Furthermore, the impacts of the programme's measures are only identified for the Netherlands, and not (yet) for neighbouring regions (Lammersen, 2013).

Within North Rhine–Westphalian plans, programmes, and strategies, the solidarity principle is explicitly considered. For instance, it is a fundamental principle behind the German 'Room for the River' concept (Nagel, 2012; Verwijmeren, 2007). Furthermore, the strategy 'Mit dem Wasser leben' (2011) states explicitly that 'flood control would only be successful if North Rhine–Westphalia coordinates its plans with other States and neighbouring countries' (Ministerium KULNV, 2011). Those plans are applied in practice, leading to the establishment of upstream retention basins in North Rhine–Westphalia, for example (e.g. the polders of Worringer Bruch, Bylerward, Orsoy, and Ilverichter Bruch) (Busschüter, 2013; Die Landesregierung NRW, 2014; ICPR, 2012). However, those basins have low water intake levels, so positive effects in the Netherlands will be relatively low (Deltares, 2014). Other planned measures along the Lower Rhine in Germany – under construction until 2025 – will lead to reduced maximum water levels in the Netherlands by a maximum of 0.06 m (Lammersen, 2014). In both examples, solidarity plays a role, but self-interest seems to be dominant.

Various specifications of solidarity were found at the transboundary level. The ICPR refers to solidarity in multiple plans and strategies, including the Rhine Action Plan on Floods (ICPR, 2012, 2013; Jekel, 2013; Schmid-Breton, 2013). On the bilateral level, examples are found within the rules of the game of the Arbeitsgruppe, where solidarity is explicitly mentioned in the founding declarations of 2007 and 2013 (Arbeitsgruppe, 2007, 2013).

In order to facilitate the FD's implementation at the international level, the ICPR has established maps and plans for the whole basin (Jekel, 2013; Linsen, 2013; Schmid-Breton, 2013). Bilateral alignment regarding national maps and plans is also taking place, *inter alia* within the Arbeitsgruppe (Busschüter, 2013; Castenmiller, 2013; Goudriaan, 2013; Lammersen, 2013). It appears that the formalization of solidarity in the FD has not (yet) led to striking changes in the practices of transboundary cooperation in the Rhine basin (Buiteveld, 2013; Busschüter, 2013; Jekel, 2013; Kors, 2013; Schmid-Breton, 2013). 'The FD could be seen as a continuous step in the development of international flood risk management' (Menn, 2013). Maps and plans differ between the Netherlands and Germany as a result of the use of different methods and legends (Buiteveld, 2013). The formal status of solidarity hampers cross-border cooperation in practice, as states within the Rhine basin are now more wary of concluding further agreements (e.g. within the ICPR), because of the FD's reporting obligation and

the EU's enforcement powers (Buiteveld, 2013; Goudriaan, 2013; Lammersen, 2013; Schmid-Breton, 2013). 'Due to the FD, a third party (the EU) is looking over the shoulder of flood risk management and collaboration, making member states more reluctant' (Buiteveld, 2013).

In conclusion, solidarity is explicitly mentioned in Dutch, North Rhine–Westphalian, and international rules of the game, just as it is considered during the implementation of the FD's requirements. In practical examples, considerations regarding solidarity play a role, yet its application is often limited and merely triggered by self-interest.

8. Resources and power

For the last dimension, we assumed, again ideal-typically, that solidarity would result in financial exchanges across borders. In the present case, only a few examples of financial exchanges from downstream to upstream regions were identified. For instance, the Dutch invested in German flood risk management within the Aquadra project for the River Jeger and via the Interreg project Riparia for the River Ruhr. The Dutch investments aimed to reduce flood risks downstream, as in the Netherlands less room was available for such retention basins. Both projects were conducted at lower governmental levels and were financially supported by the EU. For both cases, it appears to be difficult to measure the (positive) impacts of funding, and the investments led to complexities due to diverging jurisdictional situations (Dekker, 2013; Goudriaan, 2013). It has become clear that these payments were conducted based on self-interest, instead of full solidarity. Furthermore, no examples of financial exchanges for flood risk management were found after establishment of the FD.

Therefore, the ideal-typical assumption in the resources and power dimension is not found in practice, as the position in the basin and the self-interest of riparians, instead of solidarity, clearly influences the exchange of financial resources.

9. Discussion

In this contribution we have considered the practical meaning of the solidarity principle for transboundary flood risk management by confronting ideal-typical assumptions concerning this principle with empirical evidence from a critical case study: the Dutch North Rhine–Westphalian border region.

Solidarity in this region, as formalized in the FD, builds upon existing historical developments, traditionally involved institutions, and actors for transboundary water management, and is seen as an important principle and motive further intensifying cooperation. Although certain aspects of solidarity are interpreted differently by the actors involved, this principle fundamentally underpins the successful collaboration in the Dutch North Rhine–Westphalian border region. Solidarity was identified in both domestic and international rules of the game, and is recognized by multiple actors at different governmental levels, leading to border-crossing information and knowledge generation and exchange. Although the latter is still the prime locus in cross-border cooperation, we found some important examples of the development of joint flood risk management plans, strategies, and projects. Whilst we assumed that (ideally-typically) financial resources would have been exchanged, this appeared a bridge too far in practice. The empirical results do not confirm most of the ideal-typical assumptions, as solidarity often goes hand in hand with self-interest related to the actor's position in the river basin.

In conclusion, the FD has clearly referred to solidarity, and despite the slight interpretation differences of actors involved in flood risk management, all interviewees acknowledge the importance of this principle for cross-border collaboration. However, this is not always followed by practical actions for flood risk management, and convincing signs of increasing transboundary orientations are scarce. State sovereignty, (national) interests, and cultural, historical, and political discrepancies between policy arrangements on both sides of the border continue to hinder transboundary flood risk management. From a climate change perspective we expect that issues will become more pressing, and more importance will be given to 'full solidarity' that meets all central elements of solidarity (Keessen et al., submitted), or in other words, helping transboundary community members for the common benefit, triggered by a moral duty to do so without immediately self-benefiting. However, it is questionable whether agents would still be willing to apply solidarity when this would hamper their own interests. From a general climate change perspective, would a state pass quantities of water downstream when its inhabitants lack sufficient drinking water, its farmers lack irrigation water, or industry is not getting enough cooling water?

We have observed that the formalization of solidarity in the FD has increased overall awareness concerning the need for communication, collaboration, and the non-shifting of risks for cross-border flood risk management. However, such a formalization will not be a sufficient condition for future transboundary climate adaptation governance, because the meaning of the principle remains vague, leaving room for differences in interpretation, and therefore the application of solidarity often remains ambivalent. Thus 'hard' (EU) legislation – providing a more specific materialization and elaboration of solidarity followed by required actions – is essential to foster transboundary governance of adaptation. At the moment, adaptation programmes focus merely on national interests and national sovereignty, but in the long run, adaptation will, at the very least, also be a matter of cross-border cooperation in Europe. This has been recognized in the EU Climate Adaptation Strategy (European Commission, 2013). Then again, we have also learned that transboundary governance moves slowly, and it takes very deep breaths.

10. Concluding remarks

To conclude, the interpretation of solidarity in transboundary flood risk management appears to differ amongst actors, and merely refers to the non-shifting of flood risks to upstream and downstream regions. Solidarity plays an important role in the Rhine basin and is one aspect within the complexity of transboundary flood risk governance. Moreover, the institutionalization of this principle in the European Floods Directive (2007) (FD) can best be seen as a step in the continuous development of transboundary flood risk management, stimulating the transboundary community and the moral duties that are part of it.

The insights obtained with regard to the meaning of solidarity are applicable to other water systems dealing with upstream–downstream dependencies, as well as for other shared resources. We expect that the necessity of solidarity across borders will increase due to climate change. Solidarity in collective arrangements reduces vulnerability and increases resilience to climate change pressures.

Future research can take a longer-term research perspective on the interpretation of the FD's solidarity principle for transboundary flood risk management, as the first implementation cycle of the FD is almost finished (the last requirement must be fulfilled in 2015). In addition, the meaning of this

principle in other border regions and river basins can be scrutinized further, leading to interesting possibilities for case study comparisons. Moreover, the research results of this study can be compared with the practices of solidarity in other fields, e.g. fields related to aspects of climate adaptation governance, such as dealing with heat and health issues in cities, drought issues in river basins, and nature conservation in border-crossing nature reserves.

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Notes

1. Interviewees represented the following transboundary organizations: the ICPR, the Dutch–German cross-border platform for regional water management, and the Dutch–German High Water Working Group. Moreover, interviewees represented the following German organizations: the German Federal Ministry of Environment, the Ministry of North Rhine–Westphalia concerning Climate Protection, Environment, Agriculture and Nature Conservation, the Bezirksregierung Düsseldorf, Wasserverband Eifel-Ruhr, the Emschergenossenschaft/ Lippeverband and Deichverband Bislich-Landesgrenze. Finally, interviewees represented the following Dutch organizations: the Dutch Ministry of Infrastructure and Environment, its Public Works Department, the Dutch provinces of Limburg and Gelderland, Regional Water Authorities Roer en Overmaas and Rijn en IJssel and the municipality of Nijmegen.
2. One workshop was organized by the researchers on the transboundary aspects of water safety in the Meuse and Rhine basin (7 May 2014, Utrecht, the Netherlands) and one concerning the search for integrated and transboundary climate adaptation strategies (22 June 2014, Nijmegen, the Netherlands).
3. The researchers were present at the High Water Conference on 30 October 2014 in Rees, Germany.
4. The researchers joined a meeting of the working groups from the ICPR (19 March 2014, Koblenz, Germany).

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