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Constructing risks – Internalisation of flood risks in the flood risk management plan

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A R T I C L E I N F O

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A B S T R A C T

Traditional flood protection methods have focused efforts on different measures to keep water out of floodplains. However, the European Flood Directive challenges this paradigm (Hartmann and Driessen, 2013). Accordingly, flood risk management plans should incorporate measures brought about by collaboration with local governments to develop and implement these measures (Johann and Leismann, 2014). One of the challenges of these plans is getting and keeping stakeholders involved in the processes related to flood risk management. This research shows that that this challenge revolves around how flood risks are socially constructed.

Therefore it is essential to understand and explain the risk perception of stakeholders. System Theory by Luhmann provides the analytical distinction between 'internal risk' and 'external danger' as key concepts to understand whether or not stakeholders will take action (Luhmann, 1993). While perceptions of 'external danger' will not lead to action, perceptions of 'internal risk' urge stakeholders to take action.

The cases of the rivers Lippe and Emscher in the dense populated region between Duisburg and Dortmund in Germany illustrate how these theoretical concepts materialise in practice. This contribution shows how flood risks are socially constructed and how this construction is influenced by the European flood risk management plan. While clearing up some of the difficulties from the Flood Directive, the research shows a gap between the Flood Directive and the current theory and planning practice, which needs to be addressed in further research.

1. Introduction: traditional protection and the new flood risk paradigm

Due to climate change, extreme weather events will continue to increase in frequency (IPCC, 2014). In Germany and Central-Europe, the frequency of flood events doubled since 1980 (Munich Re, 2014). Floods are the most common natural hazard in Europe and account for the highest number of casualties and economic damage (STAR-FLOOD, 2014). Technical means for controlling extreme floods is limited, which became clear during several extreme weather events in past years (Pahl-Wostl, 2007). In the 1990s, one flood in Germany was described as a 'once-in-a-century' event. The press gave the same title to the floods in 2002 (Deutsche Welle, 2013). In some locations, the flood events in 2013 were worse than in 2002 (Merz et al., 2014). However, some places were better off, such as the city of Dresden, which was heavily affected in 2002 (Pahl-Wostl, 2007), but better prepared in 2013 This, however, was at the expense of areas downstream (Merz et al., 2014; Munich Re, 2014).

The inability to cope with increasing flood risks in Europe solely with technical flood protection—predominantly focusing on dikes—fosters a need for an ongoing paradigm shift in how to deal with floods (Patt and Jüpner, 2013). This shift may move the discussion from flood resistance towards flood resilience, or from flood protection to flood risk management (Jüpner, 2005; Hartmann and Spit, 2015). This would mean not just defending against floods, but at the same time managing the flood risks in such a way that in case of a flood, the damages are minimised (Klijn and Koppenjan, 2012). This includes governing the areas behind the dikes (Tempels and Hartmann, 2014).

The European Commission released the directive on the assessment and management of flood risks (Directive, 2007/50/EC), referred to as the Floods Directive (Hartmann and Spit, 2016). It aims to reduce the adverse consequences of floods to preserve human health and life, the environment, cultural heritage, economic activity and infrastructure. According to the directive, each member state has to accomplish three stages. These stages consist of creating (1) a preliminary flood risk assessment, (2) flood hazard maps and flood risk maps, and (3) a flood risk management plan for each catchment. The last stage is crucial as it institutionalises an ongoing paradigm shift from flood protection

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towards flood risk management.

The flood risk management plan (FRMP) implies also a shift in the modes of governance of water management. The plan foresees a close collaboration between different public stakeholders (notably spatial planning, water management, municipalities and regional administrations), but also between private and societal actors (i.e., industry, companies, or citizens) who were previously less involved in flood risk management. This is a crucial change from traditional working paradigms of water authorities (van Buuren et al., 2012). The institutions of water management and spatial planning need to collaborate to make the plan a success (Hartmann and Driessen, 2013). The schedule of the Floods Directive makes this paradigm shift very urgent. It demands a revision of the flood risk management plan and its used instruments every six years, which means the collaboration between water management and spatial planning has to be durable. Understanding the magnitude of the shift explains why this level of collaboration does not function in practice as smoothly as the European legislator intended it to in the Floods Directive. Perception, and thus awareness, of flood risks differ among governmental institutions.

The aim of this paper is to discuss flood risk perceptions of local governmental institutions in order to derive lessons for the future process of flood risk management plans. An assumption to test is if and how the process of setting up the flood risk management plan influences the risk perceptions of governmental institutions. This research allowed for the unique chance to analyse the effects of collaboration on the new instrument on risk perception of stakeholders. The study started in September 2014, which was in the middle of the planning processes of the first flood risk management plans.

In this contribution, before elaborating on the cases, the theoretical approach by Luhmann on risk perception is outlined and the analytical distinction between ‘internal risk’ and ‘external danger’ is derived from Social System Theory by Luhmann (Luhmann, 1993). Then the illustrative cases of the rivers Lippe (1) and Emscher (2) in Germany are presented. Those cases have not been selected because they are specific to a particular issue, but rather because they are representative of the average regional rivers in Europe.

Using Social System Theory as the theoretical approach has methodological implications. To gain insights in the social systems, three methods have been combined in this research: *exploratory observations*, *semi-structured interviews* and *policy analysis*. The exploratory observations were conducted at several meetings of the flood risk management planning process in North Rhine-Westphalia to gain an understanding of the actors and issues involved in the discussions. During these meetings, the involved actors discussed the progress they had made and the measures that had to be taken for the flood risk management plans. The semi-structured interviews were then used to investigate the underlying notions and motives of actors. The structured interviews provide consistency in the results and makes them comparable. Along with these two data collection methods, a policy analysis was conducted on local, regional and national water management policies. This was done both before and after the interviews to contextualise the findings.

The two case studies in North Rhine-Westphalia, Germany investigate how perceptions of various actors differ and whether the flood risk management plan triggers changes in their risk perception. The crucial question is: when do stakeholders take action in flood risk management?

Previous research on risk perceptions of flood risks provides the background information for this study (Raaijmakers et al., 2008; Hartmann, 2011; Tempels and Hartmann, 2014; Douglas and Wildavsky, 1983; Renn, 2008). This research will use Luhmann's System Theory as the main theoretical framework. From Luhmann's work, his distinction between risk and danger is of particular interest for this research. The use of Luhmann's System Theory in case studies of flood risk perceptions is rather unusual. The use of the System's theory is mainly theoretical and used in a variety of disciplines (Boldyrev, 2013; Gershon, 2005; Kihlström, 2012; Parks and Roberts, 2010; van Raak and Paulus, 2001), but rarely as the basis for case studies (Hatfield and Hipel, 2002). The combination of Luhmann's System Theory and the flood risk management plan in a case study brings an abstract “grand theory” into action by using a practical case (the rivers Emscher and Lippe). By doing so the study provides a new perspective on current European flood risk management.

2. Risk as a social construct

The term risk is a social construct, which makes defining the term risk one of the main problems when measuring risk perceptions. “Human beings have invented the concept risk to help them understand and cope with the dangers and uncertainties of life. Although these dangers are real, there is no such thing as ‘real risk’ or ‘objective risk’” (Slovic, 1998). The worldview of a certain actor determines which dangers are magnified, while obscuring other threats, selecting others for minimal attention, or even disregarding some (Dake, 1992; Slovic, 1998; Pidgeon, 1998). Since risk is a perceptual concept, it is challenging to provide one clear definition of the term risk (Aven and Renn, 2010). Renn states that all concepts of risk have one element in common (Renn, 2008): the distinction between possible and chosen action. All definitions of risk contain three elements: outcomes that have an impact upon what humans value, the possibility of occurrence (uncertainty), and a formula to combine both elements (Renn, 2008).

The Floods Directive's definition also contains those elements: “‘flood risk’ means the combination of the probability of a flood event and of the potential adverse consequences for human health, the environment, cultural heritage and economic activity associated with a flood event” (European Parliament and European Council 2007). While the definition itself is not that relevant for this study, the way it is applied and given meaning by the respective stakeholders, such as water engineers, spatial planners and policy makers, is important. The concept of risk characterises a peculiar, intermediate state between security and destruction, where the perception of threatening risks determines thought and action (Beck, 2000).

Which meaning do governmental institutions give to flood risks? This depends on the perception the governmental institutions have on flood risks. In this respect, risk is not just a matter of costs, which can be calculated beforehand and weighed against the advantages. Risk is rather a decision based on what can be foreseen and what will be subsequently regretted if a preventable loss, that one hoped to avert, occurs. The decision is the actual risk taken. As such, a decision could be made that permits actions that would cause avoidable loss—if the estimated degree of loss appears acceptable (Luhmann, 1993).

When are risks perceived as consequences of peoples' decisions and actions or when are they considered ‘an act of God’? This question is crucial if individuals feel responsible and capable to prevent or manage risks (Lupton, 2013; Renn, 2008; Aven and Renn, 2010). Climate change, for example, is increasingly seen not as an ‘act of God’ but rather that humans have a level of control over it and its consequences (Renn, 2008). However, it is still possible for risk managers to cover their own mismanagement by referring to the alleged randomness of the event (Aven and Renn, 2010). Others have claimed that risks have become more globalised, less identifiable and more serious in their effect. Therefore, manageability decreased and anxiety towards risks increased (Lupton, 2013). With this understanding, risk managers might be held accountable for events which they could not possibly provide protective actions in advance (Aven and Renn, 2010).

2.1. ‘Internal risk’ and ‘external danger’

When it comes to risk, Luhmann makes a distinction between internal and external conditions. Conditions within a subsystem are manageable, and called risks. External conditions are not manageable by the system and are instead called dangers (Luhmann, 1993; Aven and Renn, 2010). Risks are attributed to decisions made, whereas dangers are attributed externally (Luhmann, 1993). By internalising dangers, and thus accepting that they are manageable, they become risks. However, the risks a decision maker takes on become a danger for those affected (Luhmann, 1993). System management for resilience introduces its own uncertainties as a result of the complex interactions and feedbacks within the system (Cosens and Wiliams, 2012). In this perspective, the future cannot be interpreted as either predetermined or independent of human actions. Otherwise the term risk would make no sense (Zinn, 2008).

What can happen in the future also depends on decisions made in the present. This is vital to understand the system, since we can only speak of a risk if there is a decision to identify in which the loss would not occur (Luhmann, 1993). These two temporal contingencies of event and loss are firmly coupled together. However, they are not coupled as facts, but as contingencies. This coupling as contingencies makes it possible for observers to differ in the way they see things (Luhmann, 1993).

System Theory builds on the distinction between system and environment as well as the continuous interaction of the system with its environment (van Assche and Verschraegen, 2008). Risk perceptions are analysed by seeing them as a result of communications using different distinctions (Kusche and Japp, 2008). Each actor can be seen as a system of its own that interacts with its environment: the other systems. The System Theory claims to have the status of a general theory of modern society (Kusche and Japp, 2008). The universalism of the theory (Holmström, 2007) is not achieved via rigorous simplification, but rather by an inclusive, interdisciplinary and historically informed network of sociological theories. It is this universalism that makes it so attractive to use in a variety of disciplines (Stichweh, 2011; Ing et al., 2013; Boldyrev, 2013; Gershon, 2005; Kihlström, 2012; Parks and Roberts, 2010; van Raak and Paulus, 2001).

Luhmann used Parson's principle of subsystems, but instead of taking *action* as the starting point, he used *communication* (Luhmann, 1995; Luhmann, 2006; Elder-Vass, 2007; Kusche and Japp, 2008). The basis for this proclaims that someone has to have knowledge in order to make decisions. And in order to know something, communication is needed. Most of this communication takes on specific forms, each of which belongs to a specific subsystem. For example, lawyers refer to laws and rules, mathematicians to numbers and artists by expression in the form of paintings. Communications among the subsystems are always subject to their own logic and past. By using communication they can orient their operations. Since society depends on all these different functions, all subsystems are equally important and there is no hierarchy between them (Kusche and Japp, 2008). Risk is regarded as a consequence of this functionally differentiated society. In order to reach more systems, flood risk communication might have to be done in more than one form or in a form that is understandable to more than one system.

Using the distinction between system and environment, what the environment is depends on what system draws the distinction. The system *is* the difference and will always indicate to itself (Luhmann, 2006, p. 54). In the case of flood risk management many actors are involved and most of them belong to different (sub)systems. Engineers, scientists, politicians, jurists, are just some of the actors involved in the planning process and each belong to their own (sub)system. So for politicians, scientists do not belong to their respective system and are therefore part of the environment. Re-entry of the distinction basically means that any distinction the system makes always refers to the system itself, or self-reference. This self-reference also explains a systems autopoietic nature. By referring to itself, a system uses itself to evolve. It basically reproduces itself from itself (van Assche and Verschraegen, 2008, p. 266). The distinction that re-enters itself is the same and, at the same time, is not the same. This paradox can be dissolved if the distinction is drawn by an observer who can distinguish if his own distinction of system and environment is meant, or whether he is speaking of the distinction that is made within the observed system itself (Luhmann, 2006, p. 54).

A system develops its own code by experience. For example, at first there is a distinction between profit and loss. These two sides are equally balanced since there is no third variable associated with either side that could shift the weight. However, when the code is institutionalised and operations are attributed to it, an imbalance arises. Past experience will then determine which decisions will be made. This past experience informs the system which projects are likely to be profitable and which are not. In flood risk management the past experience with floods and the way the system dealt with this experience, influences their future actions. This does not eliminate the risk of making the wrong decision. The other side of the distinction (loss) is still a possibility of occurrence. In flood risk management choosing a certain solution based on past experience does not guarantee that a flood would not occur. When a system is open towards both sides of the distinction, it is possible to make a decision based on its *own* code. The system and code are firmly coupled and the code is the form in which the system distinguishes itself from the environment. This coupling between system and code eliminates decision criteria external to the particular system (Luhmann, 1993).

The floods directive obliges different actors to cooperate and therefore different social systems, each with their own code, have to cooperate. This cooperation of systems poses a challenge to the planning process, but might as well bring forward some interesting new solutions.

3. Floods as risk or danger

Floods, in particular, are regarded as mere technological challenges that can be solved with engineering solutions (Hartmann, 2011). They are seen as manageable and thus perceived as risks not as dangers (Renn, 2008; Kusche and Japp, 2008). This does not always mean that the potential flood impact has in fact increased, it has just been internalised because people are more aware of it (Renn, 2008; Rothstein et al., 2006).

For this research, we added the distinction between active and passive externalisation to the above differentiation in internalisation and externalisation. In active externalisation, policy determines who the risk taker is and who the risk bearer is. In flood risk management, it was a common practice to separate the work field of water management and spatial planning (see Fig. 1). In this practice, water management has the responsibility from dike-to-dike and the spatial planning is responsible for the surrounding areas. Water management's responsibilities include ensuring the water stays between the dikes or within retention areas (Bates, 2012; Hartmann and Driessen, 2013; Hartmann and Spit, 2016). Bates (2012) states there is a “governance Gap”, a lack of integration in planning processes, between land use and water planning. Due to this policy, water management became the risk taker for flood risks; they managed the risks, and thus created a potential danger for the surrounding area.

Passive externalisation occurs when unintended side-effects are caused due to decisions made by the risk taker. In contrast with the active externalisation, these externalisations are not steered or communicated directly by policy. They are caused by policies, but are not an intrinsic part of these policies. Decisions made by authorities upstream can have an impact on areas downstream (see Fig. 2). For example, local authorities upstream could decide to heighten the dikes along the riverbank they are responsible for. This decision could cause dangers for the areas downstream, since the water can go nowhere else but downstream. This creation of danger downstream is an unintended consequence of decisions made upstream and thus a passive externalisation. Theoretically this could cause a domino-effect of local authorities internalising the danger and moving the problem downstream.

Finally, when a potential future loss is a consequence of a decision, or attributed to a decision, it is a risk. But if the loss can be attributed to

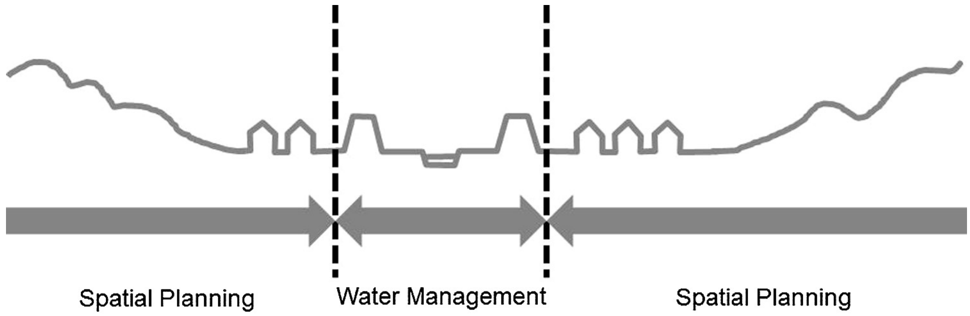

Fig. 1. The common division of responsibilities between water management and spatial planning.

external conditions outside the realm of a stakeholders' decision, it is a danger. Depending on the perspective, floods can either be a risk of decision, or a danger of the environment (Luhmann, 1993; Renn, 2008).

The flood risk management plans shall be released on a catchment-level and coordinated among upstream and downstream stakeholders. Flood Risk Management has been shown to enhance the functioning of the catchment as a whole and not to minimise flood losses (Green et al., 2013). This could solve the issues of active and passive externalisation and thus be a process of internalising–changing floods from a danger from the environment into a risk of decisions.

Water management as a subsystem needs to collaborate with other stakeholders such as spatial planning (i.e. land-use planning, regional planning), municipalities, industry, companies, or citizens. This is also foreseen in the Floods Directive: all interested parties shall be 'actively involved' in the planning process (Directive, 2007/60/EC: IX.3). According to the directive, this shall be achieved on the one side by 'solidarity' and mutual 'agreements' (Directive, 2007/60/EC: VII.4). In an interpretation of Luhmann, this implies that collaboration of subsystems is demanded, which do not necessarily share the same risk perception. Similar stakeholders can be part of the same subsystem, but this is not necessarily the case. Therefore it might happen that multiple (governmental) institutions are participating in the planning process, but do not share the same 'code'. This also goes vice versa, different stakeholders sharing the same code.

4. Case studies: FRMPs at the rivers Lippe and Emscher

According to the European Flood Directive, flood risk management plans (FRMPs) need to be developed for all rivers. In Germany, the main responsibility of developing flood risk management plans lies with the 'Bezirksregierung', a regional authority above the level of municipalities. The rivers Emscher and Lippe have been selected as the cases. The two rivers lie in the same region and share the same governmental context, but differ substantially from each other. For both the Emscher and Lippe, there are three 'Bezirksregierungen' involved, namely: Düsseldorf, Münster and Arnsberg. To develop the flood risk management plan, the 'Bezirksregierung' assesses which actors should be involved in the process and thus serves as the facilitator of the process.

The main actors involved in the development of the flood risk management plan for the rivers Lippe and Emscher, besides the 'Bezirksregierung', are the municipalities and water boards. The two water boards involved, The Emschergenossenschaft and the Lippeverband, are actually a public private partnership (Ministerium für Inneres und Kommunales des Landes Nordrhein-Westfalen, 2016) consisting of a total of 200 partners from both industrial (mining companies, commercial enterprises and the respective owners of land in the area) and governmental institutions (municipalities and district administrations) (Emschergenossenschaft, 2016).

Each 'Bezirksregierung' is free to manage the process in its own way. In cooperation with local private actors, they set out the development the flood risk management plans. The task of making the risk- and hazard maps was given to the two water boards by the 'Bezirksregierung'. For the water boards Emschergenossenschaft and Lippeverband it was the first time they had to make flood hazard and flood risk maps for different scenarios for the entire river basin. It was also the first time they had to specifically look at different scenarios in which the technical flood protection would fail. The water boards had to look behind the dikes and therefore were obliged to cooperate with the authorities responsible for the respective areas.

Municipalities are not obliged to participate in the process and the 'Bezirksregierung' acts only as the facilitator of the process. During meetings, it was noticed that, since they are not obligated to, not all municipalities are eager to participate. Even some major cities with a substantial riverbank choose not to participate. The involved 'Bezirksregierung' and water board are unsure of why these municipalities are not eager to participate. Somehow the perception or awareness of these municipalities' flood risks seems to be different than those of the actors that do participate.

While the Emscher was transformed from a natural river into a canal during the industrialisation period, the Lippe is relatively geomorphologically natural (in comparison to the Emscher). The constructed nature of the Emscher is noticeable when comparing the total length of dikes of the Emscher and Lippe. Even though the Emscher is shorter in length, the total length of dikes along the Emscher is bigger than the Lippe. Alongside its 85 km of riverbank, the Emscher has over 60 km of dikes, which is substantially more than the 32 km of dike along the

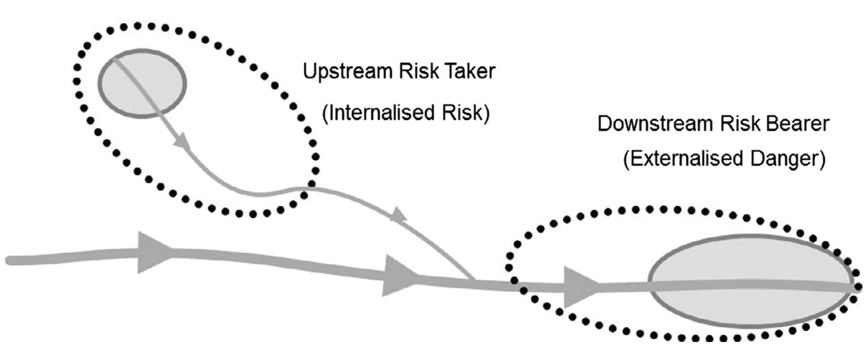

Fig. 2. Schematic of passive externalisation – the impact of upstream risk takers on downstream risk bearers.

220 km long Lippe. The dikes became a necessity because of surface subsidence caused by mining activities in the area during the 19th and 20th centuries. Surface subsidence severely disturbed and reversed the flow direction of the river, which resulted in severe flooding, and turned a predominant part of the Emscher region into "polderland" (Harnischmacher, 2007). The Lippe kept its natural course because it flows through a more rural region, where the population density is much lower than the Emscher region. While the catchment area of the Lippe is much greater than that of the Emscher, the population in the Emscher's catchment area is more dense. The Emscher flows through some of the biggest cities in the Ruhr Area, one of the most densely populated areas of Germany (2700 inhabitants/km^2). Therefore, the river does not have that much 'extra' space in case of high water levels and has caused problems during flood events.

4.1. Getting stakeholders involved: internalisation of flood risks

Since it has been some time since either the Lippe or Emscher had a major flood, municipalities are not worried about floods. The majority of the municipalities have not experienced a flood event in recent history and the awareness of the possibility that a flood might occur in their region is rather low. Therefore it was harder for the 'Bezirksregierung' to get every municipality actively involved in the planning process. However, even a municipality that is aware of flood risks does not necessarily see a flood risk as something manageable or even as their responsibility. Therefore, the risk still needs to be internalised. The interviews and observations showed that the internalisation of flood risks depends on four elements.

First, the used definition of risk sets a clear boundary between what is and what is not considered a risk. The municipalities stick to this guideline and thus only internalise flood risks for areas that fall within this guideline. In this case, North Rhine-Westphalia defined that any potential damage below €500.000, or when it is not a cultural heritage, is not automatically considered as a flood risk. When considering the definition of flood risk by the European Union, *flood risk' means the combination of the probability of a flood event and of the potential adverse consequences for human health, the environment, cultural heritage and economic activity associated with a flood event*, the definition of North Rhine-Westphalia mainly uses an economic variable to define the adverse loss of a flood. Not all the interviewed officials agreed with the used definition used as a guideline for risk internalisation. Interviewed ecologists were more interested in the adverse consequences for nature and human health than engineers, who see the monetary guideline of €500.000 – as the way to approach risks. This would suggest that social systems have their own view on how to define risks.

Second, the clear division of responsibilities is crucial for the internalisation process. The fact that it is a European directive proved to be helpful in engaging the municipalities. Both the 'Bezirksregierung' and the water board feel that the status of the plan as a European directive gives the flood risk management plan more power. Interviews with both officials from municipalities, Bezirksregierung and waterboards showed that many municipalities perceive flood protection as the responsibility of water boards (predominantly because most often flood protection is perceived as a technical, not a spatial, issue). This result corresponds with Bates'(2012) statement that there is a "governance gap" between water planning and land use planning in which the responsibilities of water management lies with the water boards. The Floods Directive tries to bridge this gap by obliging the involvement of public, private and societal stakeholders. By bridging this gap both passive internalisation and active externalisation could be covered. Both issues are caused by division of responsibilities both spatial and institutional.

The third element is the flood risk management planning process itself. The use of different forms of communication is a key factor in the process. It is a combination of the hazard maps and regional meetings. On the one hand, the hazard maps show the effectiveness of technical flood protection, but on the other hand, they also show the inability to prevent extreme flood events from happening. In the case of the Emscher and Lippe, this evokes a perception that a flood risk is unmanageable. The regional meetings are then able to explain that flood risk management is not only about the prevention of flood events, but also about damage control and risk reduction. By discussing the flood risks visible on the maps, and measures that can be taken to reduce the risks, the risk can be seen as manageable to a certain extent. By having different stages of communication, Luhmann's assumption that 'someone has to have knowledge in order in order to make decisions', can be fulfilled.

During both the interviews and observations, it became clear that the different phases in the planning process proved to be helpful. Past flood experiences were also the reason why the Germans decided to canalise the river Emscher during the industrialisation period. It has been a long time ago since a flood occurred in the Emscher river basin. Nearly all the interviewed policy makers said this is the main reason flood risk management is not seen as a priority. The municipalities needed some sort of experience or at least visualisation of the consequences. Especially the hazard maps allowed for visualisation of the actual flood risks and convinced municipalities to participate. The hazard maps functioned as artificial experience upon which the respective institutions could develop their code.

And fourth, the definition of protection levels of flood protection measures is of great importance. In German law the 1-in-100 years flood event is the standard protection level. This sets a clear boundary for the internalisation of flood risks (Fig. 3). This clear boundary of flood risks was noticed during the policy analysis, but proved to be an important legal issue during interviews with the involved water boards. Any flood events with a probability higher than 1-in-100 years is perceived as unpreventable and thus no action will be undertaken to prevent these events. In this case, the legal code determines the codes of the other systems.

5. Conclusion

The cases revealed success factors for triggering change in risk perception, or internalisation of flood risk. First, the definition of risk must be clearly understood. Second, the definition of protection

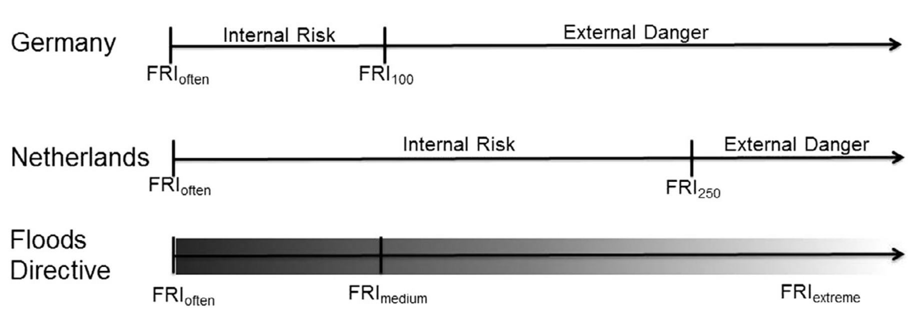

Fig. 3. Inter- and externalisation of flood risk by probability for Germany, The Netherlands and the European Floods Directive.

standards must be outlined. Third, a clear division of responsibilities should be set. And finally, the iterative phases in the planning process, notably the hazard maps, should be examined. These factors affect the awareness and worry of stakeholders and thereby contributing to internalisation of flood risk. The internalisation of the flood risk is a prerequisite for stakeholders to perceive flood risks as manageable and as their responsibility to take action and be more prepared.

For the rivers Emscher and Lippe, the lack of a recent flood experience is one of the main reasons why flood risk management is not a priority. Therefore, the risk had to be visualised first. That is where the main contribution of the Flood Risk Management Plan becomes evident. This study shows that the Flood Risk Management Plan can indeed contribute to internalisation of flood risk. The case studies confirm the expectation that “the new instrument brings the flooding issue to the agenda [but also shows that the shift is] not revolutionary” (Hartmann and Spit, 2016). The plan has indeed triggered discourses and reconsiderations in dealing with floods (Hartmann and Spit, 2015), such as to “lead to higher risk awareness in Europe, with a gradual change from a safety culture to a risk culture” (Müller, 2013, S. 124). Besides the actual measures, this will probably be one of the most important achievements of the European flood risk management plan.

The three main components of Luhman's System Theory, *communication*, *action* and *experience*, can be found in this research. Experience is needed to build up a code and with the lack of experience, other forms of communication can replace experience and eventually lead to actions to come up with solutions. In the case of the Emscher there was a lack of recent flood experience, but the Flood Risk Management Plan replaced experience with communication in the form of risk and hazard maps. This changed the perception of local governments towards flood risks. This is the major accomplishment of the Flood Risk Management Plan.

6. Discussion

Put protection levels in the international context of the European Flood Directive and the relativity of them becomes evident. Just to bring this into perspective: in the Netherlands, the protection levels differ per river. By Dutch law the standards differ between 1-in-250 year and 1-in-10.000 year flood events (Waterwet, 2017). This shows the Netherlands internalise flood risks to a greater extent than Germany. For border regions, this means that German dikes are perceived as a danger for the Netherlands, just because their standard protection levels are lower (Binnenlands Bestuur, 2014).

The comparison of flood protection levels between Germany and the Netherlands showed that there is a difference in the level of internalisation. But when comparing it to the European Flood Directive it becomes harder to draw the distinct levels of internalisation. This is caused by the scenarios used by the Flood Directive. The scenarios are ill-defined and therefore each member state can make their own definition of “an extreme flood event”. The only clearly defined scenario is the “medium scenario”, which is defined as a flood event that occurs approximately every 100 years or more often (Average Flood Recurrence Interval, RFI_{100}). However, the boundary between the probability of medium or often event occurrence is vague. This vagueness can be seen as both a blessing and a flaw. It is a clear tension between flexibility and certainty. This tension makes the boundary between internal risk and external danger less evident, but at the same time creates room for different policy solutions. The room for interpretation of what can and what cannot be defined as an extreme scenario keeps the definition of what is and what is not a risk open. Therefore, risk remains a socially constructed concept.

Laws are then used to define the norms, in Germany it is 1-in-100 year scenario and in the Netherlands a 1-in-250 year (or more) scenario. The differences in risk definition between the Netherlands and Germany can be explained by the System Theory. The Netherlands have a history of battling both coastal as well as river floods. These past flood experiences caused the Netherlands to internalise flood risks to such an extent. Slovic and Burns (2012) state that it is necessary to keep the public involved in the process to offset people’s tendency to procrastinate or to forget the hardships of past disasters.

Wood et al. (2012) also stress the importance of distributing information that is dense. Risk communication is dense when it conveys a consistent message, articulated by different information providing partners (e.g., public officials, medical experts), through multiple public communication channels (e.g., traditional and social media) over a sufficient period of time. This point has not been discussed in our study, but could well fit the System Theory approach used.

This research described the effect of the Flood Risk Management Plan on a river basin scale in Germany and also gave a short comparison between the German, Dutch and European flood risk policies. Some questions remain as to whether the European Flood Directive causes divergence or convergence of different flood risk policies. European policy itself remains flexible and in that sense, it is unclear in which direction the policies of the members will move. Due to the use of a scenario approach there is a shift from a single line of defence towards a variable line of what is and what is not considered a risk. The use of scenarios caused a gap between theory and practice. Both the stakeholder involvement and the use of scenarios on a river basin scale are new to both water management and spatial planning. Therefore, the scenarios have to be put into practice and incorporated in participation methods, while at the same time new methods for stakeholder collaboration have to be developed.

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