

Exploring the relation between governmental flood risk communication and citizens' self-protective behaviour in flood risk management

A comparative case study along the Rhine river in Germany and the Netherlands

MSc thesis by Ingrid Welles
August 2015

Forest and Nature Conservation
Policy Group



WAGENINGEN UNIVERSITY
WAGENINGEN UR

Exploring the relation between governmental flood risk communication and citizens' self-protective behaviour in flood risk management

A comparative case study along the Rhine river in Germany and the Netherlands

Study program:

MSc Forest and Nature Conservation

Student registration number:

910104937040

Course code:

FNP-80436

Supervisor:

Dr. AE Buijs

Examinator:

Dr. Ir. MA Hoogstra

Date:

24-08-2015

**Forest and Nature Conservation Group
Wageningen University**

Table of Contents

Tables and Figures	iii
Summary	v
1. Introduction.....	1
1.1. From total flood protection towards flood risk management	1
1.2. Flood risk management in the Netherlands.....	3
1.3. Flood risk management in Germany	5
1.4. Comparison between the Netherlands and Germany	7
1.5. Problem statement, research objectives and research questions	7
2. Theory and Concepts.....	9
2.1. Protection motivation theory.....	9
2.2. Hazard specific indicators of self-protective behaviour.....	13
2.3. Risk communication	15
2.4. Connecting the PMT with perceived governmental flood risk communication	16
3. Methodology	18
3.1. Study area.....	18
3.2. Data collection.....	19
3.3. Set-up of questionnaire.....	20
3.4. Data analysis.....	21
4. Results	23
4.1. Citizens' perceptions	23
4.2. Analysis of the relations within the conceptual framework	34
5. Discussion	37
5.1. Identification of current perceptions	38
5.2. Identification of the relations within the conceptual framework.....	39
5.3. Limitations and difficulties	40
5.4. Implications and recommendations for future research and policy.....	41
6. Conclusion	43
7. Reference List	44
Appendix I: Questionnaire (Dutch version).....	47
Appendix II: Average scores coping appraisal per response.....	53
Appendix III: Answer rates (%) adoption intention and actual adoption.....	54

Tables and Figures

Figure 1: Protection motivation theory, adopted from Grothmann and Reusswig (2004).	12
Figure 2: Conceptual framework based on the PMT model.	17
Figure 3: Study areas in both the Netherlands and Germany.....	19
Figure 4: Citizens's perceived preparedness	33
Figure 5: Conceptual framework.....	37
Table 1: Sampled villages	18
Table 2: Relations analysed by means of a Person correlation.....	22
Table 3: Relations analysed by means of a regression analysis..	22
Table 4: Answer rates and average attitudinal scores on statements relating governmental risk communication.....	24
Table 5: Type of Experience	26
Table 6: Interpretation of flood experience.....	26
Table 7: Perceived responsibility for personal flood disaster preparations (A) and avoidance of flood damage (B)	27
Table 8: Answer rates and average scores of risk perception.....	29
Table 9: Attitudinal scores coping appraisal	31
Table 10: Outcomes adoption intention and actual adoption.	33
Table 11: Outcomes of correlation analysis.	35
Table 12: Outcomes regression analysis.	36
Table 13: Predictive power and significance levels of regression models.	36

Summary

This report aims at gaining a better understanding of the relation between perceived governmental flood risk communication and self-protective behaviour. As total flood prevention is unachievable, the Netherlands and Germany have shifted towards a flood risk management approach. Since most damage caused by flooding is damage at the household level, governments aim to increase citizens' self-protective behaviour in order to increase resilience and decrease vulnerability of the society. Risk communication is believed to have a key role in enhancing self-protective behaviour, however no research on the role of risk communication in flood risk management has been conducted so far. In addition, differences between the Netherlands and Germany are expected. Thus, this research also compares both countries.

In order to explore the relation between perceived governmental flood risk communication and self-protective behaviour, a conceptual framework was developed based on the Protection Motivation Theory (PMT). Two hazard specific indicators were added in this model, together with perceived governmental flood risk communication. In this framework self-protective behaviour is influenced by four indicators: risk perception, coping appraisal, flood experience and perceived personal responsibility. Perceived governmental flood risk communication is an external indicator, influencing self-protective behaviour through the mentioned direct indicators.

The research conducted a survey in which the relations between perceived governmental flood risk communication and self-protective behaviour are explored. The German and Dutch outcomes were compared with each other. Data was collected through a questionnaire in villages in the municipalities of Beuningen (NL), Druten (NL), Kalkar (DE) and Xanten (DE). Villages were selected based on distance from the river and flood history. Respondents were selected through a systematic sampling design. Based on the collected data, perceptions of the respondents were identified. Relations within the conceptual model were analysed through correlation analysis and linear regression with SPSS.

Statistically significant differences between Germany and the Netherlands were found for perceived personal responsibility, flood experience, coping appraisal and self-protective behaviour. Results furthermore indicate that risk communication is perceived as ineffective, however citizens do desire more information on flood risks and options for personal flood protection. Furthermore, the probability of a flood is believed to be low, but negative consequences are estimated to be high by respondents. All attributes of coping appraisal are perceived to be relatively positive. Self-protective behaviour in Germany was significantly higher than in the Netherlands, yet levels of self-protective behaviour are low in both countries.

Statistical analysis of the possible relations found that perceived governmental flood risk communication could not predict self-protective behaviour through the conceptual framework that was tested in this research. Also, the adapted PMT model used in this research has no predictive power. Hence, the use of an adapted PMT model should be further investigated. The correlation analysis of the relations between perceived governmental flood risk perception and self-protective behaviour showed no significant correlations.

Future research should focus on deepening the knowledge on the role of risk communication in flood risk management. In addition, new potential variables of self-protective behaviour should be investigated. By means of comparisons such as conducted in this research, differences can be indicated and might prove useful in research on the construction of self-protective behaviour. Current perceptions of the Dutch and German public show promising results which flood risk managers could use. However in order to be effective as possible, flood risk communication should be two directional and citizen involvement should be further enhanced.

1. Introduction

This thesis research will focus on the role of perceived governmental flood risk communication in enhancing public self-protective behaviour within the context of flood risk management in the Netherlands and Germany. It was attempted to explore the relations between perceived governmental flood risk communication and self-protective behaviour through an adapted conceptual framework that used the protection motivation theory for its foundations. Furthermore, the model was used to explain possible differences between the Netherlands and Germany. Both countries shifted to a higher emphasis on the role of citizens and their self-protective behaviour, yet have a different approach in flood risk management (Terpstra and Gutteling, 2008; Steenhuisen et al. 2007; Petrow et al., 2006). Therefore differences between these countries were expected.

This chapter will provide background information on the concept of flood risk management and how this concept has been applied by both the Netherlands and Germany. Based on this information the problem statement, research objective and research questions will be formulated. Please note that the information in this chapter is based on the existing literature. Findings from this research will be compared with the literature in chapter 5. The second chapter of this report will focus on the theoretical background of this research. Also the conceptual framework that will be used shall be discussed. Chapter 3 and 4 will cover the methodology and outcomes of this research. These findings will be placed within the theoretical and management context in chapter 5, followed by the main conclusions which will be provided in the final chapter.

1.1. From total flood protection towards flood risk management

For generations, men have settled on floodplains worldwide in order to profit from fertile land, fresh water and shipping opportunities. Despite the benefits, living on the floodplains comes with the threat of flooding. Flooding itself is a natural phenomenon which can be defined as the temporal covering of the land by water outside its normal confines (Schanze, 2006). When social, economic and environmental systems experience negative consequences of flooding, flood becomes hazardous (Schanze, 2006). Europe for example, faced 213 major floods between 1998 and 2009 which caused 1126 deaths according to the European Commission (2014).

Beside the loss of lives, flood hazards can have an impact on varying aspects of daily life. Economic loss, for example, does not only account for direct losses of flooded houses, but can also have a large impact on the economy on national and even global scale. If a major harbour such as the Rotterdam harbour in the Netherlands should be affected by a severe flood, a significant part of the shipping and land transportation industry would be affected, which in turn negatively affects economies in several countries. Flood hazards additionally pose a threat to human health (both physical and mental) and the environment. This can be caused by inundation of contaminated sources such as waste water plants or installations holding toxic chemicals (European Commission, 2014). Finally, the cultural heritage of an area can also be affected by a flood.

The extent of the impact of a flood hazard depends on flood characteristics and the vulnerability of a social, economic or environmental system in the flood prone area (Messner and Meyer, 2006). Flood characteristics have been influenced by land use and water management practices in the past. Vulnerability and flood characteristics of flood prone areas in Europe has been increasing over the past decades due to population growth and a rise in economic activity in these areas (Bradford et al., 2012; Linde et al., 2011; Baan and Klijn, 2004). In addition these aspects are likely to be further influenced by the expected effects of climate change such as changes in weather patterns (Linde et al. 2011).

In the light of future changes in weather patterns and river systems, many European countries shifted from a preventive water management approach towards flood risk management. Total flood prevention has been proven to be impossible and unsustainable; hence more attention should be paid to the management of remaining flood risk, the *residual risk* (Bradford et al., 2012; Schanze, 2006; Terpstra and Gutteling, 2008). An essential part of flood risk management is the aim to increase resilience and decrease vulnerability of societies by covering all aspects of the disaster cycle: prevention, preparedness, mitigation, response and recovery.

This shift towards flood risk management has been acknowledged by the European Union who decided to implement the European Floods Directive in 2007. This directive emanated from the idea of flood risk management and aims at reducing the risk that flood poses to human health, environmental and cultural values and economic produce (European Commission, 2014). The floods directive requires countries to develop flood risk management plans. These plans should focus not only on flood prevention, but also include preparedness-related aspects (European Commission, 2014; Slomp, 2012). Additionally, flood risk management plans need to be incorporated with an international flood risk management plan for the whole river catchment in order to divide the risk of flood more equally instead of reducing the risk of flooding in one area and increasing it elsewhere in the catchment (Slomp, 2012).

The described situation also applies for the Rhine river which is regarded as one of Europe's main rivers. 58 million people inhabit the Rhine river basin of which 10.5 million live in flood prone areas. Additionally, the Rhine is one of the world's most important industrial routes. It connects the port of Rotterdam with the inland European markets and industrial areas (Linde et al., 2011). In the past, flooding of the Rhine has caused major flood hazards in populated areas along the Rhine, most recently in 1993 and 1995 (Baan and Klijn, 2004; Petrow et al., 2006). These floods accounted for €1.4 and €2.6 billion damage respectively (Linde et al., 2011).

Currently, the highest potential damage along the Rhine catchment can be found in the Netherlands with a potential damage of € 110 billion (Linde et al., 2011), however the area with the highest flood risk is located in Germany in the state of North Rhine-Westphalia which borders to the Netherlands. The difference in flood risk can be explained by the higher safety standards in the Netherlands.

These flood risks will likely change in the future. According to Linde et al. (2011), climate change scenarios predict an increase in both frequency and magnitude of flood peaks in the Rhine river in the future. In 2050, annual peak discharges are estimated to increase by 3% to 19%. Additionally, population and economic activity are likely to grow in the future which will increase the already high vulnerability in these areas. Similar to other European countries, both the Netherlands and Germany adopted the flood risk management approach in order to cope with future flood risks. This shift means an increasing emphasis on the involvement of citizens in flood preparedness.

Preparatory behaviour of the public plays a central role in this research. As mentioned, this research aims to explore the relation between perceived governmental flood risk communication and self-protective behaviour of the public. However, in order to investigate this relation one should be familiar with the management context in which self-protective behaviour is promoted. Therefore an overview of the current flood risk management strategies of both countries will be provided in the following sections.

1.2. Flood risk management in the Netherlands

Nearly two third of the Netherlands consists of flood prone areas threatened by both rivers and storm surges. Of these flood prone areas nearly 25% lie below sea level (Slomp, 2012; Terpstra and Gutteling, 2008). About half of the Dutch population lives in flood prone areas and two third of the Dutch gross national product is produced in this area (Slomp, 2012; Stive et al., 2011). This concentration of people and economic activity makes the Dutch delta highly vulnerable. Steenhuisen et al. (2007) indicate that potential material damage by floods can reach to 130 billion Euros.

Throughout history the Dutch population was confronted with floods and their consequences. The last river floods occurred in 1926 and the last major flood that hit the Netherlands was the 1953 North Sea flood disaster which killed 1853 Dutch. After this disaster the Dutch invested in an improved flood defence system and no major floods have occurred in the Netherlands since, although flood hazards nearly occurred in 1993 and 1995 along the Rhine river which re-ensured the danger of living in flood prone areas (Slomp, 2012).

Understandably, the Dutch have invested much in strong flood prevention works such as elaborate dike and drainage systems. This investment started centuries ago with the development of water boards, dike systems and other flood prevention measures such as “terpen”, man-made hills on which houses or villages were built in to prevent them from flooding (Slomp, 2012). In addition the Dutch modified the land and rivers through land reclamation and straightening of rivers. The reclamation of the Flevopolder between 1950 and 1968 is a famous example of land reclamation in the previous century. For long this preventive approach was described as the Dutch “fight against the water”.

1.2.1. Resistance approach

The Dutch situation, as described above, is a resistance approach according to Steenhuisen et al. (2007). This approach aims at reducing the likelihood of a flood by focussing on prevention strategies such as strengthening dikes and the creation of retention areas. Within this view, flood is seen as a safety problem that needs to be tackled. Hence, creating safety is of primary importance and other aspects of river management are of secondary importance. This means that there is no or little room for trade-offs. Weather patterns and upstream management are seen as causes of flood.

The Dutch resistance approach is most visible when one looks at the current Dutch flood defence system which is highly focussed on the prevention of floods. Within the Dutch flood risk policy setting the resistance approach is also visible. Policy makers prioritize flood safety and long relied on technical solutions for complete safety. Also, sustainable flood risk management in the Netherlands is interpreted as sustaining long term flood safety. This is reflected in projects such as, for example, room for the river, where the three main objectives are all related to water safety (Ruimte voor de Rivier, d.u.; Steenhuisen et al., 2007).

The strong focus on absolute flood safety through technological interventions has been attenuated over the last decade due to the shift towards flood risk management. This shift started following the discussion on climate change that at that time reached the public discussions. It became clear that flood events such as those in 1993 and 1995 were likely to occur more often due to climate change (Jiggins et al., 2007). It was concluded that the Dutch protection-only system was an efficient system but not resilient enough during extreme flood events, which are likely to occur more often in the future. Hence new projects were developed within a new paradigm in which flood management was no longer an engineering-only affair, but included other disciplines as well such as ecological aspects (Stive et al., 2011; Wolfert, 2005). Projects focussed on more ecological solutions such as *room for the river* were developed, aimed at restoring the rivers’ old floodplains in order to enlarge the discharge capacity and discharging water as efficient as possible.

Another shift further into the flood risk management paradigm occurred in 2005. The flood disaster caused by hurricane Katrina in New Orleans (USA) in 2005 formed a trigger point for the Dutch government to revise water management in the Netherlands once again (Terpstra and Gutteling, 2008; Stive et al., 2011). This shift towards flood risk management resulted in the adaptation of the multi-layer safety concept in the Netherlands (Slomp, 2012). Using this concept, the Dutch population will be protected by three levels of safety. The first level consists of the flood protection systems such as dike rings. Level two focuses on measures related to spatial planning. An example of this is the building of additional levees around fragile structures such as nuclear plants. In case of a dike breach these structures have a higher chance of withstanding the flood. The third layer of the multi-layer safety consists of flood alerts and communicative measures; aimed at preparing citizens (Slomp, 2012).

1.2.2. Role of citizens

Following the resistance approach, the Dutch government traditionally took full responsibility to protect citizens from flood. However, with the shift towards flood risk management and the multi-layer safety concept, other levels of protection and mitigation are acknowledged, including the role of citizens in flood mitigation. Hence the role of citizens is changing. Citizens are increasingly expected to take responsibility and enhance their self-reliance (Gutteling et al., 2010). This includes that citizens are expected to show self-protective behaviour by implementing measures for personal flood protection. These measures include for example information searching or the purchase of an emergency kit.

Citizens' responsibility to be prepared for a flood event has been non-existent in the Netherlands, yet it was concluded from surveys conducted by Terpstra and Gutteling (2008) that the majority of the respondents was willing to accept their personal responsibility to prepare for flooding. 18% of the respondents indicated the preparation for flood as a personal responsibility of citizens whereas 50% indicated the individual and the government as equally responsible for flood preparedness.

The governments' emphasis on citizens' personal responsibility also highlights another issue in Dutch water management: the low levels of risk awareness among the Dutch public. A large majority of the Dutch does not worry about the possibility of a flood as flood protection is seen as a moral responsibility of the government and other concerned authorities (Baan et al. 2008). They are aware of the fact that a flood can happen and that there will be large consequences, however most people do not know what to expect during a flood and what the exact consequences will be. Baan et al. (2008) found that 56.3% of the Dutch respondents indicated to be not or little concerned about a possible flood. However, they do perceive the consequences as high. 52% of the respondents indicated that there would be considerable damage to houses. According to Terpstra and Gutteling (2008) the low risk perception is maintained by the high trust citizens place in the Dutch expertise in water management and flood protection works. Flood protection such as the Delta works is seen as evidence of the Dutch expertise of which they are proud. Trust in governmental authorities however is rather low.

Although many of the possible measures within personal flood protection are by citizens believed to be effective, levels of actual self-protective behaviour among Dutch citizens are low. For the different measures that were examined, the rate of people who adopted the measures was between 0.7 to 10.8% (4.5% on average; Baan et al., 2008). Preparations that people were willing to conduct mostly concerned preparations related to information searching for emergency situations such as knowing where the nearest evacuation routes are (Terpstra, 2010). Preparations related to damage prevention were by the public not seen as necessary or useful preparations according to Terpstra (2010) and Baan et al. (2008).

As levels of self-protective behaviour are low among the Dutch public, the government tries to raise these levels with risk communication. However, in order to be effective, public perceptions on risk communication should be known. When asked by Gutteling et al. (2010), survey respondents indicated that they desire more information on flood preparedness which is surprising as the low risk awareness and personal responsibility suggest that the Dutch public has little interest in being informed on flood risk. Respondents were furthermore able to indicate specific needs of information such as accurate and up to date information that is relevant for the local situation. Desired information was related to crisis situations such as information on evacuation routes or probable water levels. Information how to avoid damage was seen as less urgent (Gutteling et al., 2010). Noteworthy is that preparative behaviour relevant to emergency situations was perceived as more useful than flood mitigation measures aimed at damage prevention (Baan et al., 2008).

However, current governmental communication could be improved according to the respondents. Both the information and the information sources were unclear, and information should be more in line with citizens' preferences (Gutteling et al., 2010). Also, respondents indicated that they wished to be taken seriously and wanted to be involved in decision making processes on flood risk management on a local base.

1.3. Flood risk management in Germany

The presence of the primary rivers in Germany has caused major disasters in the past. In the Rhine river basin, flooding in 1993 and 1995 caused large disruptions and in 2002, the Elbe floods caused what was thought the "flood of the century". This flood caused 100 deaths and damages reached up to 9 billion Euros, exceeding all damages caused by previous floods in Germany. The large impact of this flood shocked both the public and authorities and initiated political investments to change flood management (Garrelts and Lange, 2011).

A national political investment such as after the Elbe floods is rare, since Germany is a federal republic consisting of sixteen states. Each of the states has a high level of independence and large differences can occur between states. Therefore it is important to note that although German flood risk management in general follows similar guidelines (set by the national government), each state can fill in these guidelines freely. This research will focus on the state of North Rhine-Westphalia, which borders the Netherlands. North Rhine-Westphalia is seen as one of the leading states in Germany when it comes to flood risk management according to Becker and Raadgever (2006). According to Petrow et al. (2006), North Rhine-Westphalia emphasizes the importance of self-protective behaviour in their flood risk management and was one of the first states to acknowledge the importance flood risk maps and making them accessible to the public. In addition, the state focuses on cooperation between the Netherlands and other states as its water safety is influenced by both down and upstream measures (Becker and Raadgever, 2006; Garrelts and Lange, 2011).

1.3.1. Resilience approach

After the Elbe floods in 2002, Germany witnessed a paradigm shift in river management. The flood risk management approach was adopted in order to focus on different aspects of risk management such as flood response and preparation. Also, the floods of 2002 made such an impact and caused such political pressure that the national government adapted the Flood Control Act (Garrelts and Lange, 2011; Petrow et al., 2006). With this program the national government intended to learn lessons from the 2002 Elbe floods and to improve river management by standardizing flood policy among the states. All states are now obliged to develop management plans for the coming four years in which both upstream and downstream actors need to be involved. This includes that states and regional governments should inform the public on flood risks and how to prepare themselves. Previously, information provision was lacking as authorities were hesitant to inform the public as they were afraid that the public would not be able to deal with this information appropriately and would be frightened (Merz and Emmermann, 2006; Petrow et al., 2006). Moreover, all states must indicate flood prone areas in which building restrictions apply. Citizens should be involved in the decision making process on flood risk management in order to raise awareness.

The German response to the Elbe floods as described above emphasizes the enhancement of soft measures such as information sharing, citizen involvement and standardizing policies between both states and municipalities. Also, the focus is not on protective measures, but the avoidance of flood damage through citizens' self-protective behaviour, ecological prevention and building restrictions in flood prone areas. This approach follows from what Steenhuisen et al. (2007) indicate as the resilience approach. Instead of absolute protection, this approach strives to reduce potential damage caused by flooding. Flood is not only seen as a threat to society but it is also seen as a natural event that also has benefits such as the provision of water and fertile soils. Because flood events are seen as a part of life, the urgency of reducing the likelihood of flood is low. Therefore the safety issue is not prioritized over other aspects and can a trade-off be made between safety, economic and ecological aspects (Steenhuisen et al., 2007; Becker and Raadgever, 2006).

Looking at safety, it can be concluded that the resilience approach sees human intervention in flood prone areas as a cause of negative consequences of flooding (Steenhuisen et al., 2007; Vogt, 2012). By altering the area, flood patterns are negatively influenced and building residential areas and industries in a flood prone area increases the chance of negative consequences by flooding as Steenhuisen et al. (2007) state.

1.3.2. Role of citizens

As mentioned, German flood risk management emphasises the avoidance flood damage rather than the avoidance of flood occurrence. An important role is reserved to German citizens in the avoidance of flood damage. German citizens are expected to take their own responsibility in protecting their valuables and avoiding flood damage.

Research conducted in North Rhine-Westphalia showed that levels of personal responsibility among citizens were high (Janssen, 2008). This is supported by the article by Becker and Raadgever (2006) in which it was noted that after the 1993 and 1995 Rhine floods, levels of risk awareness and personal responsibility have increased in North Rhine-Westphalia. The notion that everyone is responsible for their own safety is underlined by the states' approach to personal protection. In the state of North Rhine-Westphalia, citizens in flood prone areas are obligated by law to strive for damage reduction and to prepare themselves appropriately (MKULNV-NRW, 2013).

Similar to the levels of self-responsibility, civil involvement increased after the Rhine floods in 1993 and 1995 (Vogt, 2012). This civil involvement has various shapes such as establishing civil flood awareness organisations, the establishment of flood museums, landmarks etc. (Vogt, 2012). Also many citizens participate in workshops which are organized by the government. In these workshops emphasis is placed on explaining potential damage and how to prevent this damage. Experiences of citizens play an important role during these activities.

Self-protective behaviour is relatively common among German citizens. In their research, Thieken et al. (2007) note that most people do seek information on emergency situations or insure themselves against financial risks (around 65%), but few take preparative action such as flood proofing their houses (varying from 20% up to 40%, depending on the measure). Grothmann and Reusswig (2004) found similar results in their research in Cologne. They found that 48% of the respondents informed themselves on options for personal flood protection, 43% moved valuables to safe places, 38% purchased flood protection devices such as water pumps and 31% implemented structural measures such as waterproofing of basement.

Recently the governments of North Rhine-Westphalia and other states have emphasized risk communication as a tool to increase self-protective behaviour among citizens. Besides workshops and flood hazard maps the government of North Rhine-Westphalia and in particular the city council of Cologne (Köln) (Vogt, 2012), communicate through different media to raise awareness such as flood emergency-exercises, exhibitions in public areas such as train stations and "high water walking routes". Flood education on schools is an important tool of the government to raise awareness (Vogt, 2012). Current communication concentrates on raising awareness but according to Thieken et al. (2007), practical information on how to protect yourself and your property is also needed in the information supply.

1.4. Comparison between the Netherlands and Germany

In general, as Steenhuisen et al. (2007) state, the Netherlands and Germany are likely minded countries. Regarding flood risk management, both countries have adapted similar principles in flood management: ensure sustainability, create more room for the river and address causes of flooding upstream (Steenhuisen et al., 2007). But there are also differences between the two countries which originate from their management approach. The Netherlands follows a resistance approach, aimed at reducing the likelihood of a flood occurrence, while Germany follows a resilience approach which accepts the possibility of flood as a part of life and instead aims at reducing flood impacts. The difference in approach also leads to different priorities in water management. In the Netherlands safety has top priority, leaving little room for other interests. In Germany these interests are seen as of equal importance and trade-offs need to be made.

Resulting from these distinctions, practical differences in management occur (Steenhuisen et al., 2007). As flood is seen as a national safety issue, the Dutch government traditionally takes the responsibility to protect the citizens, leaving little room for citizen involvement. However, with recent shifts towards the flood risk management approach, the Dutch government increasingly tries to enhance citizens' personal responsibility, which is yet non-existent. Germany on the other hand, balances different interests which makes cooperation and negotiation with different actors necessary in water management. An important role is played by local communities. Also, the believe that flooding is a natural event and part of life, emphasizes that citizens should take their own responsibility in protecting their property against flood. On the regional level this vision is translated into building restrictions in order to avoid flood damages.

When looking at the role of citizens in flood risk management it is more reasonable to compare the Netherlands with the German state of North Rhine-Westphalia which borders with the Netherlands. Whereas the resilience approach is similar in all German states, local differences in communication strategies and cooperation with local actors exist between states.

Flood risk in Germany is by the public perceived to be low, but for North Rhine-Westphalia higher levels of flood risk awareness were mentioned in the literature (Grothmann and Reusswig, 2004; Vogt, 2012). Especially after the Rhine floods in 1993 and 1995 these levels have increased. The sense of self-responsibility is also high among citizens in North Rhine-Westphalia as the general opinion among citizens is that everyone is responsible for his or her own safety. Citizens flood awareness organizations work together with the government to organize activities to raise awareness. The government itself focuses on raising risk awareness, whereas information on practical ways of self-protection often is lacking in the communication (Thieken et al., 2007).

This is contrary to the Netherlands where citizens see the prevention of flood damage as the moral responsibility of the government. Also, Dutch citizens have low levels of risk awareness, personal responsibility and self-protective behaviour, as citizen involvement has been non-existent in water management until the shift towards flood risk management. Nevertheless, Dutch citizens do want to be involved in flood risk management and wish to receive more information on flood protection.

1.5. Problem statement, research objectives and research questions

As described above, both the Netherlands and Germany have shifted towards flood risk management in the past years. One of the changes that comprises this shift towards flood risk management is the focus on citizen involvement in flood mitigation. Citizens are increasingly expected to individually prepare for a possible flood hazard since most of the flood damage caused during a flood hazard is damage of individual property (Grothmann and Reusswig, 2004). According to the ICPR, long term preparedness and adaptation at the household level could reduce the monetary damage by 80% (Grothmann and Reusswig, 2004). Hence by preparing the public, governments intent to decrease vulnerability and thus the flood impact.

In the Netherlands the involvement of the public in flood preparation is new and thus levels of self-protective behaviour among the public have been low (Terpstra and Gutteling, 2008). In Germany citizen involvement is more embedded in flood risk management however, levels of self-protective behaviour are relatively low as well (Grothmann and Reusswig, 2004; Thieken et al., 2007).

Risk communication is seen as the most important tool to enhance self-protective behaviour among citizens. In addition, risk communication is believed to influence several possible indicators of self-protective behaviour such as risk perception and perceived response efficacy (Bubeck et al., 2012; Petrow et al., 2006; Terpstra and Gutteling, 2008; Wachinger et al., 2013). Yet, current risk communication strategies seem to have little to no effect on self-protective behaviour or possible indicators of self-protective behaviour such as risk perception. Although extended risk communication is recommended in most of the literature, little research was found on the role of risk communication in flood risk management and no research was found on the actual relation between risk communication and self-protective behaviour or any of its possible indicators (Kellens et al., 2013).

Therefore the main objective of this research is *to explore the role of perceived governmental flood risk communication in citizens' self-protective behaviour*.

By investigating the role of risk communication in self-protective behaviour this research aims at contributing to filling the knowledge gap in risk communication in flood hazards. Additionally a better understanding of self-protective behaviour itself will be achieved by including possible indicators of self-protective behaviour that were found in the literature (see chapter 2).

Due to practical constraints, flood risk communication as a whole will not be researched in this research. Therefore the focus will be on governmental flood risk communication as perceived by the public. Governmental communication is seen as the most important aspect of risk communication and when recommendations are given in the literature it is mostly given for governmental flood risk communication. It was decided to focus on the perceptions on governmental flood risk communication, as current perceptions on governmental flood risk communication provide valuable information for managers.

As sub objective this research aims to compare citizens' self-protective behaviour in the Netherlands and Germany (more specifically, the state of North Rhine-Westphalia). Despite their intensive cooperation in flood risk management, a comparison between Dutch and German self-protective behaviour and flood risk communication was never made before, to the authors' knowledge. Although preventive measures are similar, the role of citizens is different in the Netherlands and Germany (MKULNV-NRW, 2013; Terpstra and Gutteling, 2008). Hence differences are expected. This research attempts to explain possible differences within the context of perceived governmental flood risk communication and self-protective behaviour.

Following from the research the following research questions are formulated:

"How does flood risk communication relate to self-protective behaviour of Dutch and German inhabitants of flood prone areas near the Rhine River?"

- a. How is the governmental flood risk communication that relates to self-protective behaviour, perceived by Dutch and German citizens?
- b. How are the different indicators of self-protective behaviour, perceived by Dutch and German citizens?
- c. How does the perceived governmental flood risk communication relate to the different indicators of self-protective behaviour?
- d. How do the different indicators of self-protective behaviour relate to self-protective behaviour itself?
- e. What are similarities and differences between the Dutch and German public, regarding self-protective behaviour and perceived governmental flood risk communication?

2. Theory and Concepts

The exploration of the role of governmental flood risk communication in self-protective behaviour starts with a good understanding of both concepts. Within the context of flood risk management, self-protective behaviour is an important aspect as it is believed that high levels of preparedness among the public increase resilience and consequently vulnerability. Hence, much research has been conducted aiming at obtaining a better understanding in how self-protective behaviour is constructed. Also, different possible indicators of self-protective behaviour have been researched extensively. Risk perception is one of the most frequently researched aspects in this context.

Although communication itself is a broad research area that has been studied comprehensively, research conducted on risk communication in the context of natural hazards has been minimal (Kellens et al., 2013). Nevertheless, its importance in flood risk management has been acknowledged and research on risk communication is increasingly encouraged in the existing literature.

This chapter will provide an overview of the different concepts that are involved in self-protective behaviour and governmental flood risk communication. In addition, a conceptual framework will be presented at the end of the chapter based on the protection motivation theory (PMT). The PMT is a cognitive decision-making theory from health behaviour research and indicates the aspects that are judged in the decision making process for self-protective behaviour. This model has proven to be a useful tool within flood hazard studies (Grothmann and Reusswig, 2004). Since the PMT does not originate from flood hazard studies, not all indicators specific to self-protective behaviour in flood risk management are included in this model. Therefore, this chapter will also introduce flood experience and perceived personal responsibility, two hazard specific concepts frequently named in the existing literature.

2.1. Protection motivation theory

Self-protective behaviour, in the literature also referred to as preparedness, precautionary action or self-reliance, plays a key role in decreasing vulnerability as flood damage is to a large extent related to citizens' property and health (Grothmann and Reusswig, 2004). Self-protective behaviour is defined as behaviour that aims at avoiding damage by taking actions to protect those goods that are of importance to the individual (Messner and Meyer, 2006). The adaptive measures that can be taken are classified into three categories: mitigation measures, preparative measures and recovery measures. Each of the measures can be taken at different times relative to the actual flood event (Kellens et al., 2013). Mitigation measures include more structural measures to prevent future damages such as waterproofing of the house, while preparative measures aim at short term preparations such as emergency responses. Recovery measures facilitate a fast recovery after a flood event. An example of recovery measures is the purchase of a flood insurance. In other literature only two types of flood responses are indicated: structural (mitigation) and emergency (preparative) measures (Terpstra, 2010; Grothmann and Reusswig, 2004). In this distinction recovery measures are included as mitigation measures.

Much research was conducted to indicate how self-protective behaviour is influenced and many possible indicators have been identified in past research. Consequently several models exist that aim to explain self-protective behaviour. Three models that were used in the context of natural disasters will be introduced in the next section.

2.1.1. Socio-psychological models

Self-protective behaviour and possible aspects that influence this behaviour have been researched extensively. Much of this research focussed on socio-economic or socio-geographic aspects. Examples of these socio-economic and social-geographic aspects are age, gender, income, marital status, distance of residence to river and education (Grothmann and Reusswig, 2004; Thieken et al. 2007, Baan et al., 2008). Beside these aspects, it is believed that people's behaviour can also be predicted from their perceptions on cognitive (or perceptual) aspects such as risk perception, perceived efficacy and experience. Models that attempt to explain self-protective behaviour through cognitive aspects are socio-psychological models.

When comparing a traditional socio-economic model with a socio-psychological model to explain self-protective behaviour in flood risk management, Grothmann and Reusswig (2004) concluded that the use of cognitive aspects provides better results than socio-economic aspects; the used cognitive aspects proved to have higher significant predictive power than the socio-economic aspects.

As this research aims at investigating a possible relation between self-protective behaviour and perceived governmental flood risk communication (a cognitive aspect), the focus of this research will be on the cognitive aspects in self-protective behaviour rather than socio-economic aspects.

There are different socio-psychological models that attempt to analyze cognitive processes in self-protective behaviour. Within disaster studies several methods are used, however these are mostly limited to studies in the USA on earthquake preparatory behaviour (Grothmann and Reusswig, 2004; Terpstra, 2009). In a European flood context, the Protective Action and Decision Model (PADM), the Motivation-intention-volition model (MIV) and the Protection Motivation Theory (PMT) are used (Kellens et al. 2013; Terpstra, 2009; Grothmann and Reusswig, 2004).

The PADM, applied by Terpstra (2009) in the Netherlands, aims at understanding the cognitive processes in self-protective behaviour through two hazard adjustment attributes: *Efficacy Attributes*, which indicate the relation between the precautionary action and the hazard itself, and *resource related attributes*, focussing on the relation between the precautionary action and the resources available within a household (e.g. money, skills and help from others). The hazard adjustment attributes are influenced by demographic characteristics and the location of the household in a risk area. Beside hazard adjustment attributes, risk perception is also believed to be of influence in self-protective behaviour. The PADM model is viewed as a good tool for policymakers, because of its focus on perceptions of different protective measures, rather than self-protective behaviour in general. By using this model, one can analyse why some measures are favoured over others and this model can therefore be used in a management context. (Terpstra, 2009)

The MIV model, as described in Kellens et al. (2013), identifies three phases in which self-protective behaviour is initiated. Risk perception initiates the first phase of motivation. The motivation to perform self-protective behaviour can be reduced by a lack of personal responsibility or the trivialization of the perceived risk in order to avoid negative emotional consequences. The second phase, intention, is influenced by the perceived response and cost efficacy. In the final phase, intention is turned into action, depending on situational barriers (Kellens et al. 2013).

The third socio-psychological model which will be discussed in this section is the Protection Motivation Theory (PMT), which is used in research on flood preparedness by Grothmann and Reusswig (2004) in Germany. The Protection Motivation Theory, developed by Rogers, originates from the domain of psychological research on health behaviour, but has also been applied outside this domain in multiple fields according to Grothmann and Reusswig (2004).

The PMT model identifies two appraisals in the decision making process of self-protective behaviour: *threat appraisal* (also known as risk perception) and the *coping appraisal*. These two appraisals influence both non-protective responses and protective responses. The protective response is active self-protective behaviour to prevent damage. Non-protective responses include fatalism, denial and wishful thinking. These non-protective responses do not lead to damage prevention.

The described models all use similar indicators for self-protective behaviour, yet the PMT was found to be the most suitable model for this research. The PMT and the PADM models are very similar, though rather than indicating self-protective behaviour as an overall concept, the PADM model makes a distinction between the different responses. Also, the efficacy attributes and resource requirements are discussed in more detail than in the PMT. This makes the PADM model rather complex and less suitable for an initial exploration of new relations between indicators and self-protective behaviour. The MIV model is less complex than the PADM model, however the flexibility of the model to include new indicators has not yet been tested. Again, this was not found suitable for an initial exploration of relations.

Contrary to the PADM and MIV, the PMT is a clear model without too many interacting variables. As demonstrated by Grothmann and Reusswig (2004), the model also proves to be a flexible model in which adaptations can easily be made by including new aspects that are of influence in self-protective behaviour. Therefore the model is ideal for exploring the relation between governmental flood risk communication and self-protective behaviour.

2.1.2. *Indicators of the PMT*

The general outline of the PMT has been explained in the previous section. This section will describe the different components in the PMT in more detail. The protection motivation theory distinguishes two main appraisals: the threat appraisal and coping appraisal (see figure 1).

Threat appraisal, commonly known and hereafter referred to as risk perception, indicates how an individual perceives the risk of experiencing the negative consequences of a hazardous event. Risk perception is by generally seen as a crucial indicator for self-protective behaviour. According to Schanze (2006), risk perception is defined as “the construction of risk as the individual or collective imagination of a probable negative consequence. This is based on values, feelings, experiences and perspectives which are influenced by the culture or a society. It is not interpreted as a gradual awareness of a somehow specified real risk” (pp. 8). Bradford et al. (2012) interprets risk perception as “an interpretation or impression based on an understanding of a particular threat that may potentially cause loss of life or property” (pp. 2300).

In much research risk perception is divided into the *perceived probability* of a flood event (the likelihood) and the *perceived negative consequences* of a flood event (i.e. Grothmann and Reusswig 2004; Bubeck et al. 2012; Sjöberg et al., 2004). The PMT recognizes this distinction as well by including perceived probability and perceived severity (perceived consequences) in the model. The latter is positively influenced by fear according to Grothmann and Reusswig (2004).

Much research has been conducted on the relation between risk perception and self-protective behaviour (i.e. Baan and Klijn, 2004; Bubeck et al. 2012; Sjöberg et al., 2004). One of the hypotheses emphasizing the importance of risk perception is the motivational hypothesis, which states that “people undertake precautionary measures to reduce the risk they perceive as being high.” (Bubeck et al., 2012, pp. 1482). This means that a high risk perception will positively influence the willingness to take action or, as named in the PMT, the protection motivation. However, much of the empirical research on the relation between self-protective behaviour and risk perception reported no or weak significant relations, especially when other aspects are included in the research as well (Bubeck et al., 2012). Despite the contradicting research results, flood risk managers see raising risk perception as one of the most important aims to enhance self-protective behaviour among citizens, although raising this awareness has been proven to be difficult.

Therefore research also concentrated on identifying how risk perception itself is constructed. However, until now only 50% percent of individual risk perception has been explained and many of the possible relations between indicators and risk perception were found to be weak or insignificant (Baan and Klijn, 2004; Bubeck et al., 2012). Many aspects that appear to influence risk perception seem to directly influence protective behaviour as well, which emphasizes the complexity of this research area.

Coping appraisal specifies how “a person evaluates his or her ability to cope and avert being harmed by a threat, along with the costs of coping” (Grothmann and Reusswig, 2004, pp 104). Coping appraisal in the PMT consists of three attributes according to Grothmann and Reusswig (2004). The *protective response efficacy* is the individual’s perception of the effectiveness of a protective response to protect the individual from harm. If a flood is expected to cause a water level of 1 meter in a house, the owner might perceive the storage of valuables in a high dry place to avoid flood damage as effective. The second attribute in coping appraisal is *perceived self-efficacy*, the believe that the person is able to conduct the action himself to prevent harm. Relating to the first example, an elderly couple might perceive the relocation of a heavy device upstairs as too difficult to do on their own, while a young couple would have little trouble moving valuables. The last aspect of coping appraisal is the *protective response costs*. This is a cost benefit analysis of all the *assumed* costs to perform the response. These costs can be monetary, but also time and effort factors are included. Note that the perceived costs are not the actual costs.

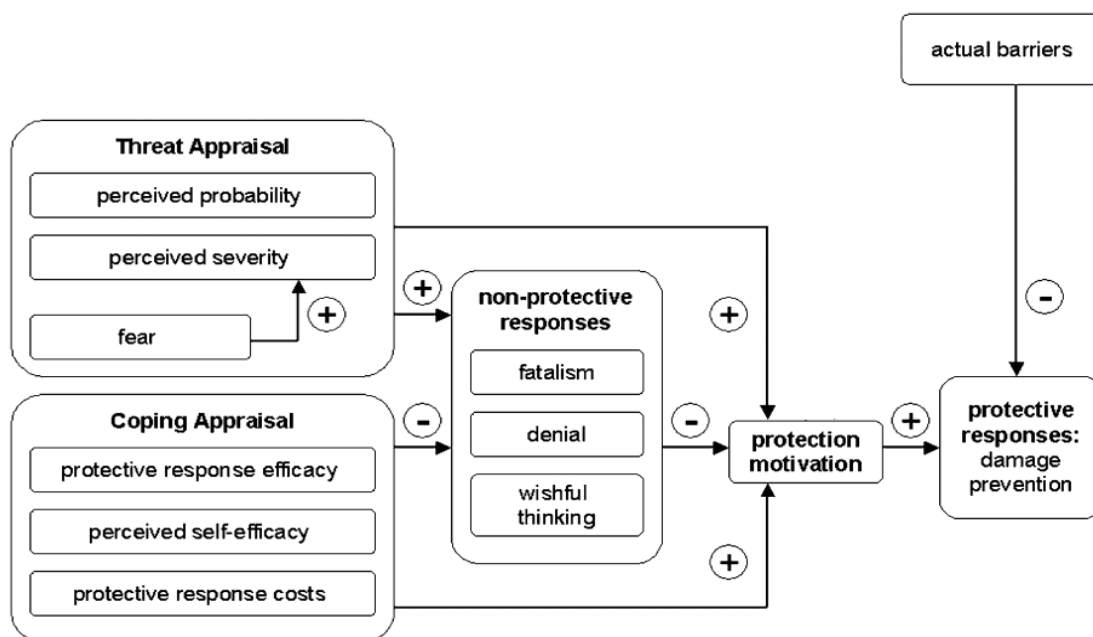


Figure 1: Protection motivation theory, adopted from Grothmann and Reusswig (2004).

Following the model in figure one, the decision making process can either have a positive or a negative outcome based on risk perception (threat appraisal) and coping appraisal. *Protection motivation*, as Grothmann and Reusswig (2004) state, is the willingness of a person to implement measures in order to prevent harm. However, the intention to conduct self-protective behaviour is not necessarily sufficient to actually implement the measures (a *protective response*, or actual self-protective behaviour). Actual barriers such as lack of resources or legislation can prevent a protective response. Note that this is different from the protective response costs of the coping appraisal which indicates the *assumed* costs.

The negative outcome of the decision making process is a *non-protective response* which does not avoid damage from a possible flood, but prevents negative emotional consequences from the perceived risk. Non-protective responses are fatalism, denial and wishful thinking. A non-protective response does not assume there is no response at all, but the response that is adopted (for example denial of the risk) is a response that will not prevent damage in case of a hazardous event. Therefore, non-protective responses are not the negative equivalent of protective responses but rather an undesirable response.

In the decision making process, risk perception provides the initiation of a response, yet the actual response is determined by coping appraisal. Thus risk perception provides the motivation for both protection motivation and non-protective responses, but does not determine which of the two responses will be initiated. The actual response which will be taken is determined by coping appraisal. Based on the different attributes a consideration is made which results in either protection motivation or non-protective responses (Grothmann and Reusswig, 2004). A high perceived self-efficacy and protective response efficacy increase the coping appraisal and thus the protection motivation, the perceived costs temper the coping appraisal.

There are also feedbacks to be expected in this model. For example, when a protective response has been adopted, risk perception lowers as people expect less damage thanks to the taken actions, resulting in a reduction in protection motivation (Grothmann and Reusswig, 2004). The feedbacks are not included in the model in order to maintain clarity. The role of the feedback loops will be discussed in chapter 5.

2.2. Hazard specific indicators of self-protective behaviour

The PMT model identifies several indicators of self-protective behaviour. Yet, this model originates from health behaviour and therefore hazard specific indicators are not included in the original model. This means that the original PMT is incomplete when it is used in relation to flood preparedness. This has also been noted by Grothmann and Reusswig (2004) who have shown that it is possible to include new elements in the PMT. They included trust in flood defence systems and threat experience in their PMT model as direct indicators of protection motivation.

However, based on findings in the literature, there are more hazard specific indicators that should be included based on their importance in self-protective behaviour, and in relation to this research, their connection with flood risk communication. This subchapter will therefore discuss two prominent hazard specific indicators that were found in the literature and will be combined with the PMT model in section 2.4.

Several indicators were found in the literature, however the most frequently named and the most relevant indicator were selected. The following indicators will be addressed: flood experience, and perceived personal responsibility.

Flood experience was selected due to its importance in risk perception and self-protective behaviour. Several articles stretched the importance of flood experience and found relatively strong relationships between either experience and self-protective behaviour or experience and risk perception (Bubeck et al., 2012; Thieken et al., 2007; Grothmann and Reusswig, 2004).

Although it should be noted that research on perceived personal responsibility in flood risk is limited so far, it appears to be of large importance within flood risk management now that citizens are increasingly expected to take own responsibility for the preparation for a flood (Wachinger et al., 2013; Gutteling et al. 2010; Terpstra and Gutteling, 2008). This aspect was selected because of its possible connection with governmental flood risk communication, as more governments increasingly focus on citizens' perceived personal responsibility in their communication strategies.

2.2.1. Experience

Previous flood experience is found to be one of the most important predictors for self-protective action, risk perception and coping appraisal (Terpstra, 2009; Thieken et al., 2007; Baan and Klijn, 2004; Grothmann and Reusswig, 2004). Flood experience as an indicator for self-protective behaviour consists not only of direct personal experiences with actual flood events, but can also include experiences with "nearly flooding". In 1995 for example, 200,000 people in the Netherlands were evacuated due to dangerously high water levels. However, an actual dike breach failed to occur. Despite the absence of flooding, the experience in the named situation is comparable to experience with an actual flood since people have similar feelings and take preparations for flood (Baan and Klijn 2004).

In addition, flood can be experienced directly (on a personal base) and indirectly through stories of others (Wachinger, 2013). Although indirect experience might have less impact than direct experience, it is believed to influence self-protective behaviour and is used in communication strategies (Vogt, 2012; Wachinger et al., 2013). Here the media play a role in publishing these stories to a broader public. Other ways of indirect experience are established by for example marking water levels of previous floods on buildings or flood museums as is done in Germany (Petrow et al., 2006; Vogt, 2012). Although applied in practice, scientific evidence of the efficacy of these strategies does not exist yet.

Beside self-protective behaviour, flood experience generally enhances an individual's perception of risk, which in turn motivates the willingness to protect oneself. Additionally, experience with flooding or implementing preparatory measures will enhance both response efficacy and perceived self-efficacy which are indicators of coping appraisal, named in the PMT. Confidence in the effectiveness of temporal measures and one's ability to conduct preparatory tasks will lead to more willingness to take the same preparatory measures during a next flood event.

Especially directly after a flood, awareness is high and levels of self-protective behaviour are increased. An example of the effectiveness of flood experience is the case of the Rhine floods in 1993 and 1995 in Cologne (Grothmann and Reusswig, 2004). The damage of the 1995 floods amounted € 35 billion less than the floods in 1993. This was largely due to the mitigation strategies taken by citizens according to Grothmann and Reusswig (2004).

However, the high levels of awareness and self-protective responses are not maintained long, as is shown by Baan and Klijn (2004). After time, the effect of the flood experience wears off and the importance of flood mitigation is forgotten. Therefore, Baan and Klijn (2004) differentiate between a crisis effect and a levee effect. The *crisis effect* is a state of urgency during and short after a flood, but rapidly disappears. The *levee effect* refers to the faith people have in protective measures, such as dikes, once they have been implemented. This can not only be seen at the scale of dike reinforcements but also at the individual scale, where people tend to feel safe after they have implemented mitigation measures (Bubeck et al., 2012).

The notion of the crisis effect shows that experience does not always automatically result in higher levels of permanent flood preparedness. When the crisis effect wears off, people tend to assume that no flood events will occur in the near future (Petrow et al., 2006). This could be explained by the way safety standards are indicated. By stating that the safety standard of a dike is once in a 100 years, citizens interpret this as a one flood in 100 years (Petrow et al., 2006). Hence, if a flood has occurred, people tend to assume that there will not be another flood the next 99 years. Additionally, a flood that did not lead to personal damage or is followed by implementations such as raising dike levels often creates a false sense of protection. People expect that a next flood to be of similar proportion as the previous one and assume that they will stay safe this time (Wachinger et al., 2013). Terpstra (2010) states that the interpretation of a flood experience influences the risk perception as well. He notes that people who indicate flood as a positive experience (e.g. solidarity among people or appreciation of beauty and power of nature) tend to have a lower risk perception than people who indicated the flood experience as a negative experience.

A similar relation is seen between information seeking and the interpretation of experience as mentioned by Kievik and Gutteling (2011). Experience can both enhance and decrease the motivation for information seeking. One could think to have sufficient knowledge since they managed to minimize damages during their previous experience, but someone who had bad experiences would be motivated to seek information to be better prepared the next time.

2.2.2. *Perceived personal responsibility*

With the implementation of flood risk management, governments emphasize the citizens' personal responsibility to prepare themselves. The aim of this strategy is to decrease flood damage on the individual level. However, citizens might perceive their responsibilities towards flood risk management differently, which influences both the effectiveness of communication and the motivation to conduct self-protective behaviour.

Perceived personal responsibility indicates the extent to which an individual perceives a responsibility to be his own (Terpstra and Gutteling, 2008) and plays an important role in self-protective behaviour. Terpstra divides perceived personal responsibility in the responsibility to avoid flood damage and the responsibility to prepare for a flood event. According to Terpstra and Gutteling (2008), preparedness tends to be higher among citizens who perceive the responsibility of mitigation behaviour as their own, than among citizens that place the responsibility at the government. When citizens do not feel responsible to take their own preparatory action, risk communication will be of little use according to Terpstra (2010).

According to Terpstra (2010) and Wachinger et al. (2013) citizens tend to place the responsibility to protect themselves against flood at the governmental level as they see flood protection as the moral responsibility of the government. This is different in emergency situations where people have a high sense of urgency and moral responsibility is replaced by "action responsibility" (Terpstra, 2010). In these situations, people are more willing to take action themselves, but only if they know what their possibilities are. However, beside emergency situations, the perceived moral responsibility is difficult to change and communication aimed at changing the perceived responsibility of the public will therefore have little impact (Terpstra, 2010).

There are several aspects that are believed to influence the perceived personal responsibility of citizens; the most relevant being the influence from persuasive communication and coping capacity. In addition, before taking personal responsibility, people require sufficient resources to fulfil this responsibility (Terpstra and Gutteling, 2008). However, what falls under sufficient resources and what not is subject to people's perception. A measure that requires monetary investment, that has no secondary uses and is not immediately necessary, is for example often seen as an unwelcome investment. In such situations it is often stated by citizens that their economic situation will not allow this kind of investments.

2.3. *Risk communication*

Risk Communication is seen as a valuable tool to connect scientific knowledge with public perceptions. In addition it can be used to enhance the publics' risk perception and to inform citizens on how to prepare themselves for a flood event. Furthermore, risk communication is used in the case of an emergency situation to mitigate immediate consequences (Petrow et al., 2006). However, in this research the focus will be on risk communication related to enhancing self-protective behaviour in non-crisis situations.

Communication, including risk communication, is the transfer of information from a sender to a receiver. According to Aarts and Woerkum (2010) classical communication models assume a direct link between sender and receiver. However, more recent models argue that the transportation of a message from the sender to the receiver is rarely direct. The receiver can be influenced by for example friends or past experiences. Also, depending on the purpose of communication, the transfer can be one sided or two sided (Aarts and Woerkum, 2010).

Risk communication, as defined in Kellens et al. (2013), is the exchange of information on topics relating to risks between individuals, groups or organisations. This definition suggests a two sided transfer of communication, yet risk communication used to be strictly one sided as the government took full responsibility for flood protection. The shift towards flood risk management in which citizens are expected participate in flood management and to take own responsibility, the importance of two sided communication has been acknowledged (Kellens et al., 2013).

In general, risk communication has two tasks when it is aimed at raising self-protective behaviour among citizens (Gutteling et al., 2010). The first task is to raise awareness, because protective action will not take place when one is not aware that they are at risk. The second task, when awareness is raised, is to motivate citizens to take precautionary action. This is done by providing information on the different possibilities and to motivate people by showing that the measures are effective, easy to implement and have low costs.

In practice, all communication, including risk communication, proves to be a complex process which makes the outcome difficult to predict and often seems to be ineffective in changing attitudes and behaviour (Aarts and Woerkum, 2010; Terpstra and Gutteling, 2008). Several reasons for this ineffectiveness were found in the literature.

Kievik and Gutteling (2011) note that communication and persuasion theories are not sufficiently incorporated in risk communication methods. For this reason the communication is ineffective and can even have reverse effects. Bradford et al. (2012) formulated several recommendations on flood risk communication related to this. He noted that in order to increase the success of risk communication, locality should play a central role in communication. By focussing the communication on a local level, people relate to their situation. Furthermore, as there are different groups within society, information should be tailor made for each group and the provided information should be clear and understandable (Bradford et al., 2012). Current terminology for example, such as once in a 100 year floods, proved to be difficult to understand by lay people. Alternatively, expressing risk as a percentage shows clearly that the protection level is not 100% and thus not completely safe. Above standing does not only apply for informing on flood risk, but also applies to explaining different measures citizens can take.

Another issue named by Kievik and Gutteling (2011), is citizens' lack of willingness to search for information on this topic to fill their knowledge gap. Campaign developers often assume that the public will be motivated to look for the information they provide, but this is often not the case.

Much information is available on the internet in the form of hazard maps and guidelines on options for individual preparation, though only few people invest time in information seeking (Kievik and Gutteling, 2011). This lack of motivation can be explained from a low level of awareness. According to Baan and Klijn (2004) citizens only absorb the information that seems relevant to them and fits within their reality. Hence a low perception of risk causes low interest as it is not seen as part of citizens' reality. Consequently, risk communication can influence the level of knowledge only to a certain extent (Bradford et al., 2012).

Markon (2013) found that the source of the risk is of influence in the effectiveness of communication as well. When the risk is portrayed as something that is influenced by the actions of citizens, they are more likely to react on it. However when the risk is something that is caused by an institution such as the government, citizens are likely to react negatively to the information. As Baan and Klijn (2004) note, citizens would experience mitigating a risk as unfair when it was not caused by themselves.

2.4. Connecting the PMT with perceived governmental flood risk communication

This section will introduce a conceptual framework in which the PMT takes a central role. As mentioned in section 2.2, the PMT by Rogers does not include hazard specific indicators. Therefore two hazard specific elements were introduced to extend the PMT: flood experience and perceived personal responsibility. Following the literature each of the hazard specific indicators has several attributes (figure 2). Adding these two new indicators to the PMT model gives us an adapted PMT model which can be seen in figure 2. Based on literature, perceived personal responsibility and flood experience were indicated as directly related to self-protective behaviour. Although some articles note that flood experience and perceived personal responsibility also directly relates to risk perception, it was decided to not include this relation as the focus of this research is on self-protective behaviour.

For practical reasons protection motivation and protective responses were merged into one box. Merging these two concepts simplifies the statistical analysis (see chapter 3) and enhances the clarity of the model. In this research a distinction will be made between the protection motivation and actual self-protective behaviour in the form of implemented protective responses.

The conceptual framework was finalized by connecting the model with perceived governmental flood risk communication. This adaptation was made in order to visualize the relation between self-protective behaviour and perceived governmental flood risk communication. Note that no relation between perceived governmental flood risk communication and flood experience is indicated. Although flood experience is an important aspect in self-protective behaviour and should therefore be included, it was assumed that perceived governmental flood risk communication would not influence experience and therefore a possible relation was not investigated.

Risk communication has two main targets that are included in the conceptual framework: raising risk awareness and enhancing self-protective behaviour. Raising risk awareness focuses on aspects of risk perception, while the provision of practical information aims at influencing the attributes of the coping appraisal such as perceived response efficacy and self-efficacy.

Within the context of flood risk communication, “fear”, “non-protective responses”, and “actual barriers” will not be investigated in this research. Due to the practical limitations of this research, elements that were assumed to have no relation with risk communication were not included in this research and this conceptual model.

The next chapter will discuss how this conceptual framework will be used in the data collection and the statistical analysis of the relations between perceived governmental flood risk communication, self-protective behaviour and the indicators of self-protective behaviour.

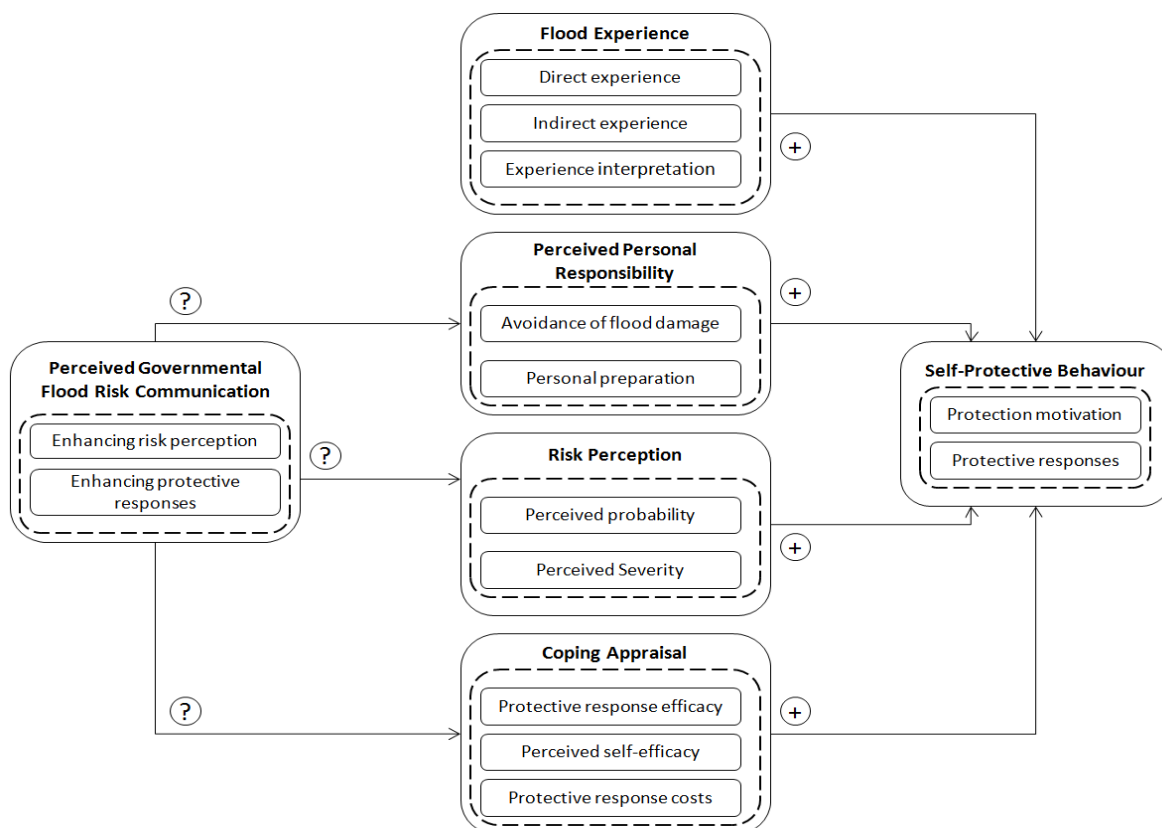


Figure 2: Conceptual framework based on the PMT model.

3. Methodology

To answer the questions formulated in chapter one, this research will conduct a survey in which the relations between perceived governmental flood risk communication and self-protective behaviour are explored. Additionally, findings from the Netherlands and Germany are compared to each other. This chapter will discuss the methods used in this research. First, an overview will be given of the study area and data collection. Hereafter, for each of the different concepts discussed in chapter 2, it will be indicated how the concept is covered in the data collection and analysis. The chapter will conclude with an overview of the statistical analysis that was conducted to analyse possible relations between the different concepts.

3.1. Study area

The questionnaire was conducted in both the Netherlands and Germany along the Rhine river (see figure 3). In the Netherlands the survey was conducted along the river Waal which is the largest tributary of the Rhine. More specifically, the study areas consist of the municipalities of Beuningen and Druten (the Netherlands), and the municipalities of Kalkar and Xanten (Germany). A total of thirteen villages were sampled of which six were Dutch and seven German (see table 1). The difference in amount of villages sampled in each country was due to the small size of some of the German villages. The villages were selected based on their past flood experience and absence of special circumstances regarding flood risk management. Furthermore, only villages closest to the river were included in the survey as it was assumed that flood risk would be most relevant for these villages.

Table 1: Sampled villages

Netherlands	Germany
Weurt	Grieth
Beuningen	Hönnepel
Ewijk	Niedermörmter
Winssen	Oberdorf
Druten	Obermörmter
Deest	Vynen
	Xanten

All of the selected villages were confronted with the high water levels in the Rhine river in 1995. In the Netherlands all selected villages experienced the nearly flooding, however only the villages in the municipality of Druten (Deest, Druten) were evacuated in 1995 out of precaution. The other villages were not evacuated but still witnessed the high water levels. In Germany the high water levels in 1995 caused major disruptions in the city of Köln (Cologne), however in the study area flooding did not occur. As respondents indicated during the survey, most damage during this time was caused by ground water flooding.

To the author's knowledge, the selected study areas have no special circumstances regarding current water management. For example, in the Dutch municipality of Groesbeek there was much protest against the creation of a retention area in 2002. These kinds of areas form exceptions in water management and are therefore not included in the research.

After 1995 dikes were strengthened in the Dutch study area, and several "room for river" projects were conducted on the flood plains. However, to the author's knowledge these recent projects did not have an influence on the survey. In the German study area, dikes were only recently strengthened in 2006. Also retention areas are created in order to cope with high water levels in the future. From the information respondents gave, it can be concluded that these projects did not cause major protests that would make the German study area an exception in flood risk management.

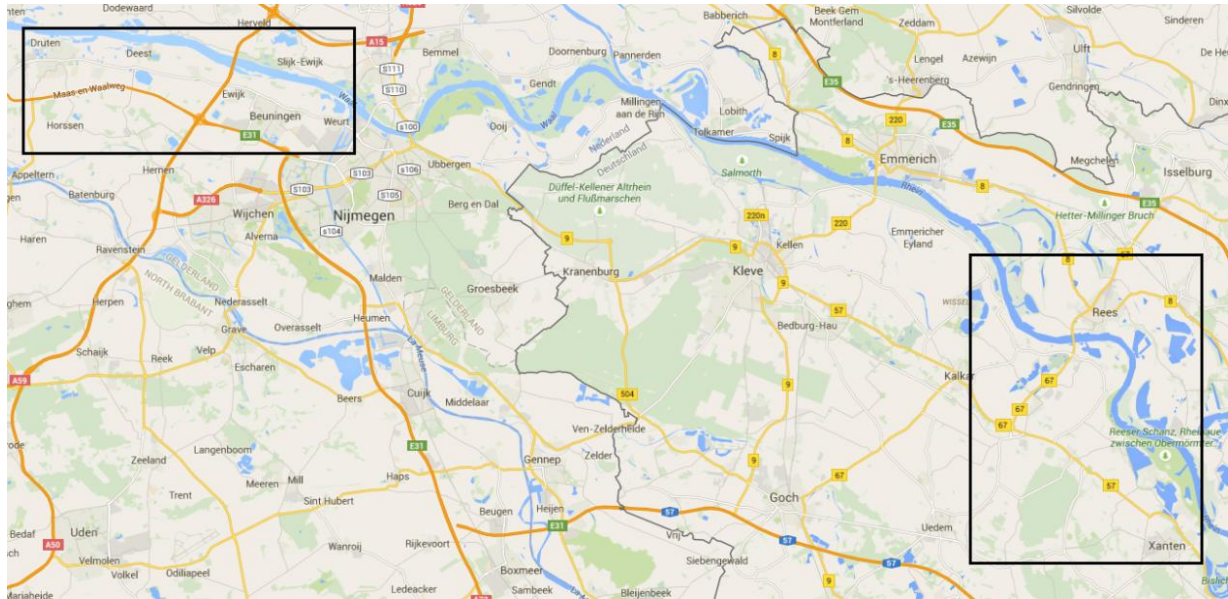


Figure 3: Study areas in both the Netherlands and Germany

3.2. Data collection

As the research aims to explore different relations and to make a comparison between countries, statistical analysis plays a key role in this research. Data collection through a questionnaire is therefore found to be a suitable method for this research as this method allows the collection of information from large samples in a relatively short time.

Furthermore, in cross-national research it is important to keep the comparative element of the research into mind from the start in order to avoid difficulties during the data analysis (Boh  lm, 1998). Surveys are therefore believed to be a valuable tool, as these standardized surveys are less prone to language-barriers and other inconsistencies than for example interviews. Questionnaires are believed not to lead to cultural or linguistic difficulties, since the Dutch and Germans are perceived to be similar minded people (Steenhuisen et al., 2007). It is presumed that all respondents will comprehend the variables and concepts used in the questionnaire in the same way.

Between 23 February and 13 April (2015) a survey in both the Netherlands and Germany was conducted in which villages in both countries were alternated in the sampling. In both countries the same questionnaire set up was used. The questionnaire was translated to the native language of each study area. The translations of the questionnaires were checked and corrected by native speakers. The questionnaire took 15 minutes on average to fill in.

Ideally, streets with a high density of houses (no flat buildings) close to the river were selected within each village. In addition, the selected streets should be representative for the village (e.g. no high class or elderly housing only). For each village two or three streets were selected depending on the available suitable streets in each village.

Respondents were selected following a systematic sampling design in which one third of each street was sampled. All questionnaires in the Netherlands were personally delivered and retrieved from each house. In order to increase the response rates, respondents were given one or two days to fill out the questionnaire. When the residents were not at home a questionnaire was given through the mailing box and retrieved later. When there would be no response when collecting the questionnaires, a ready-made envelope was given and the respondent was asked to send the questionnaire by mail. A similar method was used for Germany. However, due to factors such as time constraints and low response rates (e.g. no one home) it was decided to not deliver questionnaires by mail box, but to rather visit more houses in the village.

At the end of the survey, 204 questionnaires were filled out consisting of 102 Dutch and 96 German questionnaires. Only 6 questionnaires were not included in the data analysis because less than half of the questions were filled out. Response rates varied for each country. In the Netherlands the response rate was 47.2%, while the response rate in Germany was lower (39.8%). Gender was equally distributed; in total 49% of the respondents were male, and 47% female (4% unknown). These percentages were similar for each of the countries. The average age of the Dutch respondents was 55.2. German respondents had an average age of 52.5.

3.3. Set-up of questionnaire

The questionnaire that was used in the survey consists of six parts covering the following concepts: flood experience, perceived personal responsibility, risk perception, perceived governmental flood risk communication, coping appraisal and self-protective behaviour (see appendix I). These concepts are part of the conceptual framework which was introduced and further elaborated on in chapter 2. Most concepts in the questionnaire were covered by means of statements for which the respondent could indicate on a 5-point likert scale to what extent he or she agreed with the statement. Also the option “do not know” was included in the scale. Especially for statements related to risk communication, this proved to be useful since many respondents indicated that they have never received governmental flood risk communication and therefore felt they could not answer all questions.

The questionnaire started with questions on demographic data (age and gender) and was followed by the questions on flood experience. In the section on flood experience, respondents were asked to indicate whether they had direct, indirect or no experience. If respondents had direct experience, they were asked how they would describe this experience on a five point scale ranging from very negative to very positive. The latter question was derived from the paper by Terpstra (2010).

The section on perceived personal responsibility consisted of two questions: one relating to the perceived responsibility to prevent flood damage and one on the perceived responsibility to prepare for a flood event. Both questions used a 5 point scale ranging from “government is fully responsible” to “I alone am fully responsible”. As the concept of responsibility in self-protective behaviour was researched by Terpstra and Gutteling (2008), it was decided to use his questions on this subject.

Risk perception and perceived governmental flood risk communication were measured by means of statements for which respondents indicated to what extent they agreed with the statement (ranging from strongly disagree to strongly agree). Statements were mainly derived from questions used in the research by Baan et al. (2008), Winsum-Westra (2010) and Thieken et al (2007). Questions were not literally adopted from these studies, but were transformed into statements suitable for use with a likert scale. This was done in order to keep the questionnaire as clear and compact as possible. Also, covering a concept such as risk perception by means of statements with a likert scale will enable the calculation of attitudinal scores which in turn give a more balanced view on ones perception than one question covering the whole concept.

In order to measure coping appraisal through the questionnaire this concept was split into response efficacy, self-efficacy and response costs. These three aspects were translated into the following statements: “this response is effective”, “I am able to implement this response myself” and “the costs for this response are high”. For ten self-protective measures which were adapted from Baan et al (2008) and Thieken et al. (2007) people were asked to indicate to which extent they agree with these three statements on a five point scale ranging from strongly disagree to strongly agree.

Finally, self-protective behaviour used a four point scale instead of a 5 point scale. For the same ten measures as used for coping appraisal, respondents are asked to what extent they intent to adapt the measures, ranging from “no, no intention”, “yes maybe”, “yes I will” and “yes, already in use” (adapted from Baan et al. (2008). In this way both actual adoption rates and adoption intention were derived.

3.4. Data analysis

Data analysis was conducted in Microsoft Excel and SPSS. Analysis conducted in Excel focussed on the calculation on attitudinal scores for the identification of respondents' perceptions on the different concepts of the conceptual framework. The statistical analysis performed in SPSS mainly analysed the (possible) relations indicated in the conceptual framework (see chapter 2) and consisted of both a correlation and a regression analysis. In addition, an independent samples test was conducted in order to test for statistically significant differences between Dutch and German perceptions.

When entering the data for the data analysis all questions and statements in the questionnaire were coded in such a way that the input was suitable for statistical analysis. Questions and statements that are designed according to the likert scale use coding from 1-5. The least positive outcome is coded with a 1 while the most positive outcome is coded with a 5. Which outcome is the most positive depends on the statement. A positive statement regards "completely agree" as the most positive outcome while negative statements use a reversed coding. In these questions the answer "do not know" is also included, but is coded 0 since this option does not fit within the categories of the attitude scale. The section on self-protective behaviour is coded from 1 to 4, in which code 1 is "no, no intention" and 4 "yes, already adapted". Data was entered in Microsoft Excel in a format that is also suitable for export to SPSS for statistical analysis.

The excel analysis mainly consisted of the calculation of attitudinal scores. By calculating these scores insight was gained in the publics' perception on governmental flood risk communication and the different aspects that influence self-protective behaviour. Also, these scores were used as input for the statistical analysis.

An attitudinal score of a respondent is calculated by taking the average of the answers provided by the respondent. Which answers are included in the calculation differs for each concept that the calculation is made for. Following the research of Baan et al. (2008), no overall attitudinal scores were calculated. Instead of a overall attitudinal score, attitudinal scores of the different attributes were calculated. This was done in order to provide a more nuanced perception. Attitudinal scores on coping appraisal were calculated for both the overall coping appraisal and the different responses separately.

Note that data collected through a likert scale is generally considered ordinal data instead of interval data as we cannot know whether the distance between each option on the scale is equal. However, in much research the average attitudinal scores calculated from a likert scale were used for statistical analysis as interval data (Kumar, 2010). It is an ongoing discussion whether this approach is appropriate or not.

As this research attempts to find correlations and compare different datasets (the Netherlands and Germany), it was decided to treat attitudinal scores as interval data. This enables us to conduct statistical tests that ensure normality, identify possible relations and to compare data from the Netherlands with data collected in Germany. In addition, much of the literature named in this research that made use of a questionnaire, used average attitudinal scores as interval data as well.

The statistical analysis in SPSS was conducted to explore the occurrence of significant relations between the concepts. The first part of the conceptual framework, in which perceived governmental flood risk communication is connected to the indicators of self-protective behaviour, was examined by means of a Pearson correlation. Note that a possible correlation between perceived governmental flood risk communication and experience was not investigated in this research, as it is assumed that communication does not directly influence experience. A connection between perceived governmental flood risk communication and indirect experience might be possible according to literature (Wachinger et al., 2013), but is beyond the scope of this research due to practical and time related concerns. The correlation analysis will be conducted for each country separately and for the overall sample. The following relations were explored through a Pearson correlation (table2):

Table 2: Relations analysed by means of a Person correlation. Attributes of perceived governmental flood risk communication are correlated with the attributes of the indicators of self-protective behaviour.

Attribute of perceived governmental flood risk communication	Indicator of self-protective behaviour	Corresponding attributes
Enhancing protective responses	Perceived personal responsibility	Avoidance of flood damage
		Personal preparation
	Risk Perception	Perceived probability
		Perceived severity
	Coping Appraisal	Protective response efficacy
		Perceived self-efficacy
		Protective response costs
Enhancing risk awareness	Perceived personal responsibility	Avoidance of flood damage
		Personal preparation
	Risk Perception	Perceived probability
		Perceived severity
	Coping Appraisal	Protective response efficacy
		Perceived self-efficacy
		Protective response costs

The relations between the aspects that are believed to predict self-protective behaviour and self-protective behaviour itself were verified. The relationships between these concepts that possibly influence self-protective behaviour (see chapter 2) are investigated through a regression analysis. The regression analysis will be conducted for each country separately and for the overall sample. The following relations will hereby explored (table 3):

Table 3: Relations analysed by means of a regression analysis. Attributes of the different indicators are related to self-protective behaviour.

Indicator of self-protective behaviour	Corresponding attributes	Self-protective behaviour
Flood experience	Direct experience	Self-protective behaviour
	Indirect experience	
Perceived personal responsibility	Avoidance of flood damage	
	Personal preparation	
Risk Perception	Perceived probability	
	Perceived severity	
Coping Appraisal	Protective response efficacy	
	Perceived self-efficacy	
	Protective response costs	

The outcomes of the data analysis will be interpreted and validated with existing literature (see chapter 1 and 2). The results of both the analysis conducted in excel and the statistical analysis in SPSS will be presented in the next chapter.

4. Results

The main objective of this research is to investigate the relation between perceived governmental flood risk communication and self-protective behaviour. In order to investigate this relation in a structural manner, a conceptual model was used in which perceived governmental flood risk communication was connected with the protection motivation theory (see section 2.4; figure 2). In this model perceived governmental flood risk communication relates to self-protective behaviour through different indicators of self-protective behaviour: perceived personal responsibility, risk perception and coping appraisal. The concept flood experience is also included in the model, but it is assumed that perceived governmental flood risk communication does not relate with experience. Therefore a possible relation between the two concepts was not investigated.

The input used to test this model consists of citizens' attitudinal scores on several subjects relating to the concepts and attributes used in the conceptual model. The relations within the conceptual model were tested with two statistical methods: linear regression and Pearson correlation.

This chapter will report the outcomes in line with the conceptual model. By using the model as red thread, the different research questions will be answered (see section 1.5). First, current perceptions on the different concepts will be described in section 4.1, followed by the outcomes of the statistical analysis on the relations. Since the sub-objective of this research is to identify the differences and similarities between the Netherlands and Germany, the outcomes will be reported for each country separately and compared with each other at the end of each section.

4.1. Citizens' perceptions

Citizens' perceptions were indicated through a questionnaire. In section 3.3, an overview is given on how the perceptions on different concepts in the model were measured. This section will give an overview of the found perceptions.

The section will start with the perceived governmental flood risk communication, followed by the indicators of self-protective behaviour: flood experience, perceived personal responsibility, risk perception and coping appraisal. This section will conclude with self-protective behaviour. For each concept first the Dutch outcomes will be presented, followed by German outcomes and concluded with a comparison between both countries.

4.1.1. *Perceived governmental flood risk communication*

Perceived governmental flood risk communication was measured with fourteen statements for which respondents indicated to what extent they agreed with a statement. The statements relate to the perceived availability, clarity, effectiveness, findability and utility of governmental flood risk communication. Since governmental flood risk communication aims at both increasing risk awareness and enhancing self-protective behaviour, this division is made in the questionnaire as well. The statements cover both information on flood risks (aiming at raising awareness) and personal flood protection (to enhance self-protective behaviour). Table 4 shows for each statement the answer rates and the average scores.

Generally, the Dutch respondents perceived governmental flood risk communication as ineffective. The provided information did not relate to the personal situation of citizens and many people indicated to never have received any flood risk related information from the government. Despite this negative perception on current governmental flood risk communication, respondents indicated to be interested in (tailor made) information about flood risks and options for personal flood protection. Information relating to flood risks was by citizens preferred over information relating to self-protective behaviour. Focussing on the average attitudinal scores, Dutch respondents answered slightly negative on communication related to raising risk awareness (2.8; SD=0.57) and to self-protective behaviour (2.9; SD=0.58). Among the different aspects, utility of the information had the highest average attitudinal score (3.25), while availability scores were the most negative (2.45)

German respondents viewed governmental flood risk communication to be ineffective in motivating citizens to take protective action. In addition, many of the respondents did receive none or little information from the government and the information that was received did not fit the personal situation of respondents. Yet, German respondents found the information they received relatively clear and are open to receiving more information. When information on flood risks and information on personal flood protection was compared, information on options for personal flood protection was preferred. Regarding the attitudinal scores, German respondents scored slightly negative for perceived governmental flood risk communication aimed at raising awareness (2.8; SD=0.61) and raising self-protective behaviour (2.8; SD=0.64) on average. Statements that related to findability of information had the highest average attitudinal score (3.3), while availability of information had the lowest average attitudinal score (2.5).

Table 4: Answer rates and average attitudinal scores on statements relating governmental risk communication.

		Country	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do not know	Average Score
A	I would like receive more information on the flood risks in my region.	NL	1	15	17	46	21	1	2.3
		DE	9	14	26	21	27	2	2.6
A	I want to receive more information on how can prepare myself for a flood event.	NL	1	21	24	38	14	3	2.6
		DE	3	16	34	28	18	1	2.6
A	I often see or hear posts concerning flood risks in the Netherlands/Germany.	NL	8	39	21	29	0	4	2.7
		DE	19	22	25	20	14	0	2.9
A	The government informs me regularly on how I can prepare myself for a flooding.	NL	14	51	19	9	0	8	2.2
		DE	29	42	18	6	0	5	2.0
C	Information on flood risks provided by the government is easy to understand.	NL	1	20	24	31	5	20	3.2
		DE	3	20	33	29	4	11	3.1
C	Information provided by the government on options for personal flood protection is clear.	NL	4	15	34	26	2	20	3.1
		DE	8	18	42	18	3	11	2.9
E	Information on flood risks provided by the government makes me think about the possibility of a flood event in my neighbourhood.	NL	2	25	24	38	7	5	3.2
		DE	9	17	37	26	7	3	3.1
E	Thanks to information provided by the government, I know what I can do to prepare myself for a flood event.	NL	7	26	24	36	2	5	3.0
		DE	14	18	36	20	4	8	2.8
E	Information provided by the government on flood risks motivates me to prepare myself for a flood event.	NL	4	31	29	24	2	11	2.9
		DE	13	27	45	7	2	6	2.6
E	The government stimulates me to think about what I can do in the case of a flood event.	NL	8	37	31	14	0	10	2.6
		DE	21	32	27	13	2	5	2.4
F	I know where to find information on how to prepare myself for a flooding.	NL	4	29	11	42	7	7	3.2
		DE	7	15	25	32	17	4	3.4
F	I know where I can ask questions on flood risks.	NL	6	30	20	24	5	16	2.9
		DE	10	16	23	34	11	5	3.2
U	Information on how to prepare myself for a flooding is useful.	NL	0	5	18	57	16	5	3.9
		DE	3	4	34	40	11	7	3.6
U	The government provides information which is specific to my personal situation.	NL	6	30	30	11	1	22	2.6
		DE	14	27	35	5	1	17	2.4

A=availability, C=clarity, E=efficacy, F=findability, U=utility.

When looking at the statements in more detail, it is noticed that nearly half of the Dutch respondents indicated that they know where to find information on options for personal flood protection, but most do not know where to look for information concerning flood risks. A majority of the respondents indicated that the availability of the information is limited: nearly half of the respondents indicate that they did not receive information regarding flood risks in the Netherlands. Information on options for personal flood protection was received by even less respondents. This does not mean people are not open to receiving information on flood risks and personal flood protection; more than half of the Dutch respondents indicated they would like to receive more information from the government. Around one third of the respondents find information given by the government clear and easy to understand. Notable is that one fifth of the respondents indicated they did not know how to answer the statements about clarity. When asked, many of the respondents specified that they had never received any information, so they could not fill in these statements. A vast majority of the Dutch respondents found information on options for personal flood protection useful, but the current supply of information did not fit the personal situation of citizens. Only a minority found that the information they received fits their personal situation while one out of three believes the information given by the government was not relevant to their personal situation. The perceived efficacy of governmental flood risk communication was larger for flood risk related information than for information related to options for personal flood protection. About half of the Dutch respondents found that information on flood risks stimulates them to think about the possibility of a flood in their neighbourhood. However, when the information is related to personal flood protection, only 13% was motivated to think about options for personal flood protection.

German outcomes indicate that information related to flood risks and personal flood protection was perceived to be easy to find nearly half of the German respondents. Regarding the availability of information, only a minority indicated that the government did inform about options for personal flood protection on a regular base. However, information on flood risks was given regularly according to one third of the respondents. Respondents were interested in information regarding flood risks and personal flood protection. Nearly half of the respondents indicated that they would like to receive more information. Opinions on the clarity of the information provided by the government were rather divided. Information regarding flood risks was more often perceived to be clear than information on options for personal flood protection. The amount of people who did not know how to answer to these statements was large compared the other statements. This can be explained by the fact that people did not receive any information from the government. The majority of the German respondents found the information on possibilities for personal flood protection useful, but information provided by the government was not specific to the personal situation of respondents. Two out of five respondents did not find the information relevant to their personal situation. Most respondents found governmental flood risk communication ineffective. A large portion of the respondents indicated that governmental flood risk communication did not motivate them to adopt or consider personal protection measures. Only one out of ten respondents indicated that the information of the government motivates them to take protective action. Despite the negative perception of efficacy, one quarter of the respondents indicated that they know how to protect themselves thanks to information from the government.

Statistical analysis shows no significant differences between German and Dutch perceptions on governmental risk communication ($t(196)=0.419$, $p=0.675$; $t(196)=-1.469$, $p=0.143$). Although the answer rates do differ for each statement, general similarities are seen. In both countries governmental flood risk communication is perceived as rather ineffective. Communication is not received or does not fit with the personal situation of respondents. Dutch respondents seem to be a bit more positive towards the efficacy of governmental risk communication. Respondents in both countries desired more information on flood risks and options for personal flood protection, in which the Dutch showed a greater desire than German respondents. However, German respondents prefer information on personal flood protection, while the Dutch prefer information on flood risks.

4.1.2. Flood experience

Although it was assumed beforehand that there is no relation with perceived governmental flood risk communication, flood experience is still included as part of the conceptual framework. The reason for this is that in much of the literature experience is believed to have a (relatively) strong influence in self-protective behaviour. In the questionnaire, experience was measured by indicating whether respondents had direct or indirect experience with a dangerous (near) flood event. When respondents indicated to have direct experience, they were asked how they interpreted their experience (very negative to very positive).

The portion of Dutch respondents with (in)direct experience is high. Nearly 60% of the Dutch respondents indicated to have direct experience with dangerous (near) flood events and 70.6% has indirect experience, meaning that they know friends or family that experienced a dangerous (near) flood event. One fifth of all Dutch respondents indicated that they had neither direct experience, nor knew people with direct experience (table 5).

Most respondents would describe their flood experience as neutral (43%) or negative (32%; table 6). On a scale ranging from very negative to very positive the average score was 2.7 (SD=1.45). None of the respondents described their experience as very positive.

Of the German respondents, a relatively low portion indicated to have experience with a dangerous flood event. Over half of the respondents indicated to have no experience at all. Only 24% of the German respondents had direct experience with a (nearly) flood event and 30.2% indicated to know friends or relatives with direct experience (table 5).

Most German respondents described their experience as neutral (39%) or positive (22%). Remarkably, 4% of the respondents indicated their experience to be a very positive experience. On average the description has a score of 2.9 on a scale from very negative to very positive (table 6).

A significant difference between the two countries was found between direct ($t(187)=5.309$, $p=0.000$) and indirect ($t(186)=6.395$, $p=0.000$) experience, indicating that levels of both direct and indirect experience in the Netherlands are higher than in Germany. This difference in experience can be explained by the flood history of both research areas. The Dutch municipality of Druten was evacuated during the 1995 nearly flooding, which underlined the risk of a flood hazard. The neighbouring municipality of Beuningen was not evacuated, yet they witnessed the same water levels. In Germany flood did occur, but respondents did not experience this as a dangerous situation as water levels in flooded areas were perceived as low according to the respondents.

No significant differences in flood experience description were found between the two countries ($t(81)=-0.722$, $p=0.472$).

Table 5: Type of Experience

	Direct experience	Indirect experience	No experience
Netherlands	58.8%	70.6%	18.6%
Germany	24.0%	30.2%	58.3%
Total	41.9%	51.0%	37.9%

Table 6: Interpretation of flood experience by respondents who had direct experience

	very negative	negative	Neutral	positive	very positive	Unknown	Average score
Netherlands	7%	32%	43%	15%	0%	3%	2.7
Germany	9%	17%	39%	22%	4%	9%	2.9
Total	7%	28%	42%	17%	1%	5%	2.7

4.1.3. Responsibility

The perceived personal responsibility was measured by two questions focussing on the responsibility to prevent of flood damage and the responsibility to prepare for flood disaster. Respondents indicated on a five point scale to what extent they held the government or themselves responsible (government is fully responsible – I am fully responsible)

The responsibility to be prepared for flood disaster (see table 7) is by the majority of the Dutch respondents perceived as the responsibility of the public and government equally. 13% perceives themselves as mostly responsible for preparing to flood disaster, while nearly one third indicates that this responsibility lays at the government. On average the respondents scored 2.7 on a five point scale (SD=0.93). The responsibility for preventing flood damage is in the Netherlands perceived as a mainly a task for the government (average score 2.4, SD=0.97). In table 7 can be seen that together nearly 50% of the respondents indicated the government holds most of the responsibility to prevent flood damage. Nevertheless over 37% of the respondents indicated that citizens and the government are equally responsible for this task. Only a small portion perceives themselves as mostly responsible.

When asked who should be responsible for preparing individuals for flood disaster, most of the German respondents indicated that the government and the public are equally responsible (average score 3.2, SD=0.91). 40% of the respondents indicated that the government and the public should equally distribute the responsibility to prepare citizens for a flood (table 7). A relatively large portion of the respondents (one third) found that they are mostly or fully responsible for their own preparation for a flood. German respondents were divided when asked to indicate who is responsible for the prevention of flood damage (average score 2.7, SD=1.00; table 7). 38% of the respondents indicated this responsibility as an equal division of responsibility. However, another third of the respondents perceived the government mainly or fully responsible for the prevention of flood damage. The portion of respondents that perceived themselves as primary or fully responsible for the prevention of flood damage is 21%.

It was found that German respondents (score 3.2) see themselves statistically significantly more often responsible for personal preparations for flood disaster than Dutch respondents (score 2.7), $t(188)=4.114$, $p=0.000$. A comparison of the two countries is seen in table 7. Here it can clearly be seen that German respondents perceive themselves responsible for their own flood preparation more often than the Dutch respondents, who mainly find themselves and the government equally responsible. A statistically significant difference in the perceived personal responsibility to prevent flood damage between the Dutch and German respondents was found at a significance level of 0.05 ($t(188)=2.102$, $p=0.037$). However, as it was hypothesised that the German personal responsibility would be larger than Dutch personal responsibility (and therefore the significance level should be 0.025), it cannot be concluded statically that German respondents have indeed a higher personal responsibility than Dutch respondents. Based on the answer rates no clear difference can be seen.

Table 7: Perceived responsibility for personal flood disaster preparations (A) and avoidance of flood damage (B)

A: Who is, according to you, responsible for preparing you for flood disaster?							
	I am fully	I am mostly	Government and I are equally	Government is mostly	Government is fully	Unknown	Average score
Netherlands	2%	11%	54%	16%	15%	3%	2.7
Germany	7%	29%	40%	17%	12%	5%	3.2
Total	5%	20%	47%	16%	9%	4%	2.9
B: Who is, according to you, responsible for preventing flood damage?							
Netherlands	1%	11%	37%	28%	20%	3%	2.4
Germany	3%	18%	38%	25%	11%	5%	2.7
Total	2%	14%	37%	27%	16%	4%	2.6

4.1.4. Risk perception

Risk perception was measured by nine statements on a scale from 1 to 5 on which respondents could indicate to which extent they agreed with the statements. The statements covered both the perceived probability and the perceived consequences of a flood event. Statements regarding perceived consequences focussed on how respondents indicated the extent of damage caused by a flood. Questions captured both the consequences on an individual scale and on a local level. The answer rates and average scores are found in table 8. Please note that the option “do not know” is not included in the calculation of the scores.

In general, Dutch respondents indicated the probability of a flood event as unlikely, however they perceived possible consequences of a flood event to be high. This gap between the two attributes of risk perception is illustrated with the Dutch attitudinal scores for perceived probability 2.6 (SD=0.72) and the perceived consequences 3.6 (SD=0.66).

Although Dutch respondents occasionally consider the possibility of a flood, the probability of an actual flood is perceived as unlikely.

When indicating the perceived probability by using the statement “I find the probability of a flood in my neighbourhood very large”, the majority of the Dutch respondents, 52%, disagreed with this statement. Only 19% agreed with this statement and found the probability of a flood large. Similar results were found for the statement in which respondents indicated whether respondents felt unsafe regarding the possibility of a flood. When asked whether respondents found the occurrence of a flood in the next 10 years likely, only one out of nine respondents indicated to find this likely. Although the probability of a flood is perceived as unlikely, 40% of the respondents sometimes thinks about the probability of a flood.

Consequences of a possible flood event were perceived to be high among Dutch respondents. Especially consequences related to property damage were perceived to be very likely. A vast majority of the Dutch respondents believed that a flood would cause a disruption of daily life. Considerable damage to houses in the neighbourhood in case of a flood is perceived to be likely by nearly three quarters of the respondents. Similar to this, 77% of the respondents agreed that their own house would suffer considerable damage in case of a flood, yet “only” 65% believed that their house would be flooded in case of a flood event. In general, the respondents’ opinions are divided when they were asked whether they expected a flood to cause a life threatening situation. Interesting is that also 7-8% of the respondents indicated that they did not know whether their house or neighbourhood would suffer considerable damage. Also, 8% of the respondents did not know whether a flood would cause a life threatening situation.

German respondents perceived the consequences of a possible flood to be considerable, but the probability of a flood event was believed to be relatively low. On average, German respondents’ perceived probability has an attitudinal score of 2.7 (SD=0.82), while the perceived consequences scored 3.4 (SD=0.85).

German respondents did perceive the probability of a flood event not to be unlikely. However, the probability of a flood event was not a topic that is contemplated much by German respondents.

Of the German respondents 27% indicated that they believed the probability of a flood event to be likely. Also, the majority indicated to disagree with the probability of a flood occurrence in the next 10 years. Nevertheless, the proportion of respondents who believed that the probability of a flood in the coming 10 years to be likely was relatively high with 20%. Only 27% of the respondents indicated to sometimes think about the possibility of a flood in their neighbourhood, while nearly half of the respondents did not think of this possibility at all. When asked whether respondents felt unsafe regarding to flood, 17% indicated to feel unsafe sometimes. However, most people indicated to feel safe (43%)

Consequences of flooding were by German respondents considered to be large and likely in case of a flood event. Especially the anticipated consequences for property damage were believed to be likely. The majority indicated that flood would cause considerable damage to their houses and houses in the neighbourhood (69% and 70% respectively). When asked if their house would be flooded in case of a flood, nearly 30% did not think their house would be flooded, yet 50% agreed. Two third of the respondents believed that a flood would cause a disruption of daily life. Consequences on personal wellbeing were not perceived to be as likely as consequences to property. Only 28% of the German respondents indicated that flood would cause a life threatening situation for themselves. Noteworthy is that 4% of the respondents indicated to not know whether a flood will cause a life threatening situation. Also 5% did not know whether daily life will be disrupted or whether buildings in the neighbourhood will suffer considerable damage.

Statistical comparison of the attributes of risk perception (perceived probability and perceived consequences) did not show statistically significant differences. Both countries perceived the probability of a flood to be low, but the consequences to be high. Also regarding the perceived consequences, consequences related to property damage were perceived to be more likely than negative consequences on personal wellbeing.

In general, German respondents seemed to perceive the probability of a flood to be a bit higher whereas Dutch respondents perceived large consequences to be more likely than German respondents. However, as mentioned, no statistically significant differences were found.

One last remarkable difference between the two countries is that German respondents seemed to be better informed, as only 1-5% of the respondents indicated they did not know what the consequences of a flood would be. Respectively 2% and 1% did not know whether their house would be flooded or whether there would be considerable damage, whereas 7-8% of the Dutch respondents did not know this.

Table 8: Answer rates and average scores of risk perception. P=perceived probability, C=perceived consequences

		Country	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do not know	Average Score
P	I find the probability of a flood event very high	NL	8	45	28	19	0	0	2.6
		DE	9	27	36	21	6	0	2.9
P	It is likely that a flood event will occur in my neighbourhood in the next 10 years.	NL	7	46	28	11	0	8	2.5
		DE	7	44	27	13	7	2	2.7
P	I sometimes think about the possibility of a flood event in my neighbourhood.	NL	9	33	14	33	8	3	3.0
		DE	21	25	25	22	5	1	2.6
P/C	I feel unsafe in respect of flood events.	NL	16	37	27	15	4	1	2.5
		DE	20	23	39	13	4	1	2.6
C	If a flood event would occur, I will be in a life-threatening situation.	NL	13	34	15	21	8	8	2.7
		DE	16	34	18	17	12	4	2.7
C	A flood event would cause considerable damage to my house	NL	2	8	4	45	34	7	4.1
		DE	3	8	19	25	44	1	4.0
C	A flood event would cause considerable damage to buildings in my neighbourhood.	NL	1	77	9	51	27	5	4.0
		DE	0	7	16	24	47	5	4.2
C	If a flood event would occur, daily life will be disturbed.	NL	3	3	1	48	43	2	4.3
		DE	4	13	13	24	42	5	3.9
C	My residence is in danger of getting flooded during a flood event.	NL	3	11	11	38	29	8	3.9
		DE	13	18	18	23	27	2	3.4

4.1.5. Coping appraisal

Coping appraisal was measured through its three attributes, namely *protective response-efficacy*, *perceived self-efficacy* and *protective response costs* (see also chapter 2 and 3). For ten different measures the perception of the three attributes was measured on a 5 point scale. Table 9 shows the outcomes of coping appraisal (see also appendix II). Please note that the results show to which extent the aspects are favourable. Hence, a low score in response costs, indicated that the costs are perceived as high and therefore might lower the intention to adopt measures.

Levels of coping appraisal were rather high among Dutch respondents. Most of the measures scored between 3 and 4 on a five point scale and scores were rather constant among the different attributes, meaning that response efficacy, self-efficacy and response costs have similar scores for each response. However, response costs was often the attribute with the lowest scores of the three. Generally, Dutch respondents indicated the response-efficacy for all measures rather high with an average attitudinal score of 3.6. Most responses scored a response-efficacy between 3 and 4 on a five point scale. Securing valuables was seen as the most effective response, while water proofing your house was believed to be the least effective response.

Self-efficacy among the Dutch respondents was rather high with an average attitudinal score of 3.5, although a bit lower than the perceived response efficacy. Water proofing of houses was seen as the protective measure with the lowest self-efficacy, while people indicated they were best capable of securing valuables and making arrangements with friends and family.

Response costs were in general perceived by the Dutch respondents to be rather small. The majority of the measures had a score between 3 and 4 for response costs. Protective measures that were perceived as the responses with the least costs were securing valuables, searching for information about personal flood protection, and making agreements with friends and family. Water proofing of the house was indicated as the most costly measure, followed by the purchase of sandbags, water pumps and insurance.

Overall, water proofing was seen as the protective response with the lowest overall score. Costs of this measure are perceived to be high, respondents thought they would not be able to water proof the house themselves and found this response the least effective. The purchase of sandbags and water pumps were unpopular measures as well. Measures with high average scores were securing valuables, acquisition of information and making agreements with friends and family. These responses were perceived as effective, easy to implement yourself and had low costs.

German respondents had on average rather positive perceptions for the different measures. However, large differences can be seen between perceived response efficacy, self-efficacy and response costs among German respondents. Gaps were largest between perceived response costs, response efficacy and self-efficacy. Purchase of insurance, water proofing of house and the purchase of a water pump showed the most variation within a coping appraisal.

Most measures were by German respondents perceived as effective responses. On average, the attitudinal score for response efficacy was 3.9 among German respondents. The responses that were perceived as the most effective were the purchase of insurance and securing valuables. Least effective was the purchase of sandbags according to the respondents.

Most respondents perceived themselves to be able to implement the different measures themselves. Self-efficacy had an average score of 3.7 which is slightly lower than the response efficacy, but still rather high. Again, securing valuables was perceived as the measure that one can best execute themselves, followed by the purchase of insurance. Most difficult to implement yourself was waterproofing of the house together with the purchase of sandbags.

Response costs were generally perceived as high with an average score of 2.8. Measures which were perceived to be least costly are securing valuables and seeking information on how to protect oneself against a flood. Most costly are waterproofing the house, purchasing an insurance, and water pumps.

When focussing on the average scores of each response, water proofing was perceived as the protective measure with the lowest coping appraisal. Although the response was believed to be rather effective, the costs were perceived to be high and people thought they were unable to implement the measure themselves. Other responses with low average scores were the purchase of sandbags and the purchase of water pumps. Securing valuables had the highest average score for coping appraisal. Other high scoring responses were acquisition of information and making agreements with friends and family. Noteworthy is that for some of the protective measures were perceived to be easy to implement and to be effective, but the response costs were believed to be high as well. This caused lower average scores. This is most visible for the purchase of insurance.

Two statistically significant differences between the Netherlands and Germany were found when the means of coping attributes were compared by means of an independent samples t-test. German respondents perceived the different responses significantly more effective than the Dutch respondents ($t(185) = 3.626, p = 0.000$). All measures had equal or higher response efficacy scores in the German dataset than in the Dutch dataset. Most noticeable were the purchase of an insurance (1.0 point difference) and water proofing of the house (1.0 difference).

Response costs were by the Dutch respondents perceived to be significantly lower than by the German respondents ($t(180) = -4.114, p = 0.000$), meaning that German respondents (score: 2.8) perceived the measures to have higher costs than Dutch respondents (score: 3.2). None of German scores for the different measures' response costs were higher than the Dutch scores. Most remarkable is the purchase of insurance with a difference of 0.9 point. Although German perceptions of response efficacy and self-efficacy are much higher for this response than the Dutch perception, the costs are perceived higher by the Germans than by the Dutch.

A statistically significant difference between German and Dutch self-efficacy was not proven ($t(186) = 1.817, p = 0.071$). Also when looking at the scores for self-efficacy in table 9, no large differences were found. The largest difference in score was found for the purchase of an insurance (0.4) with a higher score for the German respondents.

Table 9: Attitudinal scores coping appraisal

	Country	Protective response efficacy	Perceived Self-efficacy	Protective response costs	Average score
Move valuables to safe (high) place	NL	4.2	4.0	3.9	4.0
	DE	4.4	4.4	3.8	4.2
Acquiring of information on personal flood protection	NL	3.8	3.7	3.8	3.8
	DE	3.9	3.9	3.8	3.8
Setting up a emergency plan for household	NL	3.7	3.8	3.6	3.7
	DE	4.0	3.9	3.6	3.9
Making agreements with friends/family	NL	3.8	4.0	3.8	3.8
	DE	3.8	3.7	3.6	3.7
Purchase of emergency survival kit	NL	3.7	3.9	3.2	3.6
	DE	3.7	3.9	3.0	3.5
Flood insurance	NL	3.6	3.7	2.6	3.3
	DE	4.6	4.3	1.7	3.5
Water proofing of house	NL	2.8	2.2	1.8	2.3
	DE	3.8	2.7	1.5	2.7
Move outdoor installations to safe area	NL	3.6	3.6	3.3	3.5
	DE	3.8	3.4	2.7	3.3
Purchase of sand bags	NL	3.0	2.9	2.6	2.8
	DE	3.3	3.0	2.4	2.8
Purchase of water pump	NL	3.1	3.2	2.6	2.9
	DE	3.8	3.6	2.0	3.0
Overall score	NL	3.6	3.5	3.2	3.4
	DE	3.9	3.7	2.8	3.5

4.1.6. *Self-protective motivation and behaviour*

Self-protective behaviour consists of protection motivation and protective responses. Protection motivation is the intention to adopt measures while protective responses is the actual adoption of one or more responses. Both protection motivation and protective responses were measured simultaneously. People were asked to what extent they intend to adopt each of the ten different measures (no, maybe, yes planning to, yes already adopted). Based on the answers an average attitudinal score (from 1 to 4) was calculated. This score shows the average intention, or motivation, to adopt measures. Secondly, answer rates give insight in the percentage of people that actually have adopted a response: the protective responses.

Overall, protection motivation and protective responses in the Netherlands are low (see table 10 or Appendix III). The majority of the respondents has no intention to adopt any of the responses and actual adoption rates for each response are less than 10% on average.

The average score for the intention to adopt protective behaviour was 1.7 on a scale from 1 to 4. Also, each of the responses separately showed low scores of adoption intention. When looking at the answer rates (table 10), it can be noticed that many Dutch respondents show only little intention in adopting measures. For eight of the ten measures the majority had no intention to implement the measure the coming year. Only for securing valuables and the acquisition of information more than half of the respondents showed intention to implement the measure. The least popular measure is the purchase of sandbags, for which 84% of the respondents indicated they had no intention to adopt this measure. Also, respondents showed little intention to water proof their house (79%).

Similar to protection motivation, the rate of protective responses is very low. Seven out of ten measures showed implementation rates of less than 10%. The most adopted responses are 'secure valuables in a dry place' and the purchase of a water pump. 17% of the respondents indicated to have purchased an insurance. It should be noted however, that no insurance exist against major floods in the Netherlands. The insurances as indicated by respondents are household or storm damage insurances. Least adopted measures were the purchase of sandbags (0%) and securing outside installations and vehicles (1%)

Overall, protection motivation is low in Germany. On average German respondents have an attitudinal score of 1.7 on a scale from 1 to 4. Actual adoption rates are relatively high, although much variation is seen between the different measures.

The average attitudinal score for protection motivation among the German respondents is 1.9. This is rather low, yet four of the measures had an individual attitudinal score of more than 2 (table 10). Most motivation for adoption was shown for the purchase of a flood insurance. Measures for which people showed the least intention to implement was the purchase of sand bags.

When looking at the answer rates in table 10, the proportion of people showing no intention to adopt one of the measures was for seven of the ten responses more than 50%. Therefore, the majority of the respondents has no intention to adopt one of the named seven responses. The least popular response is, again, the purchase of sandbags.

Actual adoption rates differed among the different measures, but were relatively high in general. The majority of the German respondents indicated to have purchased a flood insurance (61%). In addition, one third of the respondents has already placed valuables in a safe and dry place and one quarter of the respondents owns a water pump. The least adopted measures are the purchase of sandbags (2%) and drafting an emergency plan for the family (2%).

German respondents show statistically significantly higher levels of self-protective behaviour than the Dutch respondents ($t(195)= 3.113$, $p=0.002$). This difference is not only seen in higher self-protective motivation rates, but also in higher actual adoption rates.

When looking at the portion of respondents who actually implemented responses, German respondents more often adopted one of the responses. Except for making agreements and making an emergency plan, German respondents more often indicated to have already implemented the

measure. The most spectacular difference can be seen for the purchase of flood insurance, which differs 44 percent point between the countries. Differences can also be found in high cost measures. Measures that are regarded as most costly (waterproofing, purchase of water pumps, sandbags or insurance) were more often implemented in Germany than in the Netherlands.

Nevertheless, the general pattern is the same: measures that were perceived to be effective and low in costs (e.g. acquiring information, move valuables) showed higher adoption rates than measures that were perceived to be costly and inefficient (e.g. purchase of sandbags).

Aside from their self-protective behaviour and intention to show this behaviour, respondents were also asked how well they think they are prepared for a flood. On average the score for the Netherlands is 2.4, and 2.6 for the German respondents. Both in the Netherlands and Germany a minority indicates that they believe to be well prepared (figure 4).

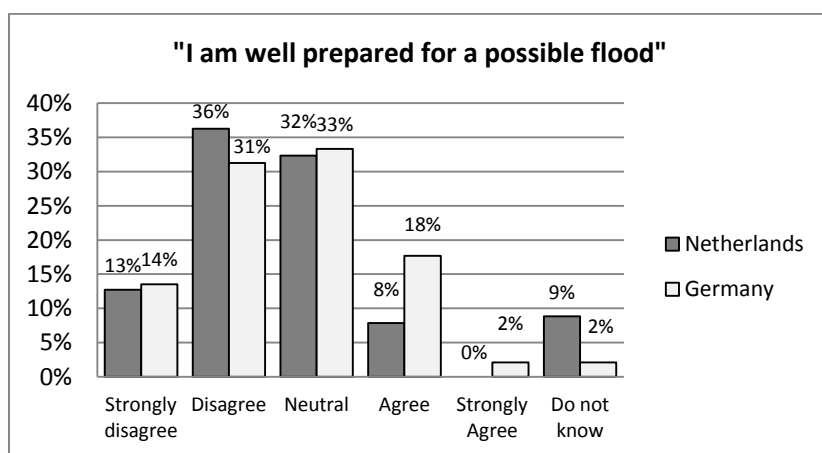


Figure 4: Citizens's perceived preparedness

Table 10: Outcomes adoption intention and actual adoption.

Adoption intention and actual adoption						
	Country	Yes, already done	Yes, planning to	Maybe	No	Average score
Move valuables to safe (high) place	NL	19	10	27	42	2.1
	DE	34	9	19	36	2.4
Acquiring of information on personal flood protection	NL	7	23	42	26	2.1
	DE	11	20	38	30	2.1
Setting up a emergency plan for household	NL	4	14	23	59	1.6
	DE	2	13	30	52	1.6
Making agreements with friends/family	NL	6	17	25	50	1.8
	DE	3	9	28	57	1.6
Purchase of emergency survival kit	NL	6	12	32	50	1.7
	DE	8	11	23	55	1.7
Flood insurance	NL	17	5	17	60	1.8
	DE	61	3	9	25	3.0
Water proofing of house	NL	4	3	13	79	1.3
	DE	16	5	22	55	1.8
Move outdoor installations to safe area	NL	1	17	18	65	1.5
	DE	7	11	25	55	1.7
Purchase of sand bags	NL	0	1	15	84	1.2
	DE	2	4	16	76	1.3
Purchase of water pump	NL	15	3	12	71	1.6
	DE	24	5	17	53	2.0

4.2. Analysis of the relations within the conceptual framework

In order to investigate the relation between risk communication and self-protective behaviour, we use the conceptual model developed in chapter 2 (figure 2). In the previous sections the indicators in this conceptual model were quantified by measuring citizens' perceptions through a Likert scale. With this data the different relations within the conceptual framework were tested. The outcomes are presented in this section. Note that the different attributes of perceived governmental flood risk communication, risk perception, coping appraisal and perceived personal responsibility were all analysed separately, rather than to merge them into e.g. risk perception. This is done in order to be as specific as possible in indicating possible relations.

Firstly, the relation between perceived governmental flood risk communication and the different indicators of self-protective behaviour (risk perception, coping appraisal and perceived personal responsibility) were investigated by means of a Pearson correlation analysis. This analysis was conducted for the dataset as a whole and for each of the countries separately in order to investigate differences. Secondly the adapted PMT model as used in the conceptual framework was tested by conducting a linear regression analysis between the independent variables of the different indicators (risk perception, coping appraisal, experience and responsibility) and the dependent variable self-protective behaviour.

4.2.1 *Perceived governmental flood risk communication and indicators of self-protective behaviour*

Perceived governmental flood risk communication does not correlate with the indicators of self-protective behaviour. Only in the overall sample (both Germany and the Netherlands) one significant, but weak, correlation was found (table 11). When looked at this overall sample, the only significant correlation found, was a weak negative correlation (-0.152 , $p=0.033$) between perceived governmental flood risk communication aimed at raising self-protective behaviour and the perception of consequences (risk perception). Notable is that the perceived governmental flood risk communication aimed at increasing risk perception was also negatively correlated with the perception of consequences, but was not significant (-0.140 , $p=0.050$). Both correlations were the highest found correlations for the overall sample. The negative correlation indicates that the higher (more positive) the perception of governmental flood risk communication, the lower are the negative consequences of a flood perceived.

When a correlation analysis was conducted for each country separately, for none of the countries significant correlations between perceived governmental flood risk communication and the indicators for self-protective behaviour were found (Table 11).

The two highest correlations found in the Netherlands (but not significant), were the correlation between perceived governmental flood risk communication aimed at increasing self-protective behaviour and perceived consequences (-0.149 , $p=0.138$), and perceived governmental flood risk communication aimed at raising risk awareness and perceived consequences (-0.140 , $p=0.166$). Significance levels of German correlations were higher, but none of the correlations had a significance level of less than $p=0.05$. Only the three correlations with the highest Pearson correlation values had significance levels between 0.050 and 0.100. Perceived governmental flood risk communication aimed at raising levels of self-protective behaviour correlated with self-efficacy (0.189 , $p=0.074$), the perceived consequences (-0.173 , $p=0.092$) and perceived personal responsibility to avoid flood damage (0.174 , $p=0.099$).

The results mentioned above indicate differences between the Netherlands and Germany. In the Netherlands perceived governmental flood risk communication seems to relate to perceived probability only, while in Germany, perceived governmental flood risk communication related to three different aspects. However, these results are not significant and thus no statistical proof was found.

Table 11: Outcomes of correlation analysis between perceived governmental flood risk communication and self-protective behaviour.

	Netherlands		Germany		Total	
Risk communication aimed at increasing risk perception	Pearson	Sig.	Pearson	Sig.	Pearson	Sig.
RC_Risk Perception - Responsibility: flood damage	0.046	0.653	0.151	0.154	0.103	0.157
RC_Risk Perception - Responsibility: preparedness	0.065	0.525	0.009	0.932	0.046	0.531
RC_Risk Perception - Perceived probability	0.024	0.809	-0.057	0.579	-0.018	0.802
RC_Risk Perception - Perceived consequences	-0.100	0.321	-0.164	0.111	-0.140	0.050
RC_Risk Perception - Protective response efficacy	-0.047	0.643	0.014	0.897	-0.007	0.924
RC_Risk Perception - Perceived self-efficacy	-0.047	0.646	0.142	0.181	0.049	0.501
RC_Risk Perception - Protective response costs	-0.002	0.985	0.088	0.422	0.044	0.557
RC_SPB - Responsibility: flood damage	0.015	0.883	0.174	0.099	0.077	0.289
RC_SPB - Responsibility: preparedness	-0.018	0.862	0.043	0.686	-0.021	0.772
RC_SPB - Perceived probability	-0.140	0.166	-0.062	0.548	-0.100	0.164
RC_SPB - Perceived consequences	-0.149	0.138	-0.173	0.092	-0.152*	0.033*
RC_SPB - Protective response efficacy	-0.010	0.922	0.125	0.242	0.031	0.674
RC_SPB - Perceived self-efficacy	0.046	0.650	0.189	0.074	0.104	0.154
RC_SPB - Protective response costs	0.022	0.829	0.100	0.363	0.101	0.175

*RC_Risk Perception = Risk communication aimed at raising risk perception, RC_SPB = Risk communication aimed at enhancing self-protective behaviour, * =significant correlations at $p < 0.05$*

4.2.2 Protection motivation theory

Besides the relation between perceived governmental flood risk communication and indicators of self-protective behaviour, the relations between the indicators of self-protective behaviour and self-protective behaviour itself were explored as well. This was done to compare the PMT model with other research on self-protective behaviour and to indicate possible malfunctions in the model. Both a linear regression with a forced entry (default setting in SPSS) and a stepwise linear regression were conducted and showed similar results. Therefore only the linear regression with forced entry will be discussed in this section in order to keep a clear overview.

In line with the conceptual model (see figure 2), the indicator *experience* is also included in the regression analysis besides risk perception, coping appraisal and perceived personal responsibility. Initially the variable “description of experience” was included in the concept “experience”, however due to the low amount of respondents who filled out the question related to this, it was decided to not include this variable in the regression analysis. Furthermore, the different variables were checked for collinearity by including the collinearity analysis in the linear regression. For none of the models problems with collinearity were detected. Table 12 and 13 show the results of the linear regression analysis that was conducted to assess the explanatory power and relations of the different indicators and self-protective behaviour.

A regression analysis was run for the German, the Dutch and the overall sample. Only for the overall sample the model proved to be significant. The regression model of the overall sample has an explanatory power of 12.8% ($R^2 = 0.128$) and is significant ($p = 0.009$). When looking at the different aspects within the model of the overall sample, one significant variable was found: response efficacy ($B = 0.318$, $p = 0.000$). This means that response efficacy is the only variable in the model that has predictive power and that other variables could be excluded from the model.

Although not significant ($p = 0.065$), the Dutch regression model explains 17.6% of the variance ($R^2 = 0.128$). The only significant variable in the Dutch model is the *perceived probability* with a b-value of 0.193 ($p = 0.031$). This is not the highest b-value in the model. The highest value corresponds with the response efficacy ($B = 0.215$, $p = 0.072$) which was not significant.

The explanatory power of the German regression model is 17% ($R^2=0.170$), however with a significance of $p=0.158$ the model is not significant. Only one variable, response efficacy, is significant ($B=0.378$, $p=0.003$) in this model and is also the variable with the largest b-value.

Table 12: Outcomes regression analysis between indicators of self-protective behaviour and self-protective behaviour itself.

	Netherlands		Germany		Total	
	B	p	B	p	B	p
1. Experience						
- Direct Experience	0.051	0.694	0.311	0.132	0.086	0.444
- Indirect experience	0.260	0.075	-0.001	0.997	0.044	0.690
2. Responsibility (...)						
- to prevent damage	-0.124	0.055	0.100	0.222	-0.020	0.688
- to be well prepared	0.004	0.954	-0.030	0.737	0.032	0.548
3. Risk perception						
- Perceived probability	0.193*	0.031	0.099	0.344	0.122	0.072
- Perceived consequences	-0.132	0.181	-0.059	0.542	-0.106	0.130
4. Coping appraisal						
- Response efficacy	0.215	0.072	0.378**	0.003	0.318*	0.000
- Self-efficacy	0.022	0.847	-0.126	0.305	-0.038	0.643
- Response costs	0.179	0.129	0.137	0.264	0.039	0.624

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 13: Predictive power and significance levels of regression models.

	R^2	R^2 Adjusted	Sig.
Netherlands	0.176	0.083	0.065
Germany	0.170	0.058	0.158
Total	0.128	0.078	0.009

5. Discussion

This research primary focuses on the exploration of the relation between perceived governmental flood risk communication and self-protective behaviour of Dutch and German citizens. It was hypothesised that perceived governmental flood risk communication would indirectly influence self-protective behaviour through different indicators of self-protective behaviour (experience, perceived personal responsibility, risk perception and coping appraisal). Additionally, significant differences between the Netherlands and Germany concerning perceived governmental flood risk communication, self-protective behaviour and its indicators were expected. In order to explore the relation between perceived governmental flood risk communication and self-protective behaviour, and to compare both countries, the current perceptions of the Dutch and German citizens of these aspects were identified. Also, the perceptions of the Dutch and German citizens on the indicators of self-protective behaviour were indicated. For the exploration of the relations between perceived governmental flood risk communication and self-protective behaviour, a conceptual framework was developed in which the protection motivation theory was adapted and connected with perceived governmental flood risk communication (figure5).

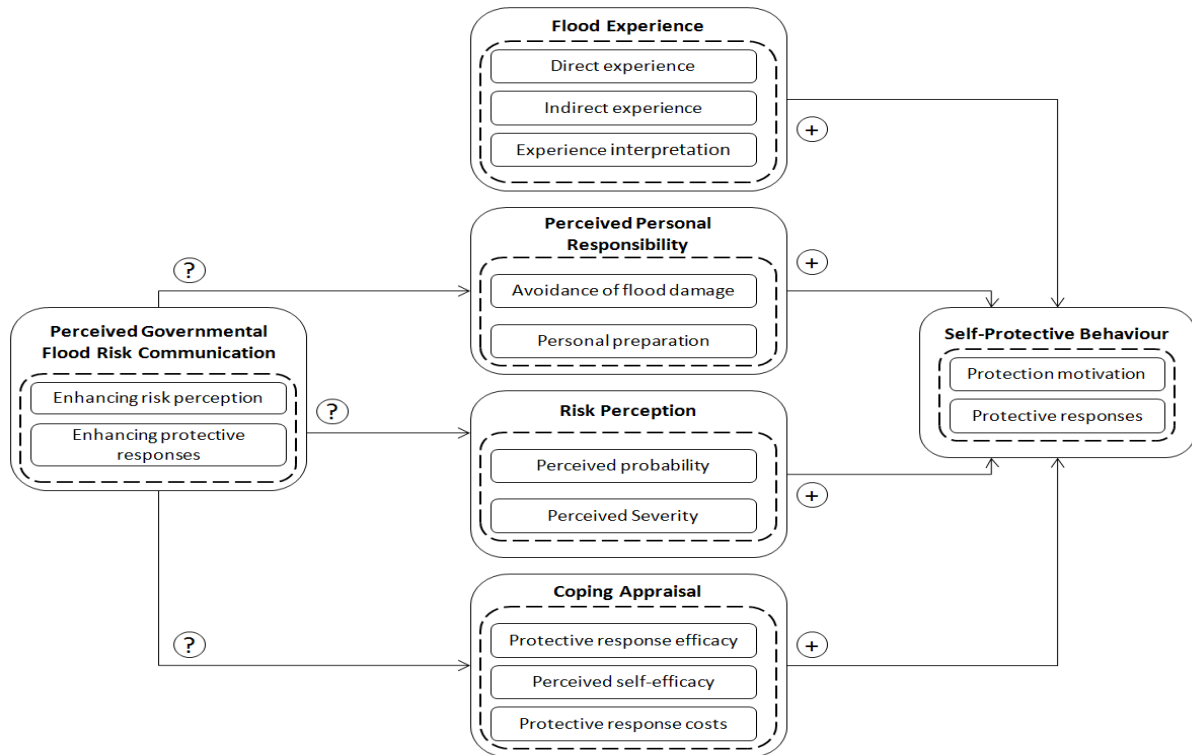


Figure 5: Conceptual framework

This chapter will interpret and discuss the results as shown in the previous chapter in the context of other scientific work in the field of self-protective behaviour in flood risk management. This chapters' structure follows the research questions that were defined in section 1.5:

- The identification of the perceptions on governmental flood risk communication;
- The identification of the perceptions on self-protective behaviour and its indicators;
- How governmental flood risk management relates to indicators of self-protective behaviour;
- How the indicators of self-protective behaviour relate to self-protective behaviour itself.

For practical reasons the final research question, identifying the similarities and differences between German and Dutch citizens, are interwoven with the other sections. In addition, the restrictions and advantages of the used methodology are discussed. Finally, implications of this research for (future) flood risk management will be conferred as well in this chapter.

5.1. Identification of current perceptions

In general, Dutch and German respondents perceive different aspects likewise. Yet, significant differences were found, although these differences were often relatively small. Citizens show positive attitudes towards aspects such as coping appraisal and personal responsibility. Yet, citizens show little motivation to adopt protective responses. Also actual adoption rates for different responses are low. The consequences of a flood event are perceived to be high, but the probability of a flood event is believed to be low.

Outcomes of this research are in line with results from existing literature. Deviations what were found could be attributed to the selected research areas. When a comparison with the existing literature was made, it was also found that much of the (German) literature used qualitative data for their estimations. As many of the outcomes were in line with existing qualitative outcomes, the outcomes of this research can be seen as a quantitative supplement to the existing knowledge.

This section will discuss the found perceptions (as indicated in chapter 4) in the context of existing research

The results indicate that German and Dutch citizens share a similar perception on governmental flood risk communication. Citizens find communication about flood risks and personal flood protection important and are open to receiving more information. However, the current supply of information is seen as insufficient and ineffective. Information is not received at all or does not fit the personal situation of respondents. This is comparable to the results of a case study by Gutteling et al. (2010) on perceived governmental flood risk communication of Dutch citizens

Dutch citizens in the study area have significantly more direct and indirect experience (through friends and family) with flooding than German citizens. While the majority of the Dutch have direct experience with (near) flood events, the majority of the Germans do not have such experience.

German respondents perceive themselves significantly more often responsible for their own preparation for a flood event than Dutch respondents. Responsibility to prevent flood damage is perceived to be the responsibility of both the government and the citizens. However, the emphasis lies at the government in both the Netherlands and Germany. It could not be statistically proved that one of the two countries has a significantly higher perception on this.

The found Dutch perceptions on personal responsibility are comparable to those found by Terpstra and Gutteling (2009). When compared to German literature on personal responsibility, no quantitative data was found. Instead estimates were based on qualitative data from interviews. German sense of personal responsibility in flood risk management is by most authors described as high thus the outcomes of this research were in line with existing literature. (Janssen, 2008; Becker and Raadgever, 2006).

Risk perception is similar in the Netherlands and Germany. While the probability of a flood event is perceived to be low, negative consequences are perceived to be high. This indicates that although citizens realize the potential danger of a flood, they do not find the probability of an actual flood to be very likely. This perception of risk in both the Netherlands and Germany is in line with the outcomes of other research (Terpstra and Gutteling, 2009; Baan et al., 2008). Terpstra and Gutteling (2009) and Baan et al (2008) found relatively high risk perception scores for Dutch citizens, but this might be due to the selection of research areas that have a different flood history. Although German literature acknowledges a raised risk awareness among German citizens after the floods of 1993 and 1995 the literature indicates general risk awareness to be low (Grothmann and Reusswig, 2006). Thus far, no quantitative data was provided, so no further comparison could be made.

Statistically significant differences between German and Dutch citizens are found for two of coping appraisal's attributes: German citizens find the responses in personal flood protection more effective than Dutch citizens, while Dutch citizens indicate the costs of these responses to be lower than German citizens. Despite the significant differences, the response efficacy is believed to be high, while the perceived response costs vary for each response in both countries. A comparison of self-efficacy shows no significant differences and is relatively high.

Although previous research stretches the potential importance of coping appraisal, a standardized approach to measure this coping appraisal is absent in the literature. Terpstra (2010) uses seven indicators instead of three, while Baan et al. (2008) and Thieken et al. (2007) only measure response efficacy. When comparing the results with findings from the existing literature, several differences in outcomes are found. Dutch respondents in this research perceived the responses to be more effective than the respondents in the research conducted by Terpstra (2010). Response costs and the ability to implement the responses yourself are perceived likewise. Thieken et al. (2007) only measures the effectiveness of responses in East Germany. Surprisingly, most responses are perceived as quite ineffective. This is contrary to the outcomes of this research, although this might be caused by the research design and context of the research by Thieken et al. (2007), as they investigated the impact of the 2002 floods in East Germany; a severe and relatively recent flood.

German citizens show significantly higher levels of self-protective behaviour than Dutch citizens, yet both adoption motivation and actual adoption rates are low in both countries. For most of the measures the majority of the citizens indicate to have no intention in adopting the measure within one year. Measures that are perceived to be effective and low in costs are adopted most by respondents. Reviewed research in self-protective behaviour mainly focuses on actual adoption rates. It was found that results from Dutch case studies show lower adoption rates than the outcomes of this research (Baan et al., 2008). This is contrary to results from the German case study which found higher levels of response adoption (Grothmann and Reusswig, 2006). The difference in adoption rates can be explained by the choice of the research area of the other authors. Research areas included areas where floods had caused considerable damage in the past which motivated the respondents to conduct these measures according to the authors (Grothmann and Reusswig, 2006; Baan et al., 2008).

5.2. Identification of the relations within the conceptual framework

As mentioned, the relations as presented in the conceptual framework (figure 5) are analysed by means of two different statistical analyses. First the predictive power of indicators of self-protective behaviour was determined by means of a linear regression analysis. The relations between perceived governmental flood risk communication and the indicators of self-protective behaviour were analysed by means of a correlation analysis. This chapter will discuss the outcomes and compare these with existing literature.

5.2.1. *The indicators of self-protective behaviour and self-protective behaviour*

In order to explore the relation between the indicators (or predictors) of self-protective behaviour and self-protective behaviour itself an adapted model of the protection motivation theory (PMT) was used in the conceptual framework. Unfortunately the PMT model as used in this research had no predictive power for both the Netherlands and Germany. Only when the model was tested with the complete sample (Germany and the Netherlands) a significant model with predictive power was produced. In this model only weak relations were found which were in nearly all cases not significant.

An explanation may be found in the fact that the original PMT was adapted in this research by including more hazard specific indicators and at the same time simplifying the model by excluding the influence of non-protective responses, actual barriers and possible feedback loops. Differences could therefore have occurred due to the different variables that were used. Especially the role of non-protective responses could have been underestimated as Grothmann and Reusswig (2004) note.

Grothmann and Reusswig (2004), for example, found that their PMT model had statistically significant explanatory power of all the indicators. These results are different to the results found in this research. However, contrary to this research, Grothmann and Reusswig did not simplify the PMT and included *reliance on public flood protection* instead of perceived personal responsibility.

Despite the adaptations in the PMT, it should be noted that weak relations or indicators with no predictive power are not uncommon in research on self-protective behaviour. According to a meta study by Bubeck et al. (2012), most of the studies they investigated showed no or weak relations between several indicators and self-protective behaviour.

Also it might be possible that some of the indicators do not directly influence self-protective behaviour. For example: Terpstra (2008) noted that people who “attribute responsibility for damage mitigation to the government have a less positive attitude toward their own damage mitigation activities” (Terpstra 2008, pp. 564), indicating that perceived personal responsibility could be linked with coping appraisal. In addition, Bubeck et al (2012) indicated that some studies found that experience did not have a direct influence on self-protective behaviour, but only influenced self-protective behaviour indirectly through another variable.

By adding new concepts to the PMT, a direct relation with protection motivation or self-protective behaviour is often assumed. However, several studies recognize the possibility of indirect relations. This can influence the accuracy of an adapted PMT model. Thus, different adaptations in the PMT model can give varying results and might therefore not be as suitable for adaptation as believed.

5.2.2. *Perceived governmental flood risk communication and self-protective behaviour*

The relation between perceived governmental flood risk communication and the indicators of self-protective behaviour was explored through correlation analysis. No significant correlations were found between perceived governmental flood risk communication with any of the indicators of self-protective behaviour (perceived personal responsibility, risk perception and coping appraisal). Based on this finding, it cannot be proved that risk communication has influence on self-protective behaviour. This is contradicting previous research that stretches the importance of risk communication in raising risk perception and self-protective behaviour (Wachinger et al., 2013; Gutteling et al., 2010; Thieken et al., 2007).

There are a few possible explanations for this result. First, many of the respondents indicated that they were not familiar with governmental risk communication and that they therefore answered “do not know” in the questionnaire. These answers were not included in the calculation of average scores as it was agreed that this option does not fit within the range of the likert scale. The option “do not know” was included in the questionnaire in order to avoid untrue answers.

Secondly, if communication from the government is not effective (either people do not receive the information or are not stimulated to undertake action), no connection with self-protective behaviour is made in the first place. Respondents in this research indicated that governmental flood risk communication was not stimulating and the information supply does not fit personal demands. These results are in line with Gutteling et al. (2010) and Thieken et al. (2007) who confirm the need for tailor made information.

5.3. *Limitations and difficulties*

In general, the perceptions found for each of the concepts are in line with findings from other literature. However, most of the empirical data that was found related to the Netherlands. Empirical data on perceptions and attitudes in Germany, and more specific North Rhine-Westphalia was scarce. This division in available data also influenced the questionnaire that was used. Most of the questions and responses used in the questionnaire, originate from Dutch research. It must be noted however, that it was assumed that Dutch and German respondents would interpret the questions likewise.

Although the Dutch and Germans are believed to be likely minded some differences and difficulties occurred that were initially not anticipated. One difficulty that occurred during the questionnaire, was the that perception of flood differed between both study areas. Dutch citizens related to the 1995 high water levels when asked about flooding, German respondents often related to ground water flooding. Since the German emphasis lied on groundwater flooding, questionnaires might have filled in differently. Also because the survey was conducted by a non-native speaker, German respondents might have been less willing to participate in this research. Response rates were lower in Germany than in the Netherlands.

It should also be recognized that a questionnaire which is filled in by respondents themselves can be prone to bias or misinterpretation. Some respondents for example refused to answer certain questions, and some people might have indicated a higher adoption intention than they actually had. In addition, some questions in the questionnaire were interpreted differently by some respondents. Due to the layout of the question on coping appraisal, some respondents only answered the question for one attribute instead of all three attributes.

Relating to the measurement of perceived governmental risk communication, citizens might not always know which communication is governmental communication. I.e. a news bulletin on flood risk could be interpreted as governmental information. As citizens rely on past experiences to answer the questions, the accuracy of answers could be influenced. Citizens might also be biased. Negative experience with the government might lead to generalisation and influence the answers.

It is important to realize that, besides practical difficulties, there are certain methodological limitations as well when analysing and comparing the results of a research that uses a socio-psychological model. Firstly, as Grothmann and Reusswig (2012) mention, one should question to what extent it is possible to capture the real thoughts of your respondents by means of a standardized questionnaire. Even though special care was taken to incorporate as much nuance as possible in the questionnaire, it is difficult to indicate a complete opinion on such a complex topic by means of a questionnaire that can be filled out in 15 minutes. In addition, the perception of citizens on flood risk communication is debated. Literature suggests that citizens' attitude form part of the problem of ineffective risk communication (Baan and Klijn, 2004; Gutteling et al.,2010; Kievik and Gutteling, 2011; Bradford et al.,2012; Markon, 2013). Citizens' openness towards risk communication might be sincere, but research found that citizens often only absorb information that seems relevant to them and fits within their reality (Markon, 2013; Kievik and Gutteling, 2011). When people do not perceive the risk to be high and urgent they are likely to ignore information on flood protection.

A second important limitation is the fact that a model such as the PMT, tries to indicate causal relations, however, as Grothmann and Reusswig (2004) noted, the design of the research is not experimental, nor cross sectional. Therefore it is not appropriate to assume causal relations. Another difficulty with this limitation is mentioned by Bubeck et al. (2012). They state that research in this scientific domain often only focuses on current opinions; however, these opinions might be influenced by decisions made in the past. This research followed the advice of Bubeck at al. (2012) by also indicating the intention to adopt measures in the future in order to have a more nuanced input.

5.4. Implications and recommendations for future research and policy

Much research in flood risk management highlighted the importance of risk communication in enhancing different aspects of flood risk management. However, actual empirical research is scarce and needs to be extended. This research aimed at getting a better understanding of the relation between flood risk communication and self-protective behaviour by adapting a socio-psychological model that is currently used in flood risk management research. The outcomes suggest that existing (adapted) psychological models might not be suitable for including external aspects such as perceived governmental flood risk communication. Hence, alternative models should be explored or developed in which the role of risk communication in flood risk management can be investigated. In order to develop such models, a good understanding of risk communication itself is needed and current knowledge should be deepened.

The use of the protection motivation theory (PMT) has been promoted by Grothmann and Reusswig (2004), who have successfully applied this model in the context of flood hazards. However, this research showed that the PMT is not as flexible as suggested by Grothmann and Reusswig (2004). Thus, the suitability of the model within flood hazards should be investigated further.

In line with this, future research should explore new potential indicators. This research found significant differences between the Netherlands and Germany concerning self-protective behaviour and attempted to explain these differences through perceived governmental flood risk communication. It was not possible to explain these differences, however these differences might be of importance to get a better understanding in how concepts such as self-protective behaviour are constructed. The introduction of this research discussed for example differences in flood risk management approaches that might be of influence.

The results of this research show positive signs for managers in the Netherlands and Germany. Coping appraisal and perceived personal responsibility are relatively high in both countries. Also, citizens are positive towards receiving risk communication. However, citizens indicate a lack of tailor made information and do not find provided information effective. Managers should therefore enhance two way communication in which the wishes and requirements of citizens are acknowledged and incorporated in communication strategies. In order to enhance citizen involvement and responsibility, the government should facilitate and encourage this. In order to influence the attitudes of citizens, existing communication theory should be incorporated in the current communication approaches.

Significant differences between the Netherlands and Germany indicate that flood risk management should not be generalized, but rather be specific to the area. Comparison with existing literature showed differences between areas, which emphasizes the diversity in flood risk history and risk perceptions in each area. Recognizing these differences and understanding how these differences developed is crucial in improving both local and regional flood risk management.

6. Conclusion

Governmental risk communication is seen as the main tool to increase the currently low levels of self-protective behaviour. However, the impact of governmental flood risk communication on self-protective behaviour seems small and the relation between governmental flood risk communication and self-protective behaviour has never been investigated. This research contributed to fill this knowledge gap by exploring the relation between citizens' perceived governmental flood risk communication and self-protective behaviour in Germany and the Netherlands.

Following the outcomes of this research, it is concluded that perceived governmental flood risk communication could not predict self-protective behaviour through the conceptual framework that was tested in this research. The PMT model is in existing literature viewed as a promising tool in investigating self-protective behaviour due to the possibility of adding new variables to the model. However, this research showed that the PMT model is not as flexible as suggested: the adapted model that was used in this research showed no predictive power. Therefore, the PMT model is probably not suitable for connecting possible indirect variables such as perceived governmental flood risk communication with self-protective behaviour.

A comparison between the Netherlands and Germany confirms, as hypothesised, that German citizens show significantly higher levels of self-protective behaviour than Dutch citizens. German citizens also perceive protective responses to be more effective and see the responsibility to prepare for a flood event more often as a personal responsibility. The Dutch on the other hand have significantly more flood experience and perceive response costs to be lower than German citizens. Unfortunately, it could not be concluded that these differences are caused by a different perception of governmental flood risk communication, because the model used to test this hypothesis did not have any significant predictive power.

Concerning the perceived governmental flood risk communication and risk perception, no significant differences between the two countries were found. Governmental flood risk communication is by citizens in both countries perceived as potentially important information, however the current supply of information provided by the government is perceived to be too little and does not fit citizens' requirements. The probability of a flood event is perceived to be low, but negative consequences on the other hand are perceived to be large.

Future research should focus on identifying models in which risk communication in flood risk management can be effectively studied. In order to develop such models, a good understanding of (risk) communication theory is necessary. In addition, alternative or supplementary indicators should be explored to contribute to a better understanding of self-protective behaviour. Possible indicators of interest could be the role of trust in water managers or flood defences but also more general perceptions on safety or nature. As described in the introduction of this research, flood risk management in the Netherlands and Germany differs in citizen involvement and perceptions on river management. These perceptions could also play a role in self-protective behaviour. The influence of these cultural differences should not be underestimated and a better understanding of how differences between countries occur, contribute to a better understanding of self-protective behaviour and citizen involvement in general.

Current flood risk communication is ineffective and does not provide the desired information according to citizens. As citizens do desire more information and show relatively high levels of coping appraisal, it is important to practice two-way communication in which citizens can indicate which information is desired and required. In order to increase citizen involvement and responsibility, this should be facilitated first. For this a good understanding of communication is of importance and policy makers should be aware of communication theory and possible effects of each communication strategy possible impacts before applying them.

7. Reference List

1. Aarts, N., Woerkum van, C., 2010. *Strategische communicatie: principes en toepassingen*. Assen: Van Gorcum. Ch.3, pp.36-56.
2. Baan, P.J.A., Klijn, F., 2004. Flood risk perception and implications for flood risk management in the Netherlands. *International Journal of River Basin Management*, 2 (2) pp. 113-122.
3. Baan, M.E., Gutteling, J.M., Terpstra, T., 2008. *Risicoperceptie en Risicocommunicatie bij overstromingen: rapportage van dataverzameling in het kader van de oefenweek 'waterproef' van de Taksforce Management Overstromingen (TMO)*. Universiteit Twente
4. Becker, G., Raadgever, D.T., 2006. *Interview Report: Dutch-German 'Arbeitsgruppe Hochwasser'. Long term flood management in the Lower Rhine region*. Amsterdam: Institute for Environmental Studies, Seecon and TU Delft.
Available at:
http://promise.klimaatvoorruijme.nl/pro1/publications/publications.aspx?workspaceid=0&personid=0&pubtypeid=7&groupid=0&clusterid=1&subclusterid=0&string1=&string2=&string3=&string4=&operator1=AND&operator2=AND&operator3=AND&search_scope=1&age_start=0&age_end=0&pub_year=0
[Accessed 14 December 2014]
5. Bohölm, A., 1998, Comparative studies of Risk Perception: a review of twenty years of research, *Journal of Risk Research*, 1 (2). pp. 135-163.
6. Bradford R.A. et al., 2012, Risk perception – issues for flood management in Europe, *Natural hazards and Earth System Sciences*, 12, pp: 2299-2309.
7. Brinke ten, W.B.M., Saeijs, G.E.M., Helsloot, I., Alphen van, J., 2008. Safety chain approach in flood risk management, *Municipal Engineer*, 161 (ME2) pp.93-102.
8. Bubeck, P., Botzen, W.J.W., Aerts, J.C.J.H., 2012. A Review of Risk perceptions and Other Factors that Influence Flood Mitigation Behavior. *Risk Analysis*, 32 (9), pp.1481-1495.
9. Demeritt, D., Nobert, S., 2014. Models of best practice in flood risk communication and management. *Environmental Hazards* 13 (4), pp 313-328.
10. European Commission, 2014, *A European Flood Action programme*, [Online] (Updated 30-10-2014)
Available at: http://ec.europa.eu/environment/water/flood_risk/impacts.htm
[Accessed 5 November 2014]
11. Garrelts, H., Lange, H., 2011. Path Dependencies and Path Change in Complex Fields of Action: Climate Adaptation Policies in Germany in the Real of Flood Risk Management. *AMBIO*, 40, pp. 200-209.
12. Grothmann, T., Reusswig, F., 2004. People at risk of Flooding: Why some Residents take Precautionary Action while Others do not. *Natural Hazards*, 38, pp.101-120.
13. Gutteling, J.M., Baan, M., Kievik, M., Stone, K., 2010. Geen Paniek! Risicocommunicatie door de ogen van de 'burger'.
In: H. van der Most, S. de Wit, B. Broekmans and W. Roos, Eds. 2010 *Kijk op waterveiligheid*. Delft: Eburon. Essay 7, pp. 150-169.
14. Hooijer, A., Klijn, F., Pedrolí, G.B.M., Os van, A.G., 2004. Towards Sustainable Flood Risk Management in the Rhine and Meuse River Basins: Synopsis of the Findings of IRMA-SPONGE. *River Research and Applications*, 20, pp.343-357.
15. Janssen, J.A.E.B., 2008. On peaks and politics; governance analysis of flood risk management cooperation between Germany and the Netherlands. *International Journal of River Basin management*. 6(4), pp. 349-355.
16. Jiggins, J., Slobbe van, E., Röling, N., 2007. The organisation of social learning in response to perceptions of crisis in the water sector of the Netherlands. *Environmental Science and Policy*, 10, pp.526-536.

17. Kellens, W., Terpstra, T., De Maeyer, P., 2013. Perception and Communication of Flood Risks: A Systematic Review of Empirical Research, *Risk Analysis*, 33(1) pp. 24-49.
18. Kievik, M., Gutteling, J.M., 2011. Yes, we can: motivating Dutch citizens to engage in self-protective behaviours with regard to flood risks, *Natural Hazards*, 59(3) pp. 1475-1490.
19. Linde te, A.H. et al., 2011. Future flood estimates along the river Rhine. *Natural Hazards and Earth System Sciences*, 11, pp. 459-473.
20. Markon, M. L., Crowe, J., Lemyre, L., 2013. Examining uncertainties in government risk communication: citizens' expectations. *Health, Risk & Society*, 15 (4), pp.314-332.
21. Merz, B., Emmermann, R., 2006. Zum Umgang mit Naturgefahren in Deutschland: Vom Reagieren zum Risicomanagement. *GAIA*. 15 (4) pp. 265-274.
22. Messner, F., Meyer, V., 2006. Flood Damage, Vulnerability and Risk Perception – Challenges for Flood Damage Research.
In: J. Schanze, E. Zeman, J. Marsalek, Eds. 2006 *Flood Risk Management: Hazards, Vulnerability and Mitigation Measures*. Dordrecht: Springer in cooperation with NATO Public Diplomacy Division. Ch13. pp.149-167.
23. MKULNV-NRW, 2013. *Mit dem Wasser Leben: Hochwasserschutz in NRW*. [online] Ministerium für Klimaschutz, Umwelt, Landwirtschaft, Natur- und Verbraucherschutz des Landes Nordrhein-Westfalen.
Available at: http://www.umwelt.nrw.de/umwelt/pdf/broschuere_mit_dem_wasser_leben.pdf [Accessed 29 September 2014]
24. Petrow, T., 2006. Improvements on Flood Alleviation in Germany: Lessons Learned from the Elbe Flood in August 2002. *Environmental Management*, 38, pp.717-732.
25. Plate, E. J., 2002. Flood risk and flood management, *Journal of Hydrology*, 267, pp. 2-11.
26. Ruimte voor de Rivier, d.u. *Room for the River programme*. [Online] (last update unknown)
Available at: <http://www.ruimtevoorderivier.nl/english/room-for-the-river-programme/> [Accessed 14 November 2014]
27. Schanze, J., 2006. Flood Risk Management – A basic Framework.
In: J. Schanze, E. Zeman, J. Marsalek, Eds. 2006. *Flood Risk Management: Hazards, Vulnerability and Mitigation Measures*. Dordrecht: Springer in cooperation with NATO Public Diplomacy Division. Ch1. pp.1-20.
28. Siegrist, M., Cvetkovich, G., 2000. Perception of Hazards: the Role of Social Trust and Knowledge. *Risk Analysis*, 20 (5), pp. 713-720.
29. Sjöberg, L., Moen, B., Rundmo, T., 2004. *Explaining risk perception: an evaluation of the psychometric paradigm in risk perception research*. Trondheim: Rotunde Publikasjoner.
30. Slomp, R., 2012. *Flood Risk and Water Management in the Netherlands: A 2012 update*. [online] Rijkswaterstaat.
Available at:
http://www.preventionweb.net/files/29781_hr3845545binnenwerkfloodriskandwate.pdf [Accessed 23 September 2014]
31. Slovic, P., 2000. *The Perception of Risk*, 1st ed. London: Earthscan Publications Ltd.
32. Steenhuisen, B., Dicke, W., Tjink, D., 2007. 'Trade-offs' versus 'safety first': how national Differences in Flood Policy can be bridged. *Water International*, 32 (3), pp.380-394.
33. Stive, M. J. F., et al., 2011. How the Dutch plan to stay dry over the next century, *Civil Engineering*, 164, pp. 114-121.
34. Terpstra, T., Gutteling, J.M., 2008. Households' Perceived Responsibilities in Flood Risk Management in The Netherlands. *Water Resources Development*, 24 (4), pp.555-565.
35. Terpstra, T., 2009. *Flood Preparedness: Thoughts, Feelings and Intentions of the Dutch Public*, Thesis, Enschede: Twente University.
36. Terpstra, T., 2010. Tegen dovemans oren gezegd? Adviezen over de opzet en inhoud van overheidscommunicatie over voorbereidingen op overstromingen.
In: H. van der Most, S. de Wit, B. Broekmans and W. Roos, Eds. 2010 *Kijk op waterveiligheid*. Delft: Eburon. Essay 10, pp. 208-229.

37. Thieken, A.H., Kreibich, H., Müller, M., Merz, B., 2007. Coping with floods: preparedness, response and recovery of flood-affected residents in Germany in 2002. *Journal of Hydrological Sciences*, 52 (5), pp. 1016-1037.
38. Vogt, R., 2012. Sensibilisierung und Beteiligung der Bürger im Hochwasserschutz Köln. In: Österreichischer Wasser- und Abfallwirtschaftsverband, *FlussBautagung 2012 Hochwasserrisikomanagement*. Bad Ischl, September 2012, Salzkammergut Media GmbH:Gmunden.
Available at: <http://www.wasseraktiv.at/resources/files/2012/10/3/3305/flussbautagung-12-pdf-version-kl.pdf>
[Accessed 18 November 2014]
39. Wachinger, G., Renn, O., Begg, C., Kuhlicke, C., 2013. The Risk Perception paradox – Implications for Governance and Communication of natural Hazards. *Risk Analysis*, 33 (6), pp. 1049-1065.
40. Winnegge, R., Maurer, T., 2002. *Water Resources Management Country Profile Germany: report no. 27*. [Online]Koblenz: Bundesanstalt für Gewässerkunde.
41. Winsum-Westra, M. van, Buijs, A.E., Groot de, M., 2010. *Pilot: Tevreden met hoogwaterbescherming?; Een studie naar de tevredenheid met hoogwaterbescherming onder de bevolking*. Wageningen: Alterra
42. Wolfert, H.P., Koning, M.J., Nijhof, B.S.J., 2005. *Grote rivieren: veiligheid en natuur*. [Online] Wageningen: Alterra.
Available at: <http://www.rivm.nl/bibliotheek/rapporten/408763013.pdf>
[Accessed 12 October 2014]

Appendix I: Questionnaire (Dutch version)

Beste meneer of mevrouw,

Deze enquête, is onderdeel van mijn afstudeeronderzoek voor de studie *Bos en Natuurbeheer* aan de Wageningen Universiteit. Ik zou het zeer op prijs stellen als u deze vragenlijst invult. Dit kost ongeveer 15 minuten van uw tijd en levert mij heel veel waardevolle informatie op voor mijn onderzoek.

Het onderzoek waarvoor deze enquête is opgesteld heeft als doel om meer inzicht te krijgen in meningen van burgers over de gevaren van overstroming en hoe de effecten hiervan verkleind kunnen worden. Het voorkomen van overstromingen heeft altijd een belangrijke rol gespeeld in water beheer en zal dat ook blijven doen in de toekomst. Om in te spelen op toekomstige veranderingen is het noodzakelijk dat het beleid rondom waterveiligheid op tijd wordt aangepast.

In de enquête wordt u gevraagd om uw mening aan te geven op een schaal met 5 punten, waarbij 1 de laagste beoordeling is en 5 de hoogste beoordeling. Tot slot is het voor u belangrijk om te weten dat u anoniem bent bij het invullen van de enquête. Alle antwoorden die u geeft zullen vertrouwelijk worden behandeld.

Mocht u bij het invullen van de vragenlijst vragen of opmerkingen hebben dan kunt u mij op de volgende manieren bereiken:

Telefoon: XXXXXXXXXX

E-mail: ingrid.welles@wur.nl

Ik kom over enkele dagen bij u langs om de vragenlijst weer op te halen.

Als u de resultaten van het onderzoek wilt ontvangen, kunt u dit via bovenstaand email aan mij doorgeven. De resultaten worden in de zomer verwacht.

Eventuele opmerkingen kunt u ook hieronder of aan het eind van de vragenlijst noteren.

Alvast hartelijk dank

Ingrid Welles

Masterstudent Wageningen Universiteit

Z.O.Z

Algemeen

1. Leeftijd:
2. Geslacht: Man/Vrouw

Ervaring met hoogwater

3. Heeft u zelf eens een gevaarlijke situatie met hoogwater meegemaakt? Ja/Nee
4. Hebben vrienden en/of familie van u eens een gevaarlijke situatie met hoogwater meegemaakt? Ja/Nee
5. Indien u zelf ervaring heeft met gevaarlijke hoogwater situaties, hoe beschrijft u uw ervaring met deze situatie?

Zeer negatief	Negatief	Neutraal	Positief	Zeer positief
---------------	----------	----------	----------	---------------

Verantwoordelijkheden

6. Wie is volgens u verantwoordelijk voor het voorkomen dat er schade ontstaat aan uw bezittingen?
- ☐ Ik ben volledig zelf verantwoordelijk
 - ☐ Ik ben voornamelijk zelf verantwoordelijk
 - ☐ De overheid en ik zijn evenveel verantwoordelijk
 - ☐ De overheid is voornamelijk verantwoordelijk
 - ☐ De overheid is volledig verantwoordelijk
7. Wie is volgens u verantwoordelijk om er voor te zorgen dat u goed bent voorbereid op een noodsituatie zoals een overstroming?
- ☐ Ik ben volledig zelf verantwoordelijk
 - ☐ Ik ben voornamelijk zelf verantwoordelijk
 - ☐ De overheid en ik zijn evenveel verantwoordelijk
 - ☐ De overheid is voornamelijk verantwoordelijk
 - ☐ De overheid is volledig verantwoordelijk

Risico perceptie

8. Hieronder volgen tien stellingen met betrekking tot risico perceptie. Bij elke stelling kunt u aankruisen in hoeverre u het met de stelling eens bent.

	Zeer oneens	Oneens	Neutraal	Eens	Zeer eens	Weet niet
Ik vind de kans op een overstroming in mijn woonomgeving erg groot.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Het is waarschijnlijk dat er in de komende 10 jaar een overstroming in mijn buurt plaatsvindt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In het geval van een overstroming zal er voor mij een levensbedreigende situatie ontstaan.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Er zal aanzienlijke schade aan mijn huis ontstaan bij een overstroming.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ik ben goed voorbereid op een mogelijke overstroming.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ik voel me onveilig met betrekking to overstromingen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Er zal aanzienlijke schade ontstaan aan de gebouwen in mijn buurt bij een overstroming.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In het geval van een overstroming zal het dagelijks leven ontwricht zijn.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ik denk wel eens na over de mogelijkheid van een overstroming bij mij in de buurt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mijn woning loopt gevaar om onder water te komen staan bij een overstroming.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Overheidscommunicatie

9. De overheid informeert burgers over de overstromingsrisico's in dit land om mensen bewust te maken van de gevaren van een mogelijke overstroming in hun leefomgeving. Ook informeert de overheid via verschillende media (tv, krant, radio, internet) over hoe men zich op een mogelijke overstroming kan voorbereiden.

Hieronder volgen 14 stellingen met betrekking tot risicocommunicatie. Bij elke stelling kunt u aangeven in hoeverre u het met de stelling eens bent of niet.

	Zeer oneens	oneens	neutraal	eens	Zeer eens	Weet niet
Als ik informatie wil over hoe ik me kan voorbereiden op een overstroming, weet ik waar ik deze kan vinden	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De informatie over overstromingsrisico's die de overheid geeft is makkelijk te begrijpen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Informatie over de mogelijkheden om mezelf voor te bereiden op een overstroming is nuttig.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Informatie die de overheid geeft over overstromingsrisico's zet me aan het denken over de kans op een overstroming in mijn buurt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ik weet wat ik kan doen om mezelf voor te bereiden op een overstroming dankzij de informatie van de overheid.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De informatie die de overheid geeft over hoe ik mezelf kan voorbereiden op een overstroming is duidelijk.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Informatie die de overheid geeft over overstromingsrisico's motiveert me om mezelf voor te bereiden op een overstroming.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De overheid geeft informatie die aansluit op mijn persoonlijke situatie.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ik weet waar ik terecht kan met vragen over overstromingsrisico's.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ik zie en/of hoor vaak berichten over overstromingsrisico's in Nederland	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ik zou graag meer informatie willen krijgen over hoe ik mezelf kan voorbereiden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De overheid stimuleert me om na te denken over wat ik zelf kan doen tijdens een overstroming.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De overheid bericht regelmatig over wat ik kan doen om mezelf voor te bereiden op een overstroming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ik zou graag meer informatie willen krijgen die is toegespitst op de overstromingsrisico's in mijn regio.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Vorbereidings

10. In de onderstaande tabel wordt u gevraagd om voor tien vorbereidingen aan te geven in hoeverre u deze vorbereiding als doeltreffend ziet, of u in staat denkt te zijn de vorbereiding uit te voeren en hoe u de kosten per vorbereiding inschat. Deze kosten bestaan uit de hoeveelheid geld, tijd en energie u in het aanschaffen of gebruik van deze vorbereiding moet stoppen.

	Deze vorbereiding is doeltreffend.						Ik ben in staat om deze vorbereiding zelf uit te voeren.						De kosten voor deze vorbereiding zijn hoog.					
Vorbereitung	Zeer oneens	Oneens	Neutraal	Eens	Zeer eens	Weet niet	Zeer oneens	Oneens	Neutraal	Eens	Zeer eens	Weet niet	Zeer oneens	Oneens	Neutraal	Eens	Zeer eens	Weet niet
Waardevolle spullen en/of documenten naar (hoge) droge plek verplaatsen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Informatie zoeken over hoe ik mezelf kan vorbereiden op een overstroming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Noodplan maken voor gezin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Afspraken maken met familie/vrienden	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Noodpakket aanschaffen*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verzekering afsluiten	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Huis waterbestendig maken**	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Buiteninstallaties en/of voertuigen veilig stellen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Zandzakken en/of vloedschotten aanschaffen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Waterpomp aanschaffen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*Een noodpakket bestaat uit materialen die van pas komen tijdens een noodsituatie. Denk aan lucifers, een EHBO pakket en een voorraad eten. Dit pakket kan kant en klaar worden gekocht of zelf samen worden gesteld.

**Water bestendig maken van een huis houdt in dat (bouw)materialen zijn gebruikt die er voor zorgen dat water buiten blijft of zo min mogelijk schade aan richt. Denk aan speciale deuren of het waterdicht maken van de kelder met een speciale bekleding.

Z.O.Z.

11. In onderstaande tabel wordt u verzocht om voor de 10 verschillende voorbereidingen op een overstroming aan te geven of u deze al genomen heeft of het komende jaar van plan bent deze te treffen.

Heeft u al voorbereiding getroffen en/of bent u van plan om komend jaar daadwerkelijk zulke voorbereidingen te treffen?				
voorbereiding	Ja, al gedaan	Ja, van plan	Misschien	Nee, niet van plan
Waardevolle spullen en/of documenten naar (hoge) droge plek verplaatsen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Informatie zoeken over hoe ik mezelf kan voorbereiden op een overstroming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Noodpakket aanschaffen*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Noodplan maken voor gezin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Afspraken maken met familie/vrienden	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verzekering afsluiten	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Huis waterbestendig maken**	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Buiteninstallaties en/of voertuigen veilig stellen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Zandzakken en/of vloedschotten aanschaffen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Waterpomp aanschaffen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Anders namelijk:				
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*Een noodpakket bestaat uit materialen die van pas komen tijdens een noodsituatie. Denk aan lucifers, een EHBO pakket en een voorraad eten. Dit pakket kan kant en klaar worden gekocht of zelf samen worden gesteld.

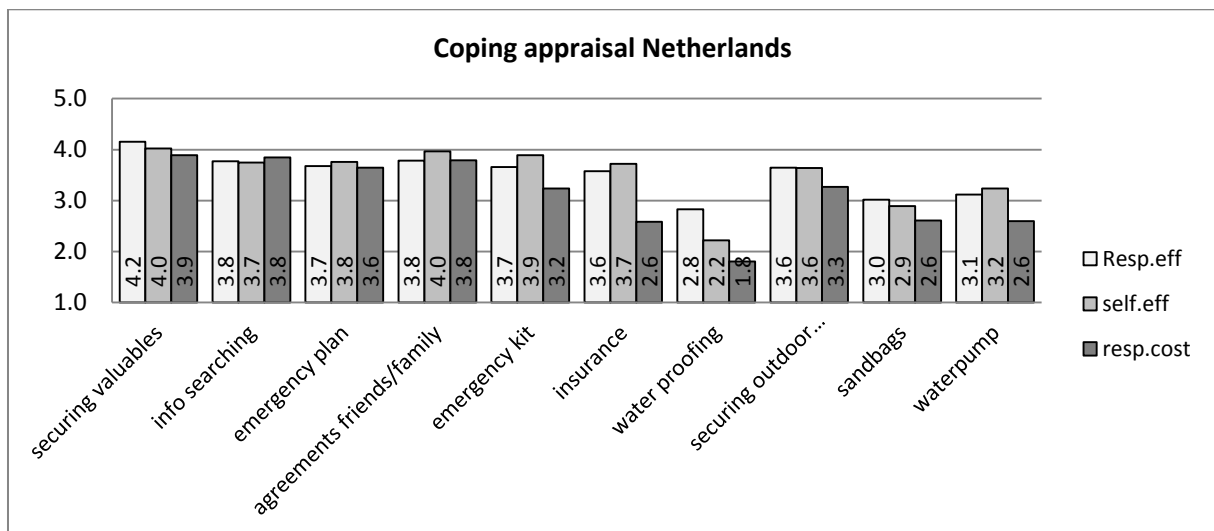
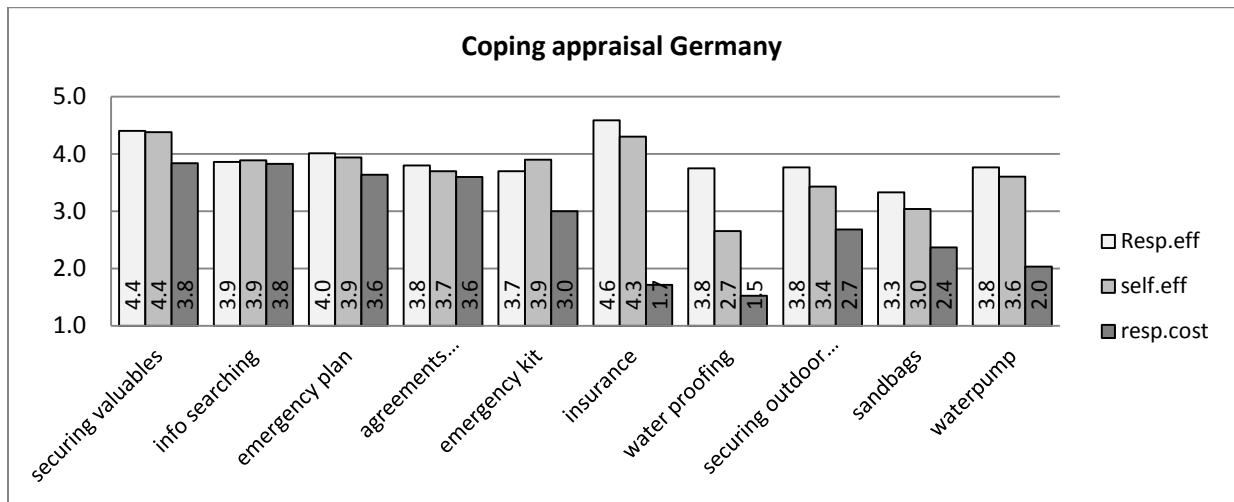
**Water bestendig maken van een huis houdt in dat (bouw)materialen zijn gebruikt die er voor zorgen dat water buiten blijft of zo min mogelijk schade aan richt. Denk aan speciale deuren of het waterdicht maken van de kelder met een speciale bekleding.

12. Wat is uw hoogst afgeronde opleiding?

- ☐ Lager onderwijs/basisschool (VGLO,LAVO)
- ☐ Lager beroepsonderwijs (LTS ITO, LEAO, LHNO, VMBO, Huishoudschool e.d.)
- ☐ Middelbaar algemeen onderwijs (MAVO,ULO,MULO,IVO e.d.)
- ☐ Middelbaar beroeps onderwijs
- ☐ Hoger algemeen voorbereidend wetenschappelijk onderwijs (HAVO, VWO, HBS e.d.)
- ☐ Hoger beroepsonderwijs (HBO, HTS, HEAO, e.d.)
- ☐ Wetenschappelijk onderwijs

Dit is het einde van de enquête!
Bedankt voor uw deelname!

Appendix II: Average scores coping appraisal per response



Appendix III: Answer rates (%) adoption intention and actual adoption

