THE IJSSEL: STILL THE ENEMY OR A NEW FRIEND?

THE EFFECT OF A ROOM FOR THE RIVER PROJECT ON THE RISK PERCEPTION OF PEOPLE LIVING IN THE IJSSELDELTA: ZWOLLE AND KAMPEN

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PROLOGUE

In 1993 and 1995 the Dutch river system experienced extreme high water levels what caused the introduction of the *"Deltaplan Grote Rivieren"*. The Deltaplan Grote Rivieren provided a plan for the acceleration of the reinforcement and elevation of dikes along the rivers. In 2006, the government of the Netherlands introduced the Planologische Kernbeslissing *Room for the River*. Room for the River is a set of spatial measures to avoid future river flooding by increasing the space of the rivers by the implementation of different measures along the Rhine, IJssel, Waal, Nederrijn and Lek. The shift from "fighting against water towards living with water" is central in this concept. (PKB Ruimte voor de Rivier, 2006)

In the year 2015, almost all of the Room for the River projects were completed. What is the effect of the measures being taken on the water level? Are inhabitants in the region aware of the measures being taken and did the construction of the measures change the way in which inhabitants think about their safety?

This thesis investigates the effect of a Room for the River project on the risk perception of people living in Zwolle and Kampen.

I want to show my gratitude towards Arjan Otten, project manager at Room for the River IJsseldelta, for the interview and his invitation for attending an excursion to the construction site of the Room for the River project in Kampen. The collected information and suggestions for the improvement of the research helped me answering my research question.

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ABSTRACT

After the extreme high water level in 1993 and 1995, the Dutch government decided that a new approach was required to maintain the safety of the Dutch inhabitants concerning water safety. In 2006, the government of the Netherlands introduced the Planologische Kernbeslissing *Room for the River*. Room for the River is a set of spatial measures to avoid future river flooding by increasing the discharge capacity to 16.000m^3 river water per second at the Rhine near Lobith by increasing the space of the rivers by the implementation of different measures along the Rhine, IJssel, Waal, Nederrijn and Lek. (PKB Ruimte voor de Rivier, 2006; 28e Voortgangsrapportage, 2016)

In the year 2015, almost all of the Room for the River projects were completed. In this research, the effect of the Room for the River project on the risk perception of people living in Zwolle and Kampen will be examined.

This research aims to is to investigate what the effect of a Room for the River project is on the risk perception of the inhabitants of the cities of Zwolle and Kampen and what factors are contributing to an increased risk perception.

Based on academic literature, several factors contributing to risk perception have been formulated. These factors are gender, age, level of education, distance to the river, experience, insurance and house-ownership. Respondents were asked about these factors and their feelings about water safety by a questionnaire, which was distributed in Zwolle and Kampen.

The measures being taken in Zwolle and Kampen are described to give an idea about the size of the project and the effect of the measures, information about the taken measure was conducted by an interview and a document analysis.

The descriptive statistics provide general information about the respondents. With a multiple linear regression analysis, the formulated factors have been tested to risk perception using SPSS. The results do not prove that there is a relation between the factors mentioned in the academic literature and risk perception. This is contradictory to the results of academic literature. In the discussion & reflection part, recommendations for further research have been outlined.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 BACKGROUND

Climate change is a fact. The "Houston we have a problem" of climate change has been accepted in large parts of the world. The uncertainty about climate change lies in the time, size and strength of the coming disasters related to climate change, something that can cause life-threatening situations (Restemeyer et al., 2015; Stead, 2014). The current question is which measures should be taken to avoid great damages to lowland countries, which are more vulnerable to climate change and the additional effects of climate change. A uniform approach of climate change is hard to implement, the traditional approaches in planning might not be sufficient enough for the changes to come. (Restemeyer et al., 2015; Stead, 2014)

When we translate climate change into water management we can conclude that the weather is changing and the sea-level is rising. The intensity and frequency of rain showers is increasing and the temperature is rising, what causes the melting of perpetual snow in the Alps. As a consequence of this, the water level in Dutch rivers is rising, with sometimes dangerous situations during events with heavy rainfall (KNMI & PBL, 2015). Resilience in water management is considered to be an important element of sustainable development, which could mitigate the effects of climate change on societies (Stead, 2014). All over the world, societies are implementing resilient measures to tackle climate change, so does the government of the Netherlands.

In 1993 and 1995 the Dutch river system experienced extreme high water levels what caused the introduction of the "*Deltaplan Grote Rivieren*". The Deltaplan Grote Rivieren provided a plan for the acceleration of the reinforcement and elevation of dikes along the rivers. In 2006, the government of the Netherlands introduced the Planologische Kernbeslissing *Room for the River*. Room for the River is a set of spatial measures to avoid future river flooding by increasing the space of the rivers by the implementation of different measures along the Rhine, IJssel, Waal, Nederrijn and Lek. Examples of measures being taken are embankment widening, the relocation of dikes, groyne reduction, floodplain excavation, the removal of obstacles and the construction of a flood bypass channel (Eerste Kamer der Staten-Generaal, 2006; PKB Ruimte voor de Rivier, 2006). The second Room for the River objective is spatial quality. The implementation of a spatial measure should increase the ecological, landscape and economical quality of the area. This increase in spatial quality will be reached by establishing a measure in consultation with the immediate vicinity (Ruimte voor de Rivier, 2016).

The cities of Zwolle and Kampen are located along the IJssel and both experienced extreme high water levels in 1993 and 1995. A combination of a north-western storm and high tide in these years caused an extreme high tide in Kampen, which nearly resulted in flooding of the town (Technische Adviescommissie voor de Waterkeringen, 1995). To avoid extreme high water level situation, both Zwolle and Kampen are implementing Room for the River measures (Ruimte voor de Rivier, 2006).

1.2 RESEARCH PROBLEM

Room for the River measures are considered to reduce the risk of flooding and increase the safety of the inhabitants of an area. Room for the River measures are measures with a great impact in the area and cannot be adjusted easily in the future. Climate change is an important factor in determining the risk of an area. The uncertainty of climate change lies in the size, strength and time of hazards (Restemeyer et al., 2015; Stead, 2014).

What if the volume of the melt-, rain- and river water coming from the Alps and the Rhine river is larger than expected? Especially when there are strong inland winds coming from the IJsselmeer with additional high tides of the Ketelmeer resulting in upstream currents of the IJssel. In Kampen, the water will additionally and partly be guided to the Drontermeer, a different lake, to avoid flooding. The water will leave the area before reaching the city and resulting in congestion which could result in the flooding of the city of Kampen. In Zwolle, the situation is different. The "room" for the river is limited, the water cannot depart to another lake. The water from the IJssel has more space but will still be in the IJssel near Zwolle during high water levels. Figure 1 gives an overview of the situation in Zwolle and Kampen. Do the inhabitants of Kampen feel more safe due to the construction of a bypass compared to the inhabitants of Zwolle? And do the difference in measures being taken lead to a different perception of safety? The central problem in this research is if there is a difference in the perception of the effectiveness of the Room for the River projects of Zwolle and Kampen.

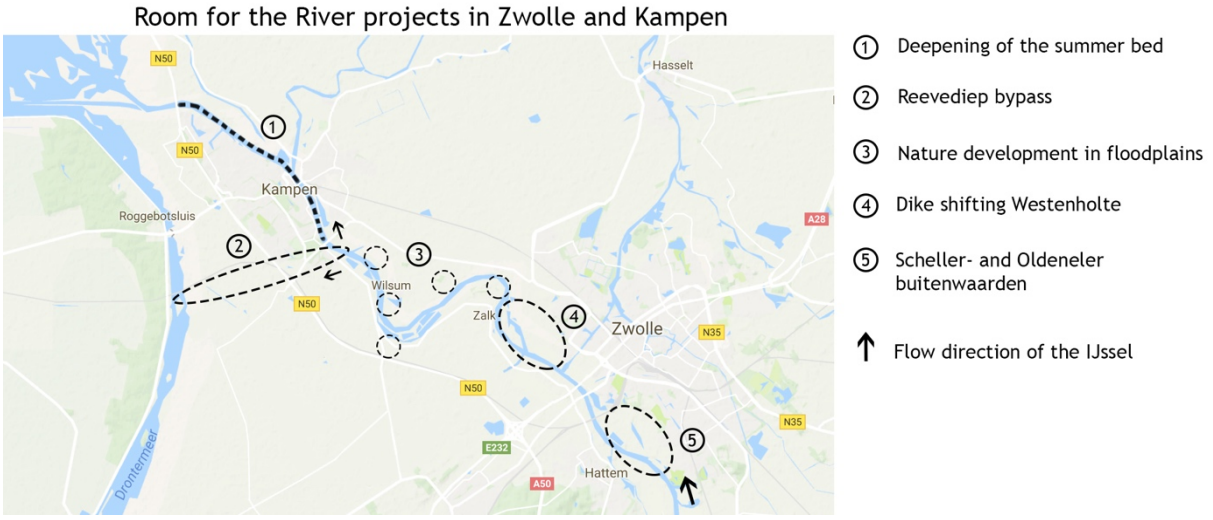

Figure 1: Overview of Room for the River projects in Zwolle and Kampen

The scientific relevance of this research is that it shows whether or not there is a difference in risk perception based on socio and demographic factors linked to risk perception by academic literature and testing this theory of risk perception in a geographical relevant area. The scientific relevance is strongly connected to the social relevance of this research what shows to what extent inhabitants are aware of flood risk and to what extent these inhabitants have taken their responsibility through for example taking safety measures. The awareness of flood risk can result in more public support for measures being taken and a combination of awareness and taken measures can result in a higher adaptability to floods and lower economical damage to the regions involved.

The aim of this research is to investigate if the risk perception of the inhabitants of the cities of Zwolle and Kampen changed due to the Room for the River projects and what factors are contributing to an increased risk perception. Is there a difference in the risk perception between the two cities?

The main research question is: **"What is the effect of a Room for the River project on the risk perception of people living in Zwolle and Kampen?"**

To answer the research question, the following sub-questions have to be answered:

I. What is risk perception?
II. What factors are part of risk perception?
III. Which Room for the River measures are being taken in the area?
IV. What factors are contributing to risk perception in the city of Zwolle?
V. What factors are contributing to risk perception in the city of Kampen?
VI. To what extent is there a difference in the factors contributing to risk perception between Zwolle and Kampen?

1.3 THESIS STRUCTURE

In this first chapter the motive of the subject and the research problem have been introduced. In the second chapter, the theoretical framework will be outlined. Risk perception and factors contributing to risk perception will be defined. The second chapter ends with a conceptual model that forms the foundation of the research. The methodology will be outlined in the third chapter. The fourth chapter will outline of the results of the quantitative research done in Zwolle and Kampen. The fifth chapter consists of the conclusion of the results. In the sixth and last chapter, a reflection of the research will be made and a discussion with recommendations for further research will be outlined.

2. THEORETICAL FRAMEWORK

2.1 RESILIENCE IN WATERMANAGEMENT

2.1.1 RESILIENCE

Climate change is an irreversible process that cannot be stopped, even with the greatest effort. Resilience in water management is considered to be an important element of sustainable development, which could mitigate the effects of climate change on societies. (IPCC, 2014; Stead, 2014)
Resilience is defined as a concept open to multiple interpretations. The central idea of resilience is that a society or system is able to organise itself before and during a flooding event and that it is able to recover from the effects of the event in an efficient way without being harmed in its functionality. (González-Riancho et al., 2014; Klijn et al., 2004; Restemeyer et al., 2015; Stead, 2014)

2.1.2 ASPECTS OF RESILIENCE

Aspects of resilience are adaptation, mitigation and transformability. Mitigation is related to the robustness of a system, which is the capacity of this system to withstand an external shock. Adaptation is related to the rapidity and recovery of a system. The adaptation is the capacity of a system to bounce back to the original, an adapted or a new situation without the system being harmed (Restemeyer et al., 2015; Stead, 2014). Mitigation or the robustness attempt to reduce the drivers of climate change related events whereas adaptation attempts to target the susceptibility of an event (Restemeyer et al., 2015; Stead, 2014). Both of the aspects need to be implemented before an event takes place (Restemeyer et al., 2015; Stead, 2014). According to Restemeyer et al. (2015) transformability can be seen as the third important aspect of resilience. Transformability is the transition in the mind-set of inhabitants to participate in flood risk management. The Dutch paradigm shift of the last decades in which the traditional “fighting against the water” approach turns to the new “living with the water” approach can be seen as an example for transformability (Restemeyer et al., 2015).

This new paradigm was introduced after the extreme high tide in the main rivers of the Netherlands in 1993 and 1995. The near-flood of 1993 was the first serious challenge the Netherlands had to deal with since the river flooding in 1926. After 1995 the Dutch government concluded that a new water management strategy was necessary in the form of a paradigm shift to protect the country against the flood-threat of rivers. (Warner & van Buuren, 2011)

2.2 ROOM FOR THE RIVER

The government of the Netherlands adopted the Room for the River program as one of the new approaches for achieving the paradigm shift. The Room for the River strategy is focusing on measures to lower the water levels in rivers by extending the room of the rivers and enlarging the discharge capacity of the channel and a controlled flooding of the floodplains alternatively to the traditional measures of heightening dikes. (Baan & Klijn, 2004; Collenteur et al., 2013; Klijn et al., 2004). In the first instance, the Room for the River program banned developments in floodplains. Later on, new development in the floodplains became accepted and the Room for the River program can be considered as project connecting water management and spatial planning (Warner & van Buuren, 2004). According to Restemeyer et al. (2015), a collaboration between all disciplines regarding spatial planning and water management could protect the hinterland from flooding and can be considered as resilient.

2.2.1 RISK MANAGEMENT

Permitting controlled flooding of floodplains along the rivers adds a social dimension to risk management (Restemeyer et al., 2015). The vulnerability of an area depends on several factors, for instance, the economic value of an area, the number of people living in the area and the ecological value of the area (Klijn et al., 2004). The city of Kampen has about 50.000 inhabitants whereas the city of Zwolle has about 125.000 inhabitants. In Kampen and Zwolle, several residential and business areas located close to the river and those surrounding areas are vulnerable to flooding (CBS, 2016).

Flood risk is the risk of someone being a victim of a flooding and is defined as the flood probability multiplied by the flood damage or, in other words, as the robustness multiplied by the adaptability (Botzen et al., 2009; Bubeck et al., 2012; Klijn et al., 2004; Restemeyer et al., 2015; Schmidt, 2004). One of the measures to decrease the flood risk is Room for the River. The implementation of a Room for the River project is reducing the probability of a flood in the project area and thus reducing the overall flood risk (Restemeyer et al., 2015).
Flood risk management is defined as the activity of a society to reduce the impact of an event by either the removal or the mitigation of obstacles. As it comes to Room for the River in Kampen and Zwolle, flood risk management is reflected in the removal of obstacles in the river forelands, floodplain excavation, the construction of secondary channels in floodplains and the deepening of the river. In Kampen, the bottleneck of the river in the city centre is removed by the construction of a bypass river. (Ruimte voor de Rivier, 2016)

2.3 RISK PERCEPTION

Risk perception is, according to Rohrmann (2008), defined as a person's judgements and evaluations of hazardous events where the person is or might be exposed to. Perception could drive the decision-making process about behaviour concerning a disaster or the acceptability of risk (Rohrmann, 2008). Risk perception is fundamental to the response of people and, in relation to that, how and in what way people prepare for the perceived risks (Botzen et al., 2009; O'Neill et al., 2016). Bubeck et al. (2012) elucidate the fact that people desire to undertake safety measures to reduce the, in their perception, highest risk. Research of Fox-Rogers et al. (2016) reveals the *Levee effect* in relation to perception. The Levee effect is the often-inappropriate faith of people in the power of protection measures and the faith people have in the protection of the measures against all future floods (Baan & Klijn, 2004; Scolobig et al., 2012). According to Fox-Rogers et al. (2016), engineered flood defences have a considerable impact on flood risk perception during the building stage. This is accompanied by the levee effect and the higher safety feeling derived from the implemented protection measures.

2.3.1 RISK PERCEPTION FACTORS

Risk perception is formed by several factors of risk, including individual, socio-cultural, socio-economic and geographical factors. These factors influence the way a person reacts towards risks (Baan & Klijn, 2004; Fox-Rogers et al., 2016; O'Neill, 2016; Schmidt, 2004). In this research, the factors mentioned above will be tested to the Room for the River to see if people think different about risk due to the construction of a Room for the River projects in Zwolle and Kampen. An important element in this research is risk awareness of the inhabitants of Zwolle and Kampen.

2.3.1.1 RISK AWARENESS

Risk awareness is considered to be an essential element of risk perception. Fox-Rogers et al. (2012) defines risk awareness as "the knowledge or consciousness of the flood risk that

an individual or group is exposed to" (Fox-Rogers et al., 2012, p. 331). González-Riancho et al. (2014) has an addition to this. They state that the extent to which people talk about risk also contributes to the risk awareness. Risk awareness is important for the risk management on prevention, protection and preparedness, and for more resilient approaches in the future (O'Neill et al., 2016; Restemeyer et al., 2015). Risk awareness, and thus risk perception, can also have a negative impact on an area. The perceived risk could withhold people from settling in the area causing a stagnation in the economic development of the region (Collenteur et al., 2013).

2.3.1.2 EXPERIENCE

According to Scolobig et al. (2012) and O'Neill et al. (2016), previous flood-experience is related to the risk awareness. Fox-Rogers et al. (2016) and O'Neill (2016) both agree on the relation between flood-experience and the way people prepare. People who have had experiences with flooding in the past are likely to be better prepared for future flooding compared to people who have not had flood experiences before (Fox-Rogers et al., 2016; O'Neill, 2016). In this research, flood experience will be tested to the awareness of risk and to the risk perception by the implementation of a Room for the River project.

2.3.1.3 PREPAREDNESS

The crisis-effect is mentioned in the articles written by Scolobig et al. (2012) and Baan & Klijn (2004). The crisis-effect is defined as the enhanced awareness and preparedness during and immediately after a hazardous event, as time goes by the risk awareness decreases. A low risk awareness is related to an insufficient degree of preparedness which is related to an inaccurate response to events (Scolobig et al., 2012). Knowledge, concerns, trust, media and having an insurance determine the flood preparedness among the population. Knowledge can have different forms but are equivalent to the way in which people inform themselves, for instance by reading flood information brochures or the emergency flood plan for the region (O'Neill et al., 2016). Concerns often result in a higher demand for risk reduction and will therefore lead to a higher preparedness (Fox-Rogers et al., 2016). Trust in the local authorities could have a negative effect on the preparedness through the lower risk perception due to a lower feeling of danger and responsibility (Fox-Rogers et al., 2016; Scolobig et al., 2012). The role of the media must not be underestimated due to its range. The media report risks and can influence the risk perception and acceptance of risks (Baan & Klijn, 2004; Schmidt, 2004; Scolobig et al., 2012). Restemeyer et al. (2015) mentions the importance of flood insurance for the speed of recovery after an event. The more people are aware of a risk the better they are insured and the better they are prepared. In this research, preparedness will be tested to the perception people have due to the construction of a Room for the River project.

2.3.1.4 SOCIO-ECONOMIC FACTORS

Socio-economic factors are also of great importance for risk perception among people. Socio-economic factors mentioned in previous research into risk perception are: age, gender, level of education, income and length of time at present address (De Boer et al., 2015; Botzen et al., 2009; Burningham et al., 2007; Bubeck et al., 2012; O'Neill et al., 2016; Scolobig et al., 2012; Sjöberg, 2000). In this research, the factors age, gender, level of education and house ownership will be used as variables to examine what factors contribute to a higher risk perception.

2.3.1.5 GEOGRAPHICAL FACTOR

At last, Botzen et al. (2009), O'Neill et al. (2016) and Bubeck et al. (2012) all consider the geographical factor of distance as of great importance to the perception of risk. Distance, in their research, is defined as the distance to a main river. In this research, the distance to the IJssel will be tested to the risk perception.

2.4 CONCEPTUAL MODEL

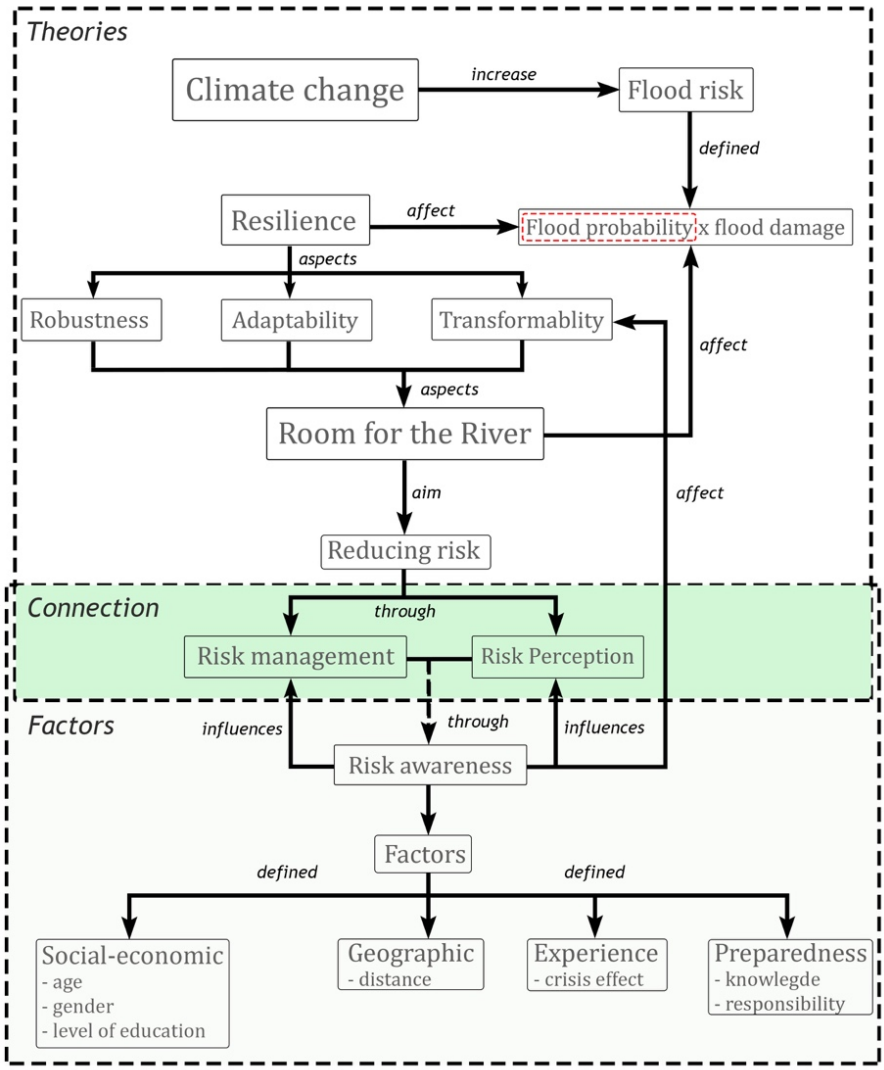

Figure 2: Conceptual model

Climate change is an irreversible process that cannot be stopped, even with the greatest effort. Due to climate change, the eternal snow is about to melt and the water released by the melting of this snow will be discharged by rivers. Next to the melting of snow the intensity and frequency of rain showers will increase due to climate change. The combination of both will increase the water level in the Rhine and the IJssel, due to the increase in water level, the flood risk increases. Resilience in water management is considered to be an important element of sustainable development, which could mitigate the effects of climate change on societies (Stead, 2014). Aspects of resilience are robustness, adaptability and transformability (Restemeyer et al, 2015). A measure containing these three aspects of resilience and tackling the change of flood probability is Room for the River. Room for the River reduces risk by the two pillars risk management and risk perception. Risk awareness is central to these two pillars. Factors contributing to an increased risk perception are according to the literature socio-economic factors, geographical factors, experience and preparedness. The interrelation between the mentioned theories and factors can be seen in figure 2. (IPCC, 2014)

In this thesis, the effect of a Room for the River project on risk perception is measured. The risk awareness factors mentioned above form the foundation of the questionnaire which is the main method for the measurement of the effect.

3. METHODOLOGY

3.1 DATA COLLECTION METHODS

The first chapter initiated the topic of this thesis, the relevance of the research and the research questions. Subsequently, the second chapter consisted of explanations of important theories and concepts related to this research. The second chapter concludes with the conceptual model, what forms the foundation of this research. This chapter connects the first two chapters to the further research. The following chapter, chapter four, will link the theories and concepts of the second chapter to the findings of the research done in Zwolle and Kampen. To answer the research questions both qualitative and quantitative research was required to obtain information. Qualitative research obtains the objective, detailed and in-depth information of the research whereas quantitative research is based on numbers and can be used to obtain numerical results of a sample (Clifford et al., 2012). In this research, three different methods were used to obtain information. The first two methods are an analysis of primary data and an analysis of secondary data, these two methods are used to construct a connection between theories and findings. The primary data consists of an interview and the secondary data consists of a document-analysis. The third and last method used is the distribution of an online-questionnaire. In the next sections the used methods will be further clarified.

3.1.1 METHOD 1: SEMI-STRUCTURED INTERVIEW

For this research, a semi-structured interview was held on March 30, 2017. The selection for this type of interview was made well-considered. A semi-structured interview has a predetermined order of questions with the flexibility to deviate from the questions if needed (Clifford et al., 2012). The interviewee was project manager Arjan Otten of the Room for the River IJsseldelta project group in Kampen. The intention of the interview was to get more information about the Room for the River measures being taken in Kampen and the effects of these measures on the water level of the IJssel. The project manager, Arjan Otten, was deliberately chosen as the interviewee due to his knowledge of various disciplines within the project and is able to provide a useful overview of the taken measures, the reasoning behind the selection of these measures and the effect on the water level caused by the taken measures.

After the semi-structured interview, the researcher was invited to participate in an excursion to the construction site of the Room for the River project and afterwards, the researcher was invited to join a presentation about the project. These two opportunities resulted into getting a better perspective of the size of the project and some additional but important information.

Prior to the interview, written contact has been made in which the subject of the thesis is discussed what resulted in some additions to the research question. Preceding to the interview ethical aspects prescribes by Clifford et al. (2012) were observed. The interviewee was inquired about the processing of delicate aspects of the topic, his anonymity and the recording of the interview. The interview was audio-taped and has been transcribed directly after the interview to avoid, for example, the loss of important facial expressions which are not audio-taped, as suggested by Clifford et al. (2012). After the interview, excursion and presentation I asked Arjan Otten about his thoughts about the research, possible additions and his interest in the final product. The complete result of the interview is included in Appendix II.

3.1.2 METHOD 2: DOCUMENT-ANALYSIS

For information about Room for the River measures being taken in Zwolle, the water board Drents Overijsselse Delta has been contacted. Written contact has been made with the project manager of the Room for the River Zwolle project. Some documents containing information about the Room for the River measures being taken and the effects of these measures were sent to me. He also gave me the option to mail further questions if necessary. Unfortunately, the information in the analysed documents is less detailed than the information obtained from the interview in Kampen. The analysed documents (table 1) were compared to the data obtained in Kampen.

Document	Year of publishing
Longread Ruimte voor de Rivier	2016
Dijkverlegging Westenholte	2017
Scheller- en Oldeneler Buitenwaarden	2017
Waterschap Drents Overijsselse Delta: Algemene presentatie Ruimte voor de Rivier Zwolle	2017
Waterschap Drents Overijsselse Delta: Excursie Ruimte voor de Rivier Zwolle	2017

Table 1: Documents used for document analysis

3.1.3 METHOD 3: ONLINE-QUESTIONNAIRE

In this research, a questionnaire is used to obtain primary quantitative data. According to Clifford et al. (2012), questionnaires are ideal in obtaining information about people perceptions, attitudes, behaviours and experiences. A questionnaire is used to obtain information through factual and opinion questions. Factual questions are perceived to be question that are easy to answer based on, for example, demographic factors. The important demographic factors in this research are mentioned in the theoretical framework and are included in the questionnaire. Opinion questions are questions in which the respondent can give their opinion and preferences about questions and thesis's. A questionnaire can consist of open-ended questions and fixed questions (Clifford et al., 2012). Fixed questions are easy to answer and can function as a guide for the respondent in answering the question. In this research, it was likely that people are not familiar with the topic. Therefore, fixed questions were chosen to increase the response to the questionnaire. Next to this, fixed questions are easier to interpret and analyse since the opinions of respondents have been summarized in categories (Clifford et al., 2012). Categories were classified according to *The Likert Scale*. The *Likert scale* represents alternative answer possibilities with, in the ideal situation, an odd number of responses. By using an odd number of responses, the middle value represents a neutral opinion and the extremes are formed by two opposing positions. Due to this, the respondent is not forced into a direction. In this research a *five point Likert scale* has been used. (Clifford et al., 2012)

The questionnaire has been set up with *Qualtrics*. Qualtrics is an online-survey program that is ideal due to the free access provided by the University of Groningen what prevents the research from restrictions imposed by other free online questionnaire websites. There were several reasons to choose for an online-questionnaire. First, it is easier to obtain responses because of the ease in which the link can be transferred to acquaintances and organizations. Second, it was inexpensive to administer and third, immobile people could be reached (Clifford et al., 2012).

The online-questionnaire was spread among a random "sample" of the population of Kampen and Zwolle by spreading 1700 research-participation requests (Appendix VI) among randomly chosen households in both cities. This request included a QR-code and link to access the questionnaire. The requests were spread randomly across every district in Zwolle and Kampen, in which every type of household has been covered. The different types of households were flats, apartments, family houses, student housing and villa's.

The quantitative data conducted by the questionnaires was analysed by the use of SPSS Statistics and GIS. Most of the factors contributing to the risk perception have been analysed by SPSS. GIS has been used to analyse the geographical factor, in this research the geographical factor has been the distance to the IJssel (Clifford et al., 2012). This distance has been joined to SPSS to test the relation between this variable and risk perception.

Some of the questions in the questionnaire could be considered as delicate. Respondents had the opportunity to skip these questions. Examples of these questions were the questions about their ZIP code. The complete questionnaire can be found in Appendix III.

3.2 DATA COLLECTION

The online-questionnaire was set available on the 11th of April, 2017. On Wednesday the 12th of April, Friday the 14th of April and Tuesday the 18th of April, a total of 1500 requests were distributed in Kampen. On Friday the 21st of April, a total of 200 request were distributed in Zwolle. Request were randomly spread among households in both cities. An important ethical consideration was the presence of adhesive labels on letterboxes which say “no advertisement leaflets”. These households were skipped.

The odd division in distributed requests between Zwolle and Kampen can be explained by the fact that there is a better personal social network in Zwolle. This made it easier to find respondents compared to Kampen where a social network is absent.

The questionnaire has been closed on the 2nd of May, 2017. The total number of responses was n=174, with n=98 in Zwolle and n=76 in Kampen.

The division of the questionnaire response rate per day can be found in figure 3.

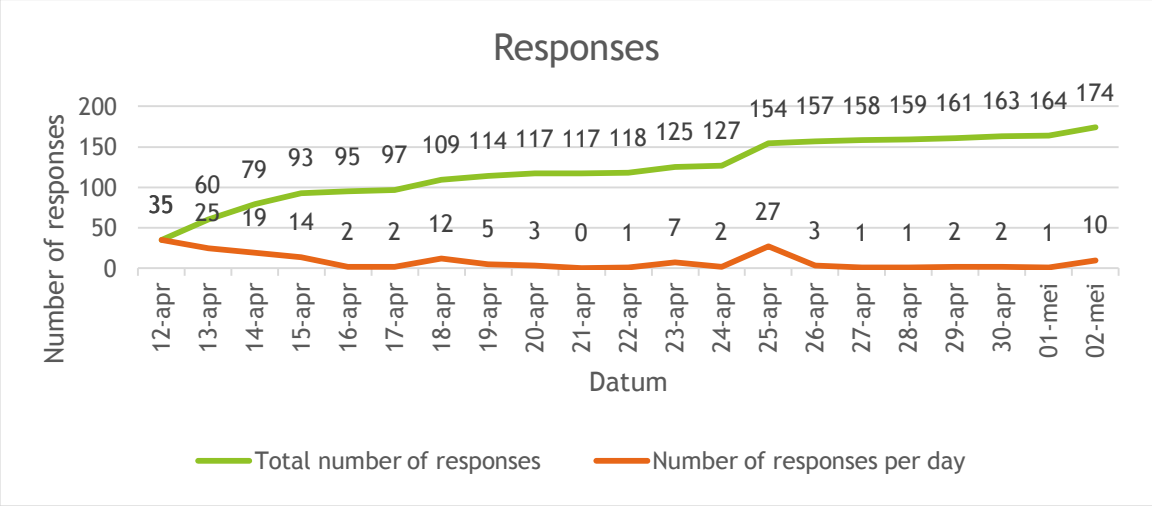

Figure 3: questionnaire response rate per day

3.3 DATA-ANALYSIS

3.3.1 SPSS STATISTICS

Qualtrics offers the option to directly download the results into a SPSS table, this made the analysis a lot easier. The results have been divided into two populations: Zwolle and Kampen. For both the data files the variables were coded in the same direction with the same name. This made it a lot easier to copy-paste the "syntax" to the other population and get the results in the same way. For the background knowledge and distribution in the population, descriptive statistics have been used. For the main analysis, a "Multiple Linear

Regression" analysis has been used. The first step was to use the "Spearman Correlation" to see which risk perception question correlate and could therefore be combined in the same analysis. These risk perception questions were "code into different variables" to get them all in the same direction and subsequently "count". As a result of the "count" a ratio variable came into existence which was then further used in the "Multiple Linear Regression" analysis. For measuring risk perception, a *five point Likert scale* has been used (very unsafe – unsafe – neutral – safe – very safe). This has been reclassified into a *three point Likert scale* (unsafe – neutral – safe) because of the low amount of cases in each group and the effect of this on the results of the analysis.

The "Multiple Linear Regression" analysis was chosen because of the option to compare multiple independent ratio/ordinal/dummy variables with the dependent "risk perception" ratio variable. The independent variables are the factors affecting risk perception. Factors contributing to risk perception are: gender, age, level of education, distance to the river, experience, insurance and house-ownership.

3.3.2 ARCGIS

According to the literature, several factors affect risk perception. One of these factors is the geographical factor distance to the IJssel. Distance is in the questionnaire measured by the ZIP code of the respondents. These ZIP codes are added to ArcGIS and joined to the Dutch 6-ZIP code what exists of a combination of four numbers directly followed by two letter (for example, 1234XX). Unfortunately, due to ethical considerations asking for respondents ZIP-code could be considered as delicate. Therefore, not all respondents gave their 6-ZIP code. The middle point of the 6-ZIP-codes were found by using the "Feature to point" tool. To measure the distance from these points to the IJssel the "Generate Near Table" tool has been used. The results could be found in the "Attribute Table". The results were manually added to SPSS. In SPSS, the distance variable formed one of the independent variables. An overview map with the distribution of the respondents ZIP codes can be found in Appendix I.

3.4 DATA SYNTHESIS

To answer the main research question, a couple of research questions must be answered. Chapter two answered the first and second research question, namely; "What is risk perception?" and "What factors are part of risk perception?". The remaining four research questions will be answered in chapter four. The three mentioned methods will be used to answer these research questions. The first two methods; semi-structured interview and document-analyses will give an answer to the research question "Which Room for the River measures are being taken in the area?". The two research questions: "What factors are contributing to risk perception in the city of Zwolle?" and "What factors are contributing to risk perception in the city of Kampen?" will be answered by the data analysis in SPSS and ArcGIS. The last research question "To what extent is there a difference in the factors contributing to risk perception between Zwolle and Kampen?" will be answered by the comparison of the results of the former two research questions.

4. RESULTS

4.1 ROOM FOR THE RIVER MEASURES

4.1.1 ZWOLLE

Zwolle is a Hanseatic city and the capital city of the province of Overijssel in the Netherlands and has a population size of 125.605 in 2017 (CBS, 2017). Zwolle is experiencing two direct threats during periods of high water levels in the IJssel. In case of a north-western storm, the river water will ling in the IJssel near Zwolle due to the decreased river water discharge capacity of the estuary of the IJssel in the IJsselmeer. In Zwolle, two Room for the River measures have been implemented to prevent the cities from flooding (Ruimte voor de Rivier Zwolle, 2017). The two Room for the River measures will be explained below.

4.1.1.1 SCHELLER- AND OLDENELER BUITENWAARDEN

The floodplains along the IJssel near Zwolle have increased in height due to natural processes of sedimentation during the past centuries. As a result of sedimentation, the water needs to reach a higher level to get more space. This causes pressure on the waterworks involved. The Room for the River project Scheller- and Oldeneler Buitenwaarden has excavated the sediments located on the floodplains up to four meters. Next to the excavation of the floodplains, secondary channels have been dug. The average width of the constructed secondary channels are 75 meters. The task setting of both the excavation of the floodplain and the construction of secondary channels is a decrease of eight centimetres during periods of high water levels (Waterschap Drents Overijsselse Delta, 2017b). An overview of the location and the taken measures can be found in figure 4.

For completing this project two residences and one farmhouse had to be moved to the dike surrounding the floodplains. Spatial quality in the form of recreation could be added to the new constructed transition zone between wet and dry nature. The total budget for the Scheller- and Oldeneler Buitenwaarden project was €17 million. (Waterschap Drents Overijssel Delta, 2017a)

4.1.1.2 DIKE SHIFTING WESTENHOLTE

By shifting the dike landwards, the surface area of the floodplains increases. As a result, the IJssel will have more space and the discharge of the IJssel increases without an increase in the water level. In the old situation, the river winter bed caused a bottle neck what resulted in upstream water impoundments. The effect of a decrease in water level, as a result of the Room for the River project in Westenholte, continues upstream. In Westenholte, the dike has been shifted landwards with 300 meters. A new dike has been constructed with a total length of 2.2 kilometres. The height of this new dike has remained the same as in the old situation. In the new area between the IJssel and the newly constructed dike, a channel system has been constructed with an open connection to the IJssel. The average width of the constructed channels are 50-100 meters. Furthermore, the old floodplains have been excavated with four meters. The task setting of the dike shift, the excavation of floodplain and the construction of channels is a decrease 14 centimetres during periods of high water levels (Waterschap Drents Overijsselse Delta, 2017). An overview of the location and the taken measures can be found in figure 4.

For completing this project, four residences and two farmhouses had to be moved to the new constructed dike surrounding the floodplains. Due to the open connection between the new constructed channels and the IJssel, dry and wet nature are getting a chance to evolve in the area. Next to this, spatial quality in the form of recreation could be added to

the floodplain. The total budget for the dike shifting Westenholte was €38 million. (Waterschap Drents Overijsselse Delta, 2017a)

Figure 2: Room for the river measures Zwolle

4.1.2 KAMPEN

Kampen is located ten kilometres downstream of Zwolle and is, like Zwolle, a historical Hanseatic league city. The population size of Kampen in 2017 is 52.666 (CBS, 2017). The city of Kampen has had much experience with floods in the past with the last big event in 1995. The city lies close to the estuary of the IJsseldelta and on the edge of the IJsselmeer. The water of the IJsselmeer will be pushed in the direction of Kampen during a storm coming from northwest direction. In 1993 and 1995 a combination of a north-western storm and high tide caused an extreme high tide in Kampen, which nearly resulted in flooding of the town (TAW, 1995)

4.1.2.1 DEEPENING OF THE SUMMER BED

The deepening of the summer bed of the IJssel would, in first instance, reach the task settings set by the Room for the River program, according to interviewee A. Otten (Appendix II). The deepening of the summer bed between Zwolle and the estuary of the IJssel would be the only Room for the River measure constructed in Kampen. Results from a planning study show a high environmental impact on desiccation of the surroundings and the attracting effects of the soil pollution in the vicinity of the central station of Zwolle. Due to this, parts of the IJssel could not be deepened and an alternative plan had to be made. The only sustainable alternative was the construction of a bypass river from the IJssel to the Drontermeer. The bypass will be further clarified in the next section.

Next to the bypass, the deepening of the summer bed is completed over a distance of seven and a half kilometres with an average depth of two meters between the Molenbrug near Kampen and the estuary of the IJssel.

4.1.2.2 REEVEDIEP BYPASS

After the discovered effect of the deepening of the summer bed on the environment, the stakeholders started to look for an alternative option to reach the task settings of the Room for the River program. The bypass option was in a former stage already labelled as a suitable but expensive option. The expensiveness of the bypass option was one of the reasons why the stakeholder did choose, in first instance, for the deepening of the summer bed above the construction of a bypass, according to interviewee A. Otten (Appendix II). Due to the soil pollution around the central station of Zwolle, both measures had to be implemented. In this stage, the former competitors of both projects became colleagues. A total of 13 stakeholders are working together on the bypass project, called the Reevediep.

During the first stages of the bypass project, civic participation was of great importance due to the arguments against the construction of the bypass from the civilians of Kampen. One of the major threats, seen by inhabitants and exaggerated by the media, was the so-called “bathtub effect”. By the construction of the bypass, Kampen would become an island and the water would not find a way out of this newly created “bathtub” in situations of floods. Civic participation created more public support for the bypass option. Together with the civilians the best option is created in which the bypass is resistant to high water levels and storms and there is room for additions in the past. One of these possible additions is the so-called climate-dike, what is part of the Reevediep bypass. The climate-dike is a new approach for future water management introduced by the government and water boards. A climate-dike is a dike that is robust and will not breach during flooding events and, on top of that, is resistant against future climate change and will provide safety for 100 to 200 years. Due to the robustness, the dike will be wider than a traditional dike (120 meters compare to the 30-40 meters of a traditional dike). The climate-dike will be multifunctional in his use by the possibilities of building houses, buildings or recreation areas on it (Kennis voor Klimaat, 2009). A climate-dike is a dike that can be considered as future-proof and thus resilient, according to interviewee A. Otten (Appendix II), due to the already planned space for a possible expansion of the climate-dike as part of the bypass.

The Reevediep will have a water flow all year around, causing a decrease in water-level during the whole year. The Reevediep bypass and the deepening of the summer bed together will reach a water-level decrease of 41 centimetres in Zwolle during situation of peak discharges. According to interviewee A. Otten, the Bypass is a project within a major project in which all projects are connected and affect each other. In case of the bypass, the water level in Zwolle will decrease with 41 centimetres and next to this, Kampen will be protected against peak discharges by a decrease in the water level of 20-40 centimetres.

4.1.2.3 NATURE DEVELOPMENT IN FLOODPLAINS

With the construction of the Reevediep bypass, the normal water-level will decrease causing problems in the upstream floodplains, all part of the Natura 2000 program. Natural processes in these floodplains will be affected by a decrease in incoming water and a decline in floods of the floodplains. Due to this, some additional nature-oriented measures are necessary to keep the frequency of floods similar to the situation before the Room for the River project. The main purpose of these nature-oriented measures is to protect the nature from extinction. In five of the floodplains between Zwolle and Kampen, additional nature-oriented measures were implemented. These five floodplains are the Schererwelle, the Koppelerwaard, the Zalkerbosch, the Vreugderijkerwaard and the Bentinckswelle. Nature-oriented measures implemented in the floodplains are the reconstruction of summer embankment what resulted in an increased inundation frequency and the excavation of floodplains. The total costs of the three Room for the River project in Kampen are €280 million.

Figure 3 Overview of the Room for the River measures in Kampen

4.2 DESCRIPTIVE STATISTICS

4.2.1 ZWOLLE

In this section, the descriptive statistics of Zwolle are being outlined. The descriptive statistics are based on a SPSS analysis; the output of the analysis can be found in Appendix IV.

4.2.1.1 QUESTIONNAIRE

The questionnaire has been distributed among the citizen of Zwolle between the 11th of April and 1st of May. A total of 98 respondents completed the questionnaire. The average duration of the questionnaire was 13 minutes and 22 seconds. A QR-code and link to the online questionnaire were printed on the request. Of the 98 respondents, 5 respondents (5,1%) used the QR-code to access the questionnaire and 93 respondents (94,9%) used the link.

4.2.1.2 DEMOGRAPHIC STATISTICS

Of the 98 respondents, 45 respondents are male (45,9%) and 53 respondents are female (54,1%). The average age of the respondents is 41 year and 2 months. The youngest respondent is 16 and the oldest respondent is 81. Of the 98 respondents, 79 respondents own a house (80,6%), 19 respondents are living in a rented house (19,4%). The average distance of the respondent's house to the river is 4743 meters.

4.2.1.3 FLOODS

Experience

Out of 98 respondents, 20 respondents claim to have experience with floods (20,4%). Of these 20 respondents with flood experience, 13 respondents (65%) say that the experience affect the way in which they think about their safety.

IJssel

Of the 98 respondents, 18 respondents visit the IJssel on a daily basis (18,4%), 42 respondents on a weekly basis (42,9%), 24 respondents on a monthly basis (24,5%) and 14 respondents visit the IJssel a couple of times a year (14,3%). A visit to the IJssel is

described as an active visit (for example recreation) or during a passive visit (for example seeing the river during a daily trip). During a visit, 7 respondents never observe the water level in the IJssel (7,1%), 37 respondents observe the IJssel on an incidental basis (37,8%), 24 respondents regularly observe the IJssel (24,5%), 10 respondents frequently observe the IJssel (10,2%) and 20 respondents always observe the IJssel (20,4%). Observing the IJssel is defined as paying attention to the river in seeing it or studying it.

Kind of flood

One of the questions outlined in the questionnaire was: "Which kind of flood is, according to you, the most probable to happen?". 4 respondents (4,1%) believe that the flooding of the sea or the IJsselmeer is the most probable to happen. 46 respondents believe the most probable flood is the flooding of the IJssel (46,7%). 31 respondents (31,6%) believe that flooding due to heavy rainfall or a bad working sewage system is the most likely to happen and 17 respondents believe that a combination of the above-mentioned kinds of floods is likely to happen (17,3%).

Safety measures

Of the 65 respondents who are *familiar* with the Room for the River projects, 1 respondent has taken safety measures in order to be prepared for floods. None of the 32 respondents who are *unfamiliar* with the Room for the River projects have taken safety measures so far. 26 respondents claim that it is (very) unlikely for them to take safety measures in order to be prepared for future floods. 7 respondents do not know yet if they are going to take safety measures and 2 respondents probably will take safety measures. Safety measures could be understood as storing food, a rubber boat or life jackets in the attic.

Water level

Respondents were asked about the water level at their house during a flood. 31 respondents think that the water will not reach their house (31,6%). 27 respondents think that the water will reach up to 0.5 meters at their house (27,6%). 14 respondents think that the water level will be between the 0.5 meters and 1 meter height at their house (14,3%). 20 respondents think that the water level will be between the 1 and 2 meters at their house (20,4%) and 6 respondents think that the water level will reach a height above the 2 meters at their house (6,1%).

Responsible organizations

In the questionnaire, respondents were asked to scale organizations according to their responsibility about avoiding floods and evacuation during floods from 1 to 5 (1= main responsible, 5= barely responsible). When it comes to avoiding floods, the national government is held main responsible with an average grade of 2,11. Followed by the water board (2,22), the province (2,51) the local government (3,32) and finally the residents with an average grade of 4,84. When it comes to the evacuation of residents during a flooding event, the local government is held main responsible with an average grade of 1,97. Followed by the national government (2,48) as well as the province (2,48), the water board (3,66) and finally the residents with an average grade of 4,41.

Insurance

Respondents were asked if they took out an insurance for flooding damage. 9 respondents did take out an insurance (9,2%).

4.2.1.4 ROOM FOR THE RIVER

Respondents were asked about their familiarity with Room for the River. Out of 98 respondents, 65 respondents were familiar with Room for the River (66,3%). When asked about how these 65 respondents became familiar (multiple answers possible), most of them (43) became familiar by the media. The media is followed by information boards along the IJssel (31), work or education (26), conversations with acquaintances' (19), information brochures (10), and at last, information meetings (1).

The 98 respondents were also asked about the effect of a Room for the River project on the water level. 35 respondents think that the water level will remain the same (35,7%), 49 respondents think that the water level will decrease (50%) and 15 respondents think that the water level will increase (15,3%). The average increase as well as decrease is 37,4 centimetres.

4.2.1.5 MEASURES

Respondents were asked about their safety perception to several Room for the River measures as well as the traditional measures. Measures included are dike elevation, dike widening, dike shifting, floodplain excavation, deepening of the summer bed and a secondary channel. Respondents had to rate each measure from 1 to 10 (1=very unsafe, 10= very safe). The ranking from very safe to very unsafe perception, according to the respondents, is: dike elevation (7,06), floodplain excavation (6,96) secondary channel (6,91), dike shifting (6,56), dike widening (6,16) and deepening of the summer bed (6,15).

4.2.2 KAMPEN

In this section, the descriptive statistics of Kampen are being outlined. The descriptive statistics are based on a SPSS analysis; the output of the analysis can be found in Appendix IV.

4.2.2.1 QUESTIONNAIRE

The questionnaire has been distributed among the citizen of Kampen between the 11th of April and 1st of May. A total of 76 respondents completed the questionnaire. The average duration of the questionnaire was 10 minutes and 23 seconds. A QR-code and link to the online questionnaire were printed on the request. Of the 76 respondents, 12 respondents (15,8%) used the QR-code to access the questionnaire and 64 respondents (84,2%) used the link.

4.2.2.2 DEMOGRAPHIC STATISTICS

Of the 76 respondents, 48 respondents are male (63,2%) and 28 respondents are female (36,8%). The average age of the respondents is 47 year and 2 months. The youngest respondent is 16 and the oldest respondent is 78. Of the 76 respondents, 67 respondents own a house (88,2%), 9 respondents are living in a rented house (11,8%). The average distance of the respondent's house to the river is 1295 meters.

4.2.2.3 FLOODS

Experience

Out of 76 respondents, 40 respondents claim to have experience with floods (52,6%). Of these 40 respondents with flood experience, 19 respondents (47,5%) say that the experience affect the way in which they think about their safety.

IJssel

Of the 76 respondents, 65 respondents visit the IJssel of a daily basis (85,5%), 9 respondents on a weekly basis (11,8%), 1 respondent on a monthly basis (1,3%) and 1 respondent visit the IJssel a couple of times a year (1,3%). A visit to the IJssel is

described as an active visit or during a passive visit, for example seeing the river during a daily trip. During a visit, 4 respondents never observe the water level in the IJssel (5,3%), 32 respondents observe the IJssel on an incidental basis (42,1%), 24 respondents regularly observe the IJssel (31,6%), 7 respondents frequently observe the IJssel (9,2%) and 9 respondents always observe the IJssel (11,8%). Observing the IJssel is defined as paying attention to the river in seeing it or studying it.

Kind of flood

One of the questions outlined in the questionnaire was: "Which kind of flood is, according to you, the most probable to happen?". 2 respondents (2,6%) believe that the flooding of the sea or the IJsselmeer is the most probable to happen. 37 respondents believe the most probable flood is the flooding of the IJssel (48,7%). 22 respondents (28,9%) believe that flooding due to heavy rainfall or a bad working sewage system is the most likely to happen and 15 respondents believe that a combination of the above-mentioned kinds of floods is likely to happen (19,7%).

Safety measures

Of the 63 respondents who are familiar with the Room for the River projects, 2 respondents have taken safety measures in order to be prepared for floods. None of the 12 respondents who are unfamiliar with the Room for the River projects have taken safety measures so far. All 12 respondents claim that it is very unlikely for them to take safety measures in order to be prepared for future floods. Safety measures could be understood as storing food, a rubber boat or life jackets in the attic.

Water level

Respondents were asked about the water level at their house during a flood. 23 respondents think that the water will not reach their house (23,3%). Another 23 respondents think that the water will reach up to 0.5 meters at their house (23,3%). 13 respondents think that the water level will be between the 0.5 meters and 1 meter height at their house (17,1%). 11 respondents think that the water level will be between the 1 and 2 meters at their house (14,5%) and 6 respondents think that the water level will reach a height above the 2 meters at their house (7,9%).

Responsible organizations

In the questionnaire, respondents were asked to scale organizations according to their responsibility about avoiding floods and evacuation during floods from 1 to 5 (1= main responsible, 5= barely responsible). When it comes to avoiding floods, the national government is held main responsible with an average grade of 1,93. Followed by the water board (2,23), the province (2,62) the local government (3,30) and finally the residents with an average grade of 4,91. When it comes to the evacuation of residents during a flooding event, the local government is held main responsible with an average grade of 1,57. Followed by the national government (2,81), the province (2,85), the water board (3,35) and finally the residents with an average grade of 4,41.

Insurance

Respondents were asked if they took out an insurance for flooding damage. 19 respondents did take out an insurance (25%), the other 57 respondents did not take out an insurance (75%).

4.2.2.4 ROOM FOR THE RIVER

Respondents were asked about their familiarity with Room for the River. Out of 76 respondents, 63 respondents were familiar with Room for the River (82,9%). When asked about how these 63 respondents became familiar (multiple answers possible), most of

them (47) became familiar by the media. The media is followed by work/education (24), information brochures (19), conversations with acquaintances' (18), information boards along the IJssel (13) and at last, information meetings (8).

The 76 respondents were also asked about the effect of a Room for the River project on the water level. 37 respondents think that the water level will remain the same (48,6%), 33 respondents think that the water level will decrease (43,4%) and 6 respondents think that the water level will increase (7,9%). The average increase as well as decrease is 36 centimetres.

4.2.2.5 MEASURES

Respondents were asked about their safety perception to several Room for the River measures as well as the traditional measures. Measures included are dike elevation, dike widening, dike shifting, floodplain excavation, deepening of the summer bed and a secondary channel. Respondents had to rate each measure from 1 to 10 (1=very unsafe, 10= very safe). The ranking from very safe to very unsafe perception, according to the respondents, is: dike elevation (7,58), secondary channel (6,61), floodplain excavation (6,46), deepening of the summer bed (6,32), dike shifting (6,11) and dike widening (5,99).

4.3 COMPARISON DESCRIPTIVE STATISTICS

The descriptive statistics are showing that the traditional measured of dike elevation is perceived as the safest by the respondents of both Zwolle and Kampen. This is an extraordinary finding, since the idea behind Room for the River is to get from fighting against water till living with water, in which dike elevation is part of Room for the River projects but is seen as a traditional "fighting against water" method.

On average, the inhabitants of Kampen live closer to the river than the inhabitants of Zwolle, respectively 1295 meters and 4143 meters. In Kampen, 89,2% of the respondents is familiar with Room for the River, compare to 66,3% in Zwolle. In Kampen, more than half of the respondents have experience with floods (52,6%) compare to 20,5% in Zwolle.

Table 2 is showing the complete comparison of the descriptive statistics between Zwolle and Kampen.

		Zwolle	Kampen
Number of respondents		98	76
Average duration		13 minutes, 22 seconds	10 minutes, 23 seconds
QR/Link		5 (**5,1%**) / 93 (**94,9%**)	12 (**5,8%**) / 64 (**84,2%**)
Gender (male/female)		45 (**45,9%**) / 53 (**54,1%**)	48 (**63,2%**) / 28 (**36,8%**)
Average age		41 years and 2 months	47 years and 2 months
House owner		79 (**80,6%**)	67 (**88,2%**)
Average distance to river		4743 meters	1295 meters
Flood experience		20 (**20,4%**)	40 (**50,2%**)
Visit to the IJssel	daily basis weekly basis monthly basis yearly basis	18 (**18,4%**) 42 (**42,9%**) 24 (**24,5%**) 14 (**14,3%**)	65 (**85,5%**) 9 (**11,8%**) 1 (**1,3%**) 1 (**1,3%**)
Observation of the IJssel during a visit	never incidental regularly frequently always	7 (**7,1%**) 37 (**37,8%**) 24 (**24,5%**) 10 (**10,2%**) 20 (**20,4%**)	4 (**5,3%**) 32 (**42,1%**) 24 (**31,6%**) 7 (**9,2%**) 9 (**11,8%**)
Kind of flood	sea/IJsselmeer IJssel rainfall/bad sewage system combination	4 (**4,1%**) 46 (**46,7%**) 31 (**31,6%**) 17 (**17,3%**)	2 (**2,6%**) 37 (**48,7%**) 22 (**28,9%**) 15 (**19,7%**)
Water level at respondent house	0 meter 0 - 0,5 meter 0,5 - 1 meter 1 - 2 meter more than 2 meter	31 (**31,6%**) 27 (**27,6%**) 14 (**14,3%**) 20 (**20,4%**) 6 (**6,1%**)	23 (**23,3%**) 23 (**23,3%**) 13 (**17,1%**) 11 (**14,5%**) 6 (**7,9%**)
Organizations held responsible for avoiding floods		1. national government 2. water board 3. province 4. local government 5. residents	1. national government 2. water board 3. province 4. local government 5. residents
Organizations held responsible for the evacuation during floods		1. local government 2. national government 3. province 4. water board 5. residents	1. local government 2. national government 3. province 4. water board 5. residents
Insurance for flooding damage		9 (**9,2%**)	19 (**25%**)
Familiar with Room for the River		65 (**70,6%**)	63 (**82,9%**)
Familiarity		1. media 2. information boards 3. work/education 4. conversations 5. information brochures 6. information meetings	1. media 2. work/education 3. information brochures 4. conversation 5. information boards 6. information meetings
Effect Room for the River on water level	Water level remains the same Water level will increase Water level will decrease	35 (**35,7%**) 15 (**15,3%**) 49 (**50,0%**)	37 (**48,6%**) 6 (**7,9%**) 33 (**43,4%**)
Average increase/decrease of water level		37,4 centimetres	36,0 centimetres
Safety perception of measures (1 = safest)		1. dike elevation 2. floodplain excavation 3. secondary channel 4. dike shifting 5. dike widening 6. deepening of the summer bed	1. dike elevation 2. secondary channel 3. floodplain excavation 4. deepening of the summer bed 5. dike shifting 6. dike widening

Table 2: Comparison of descriptive statistics of Zwolle and Kampen in number of respondents and percentages.

4.4 RISK PERCEPTION

A multiple linear regression analysis has been used to measure the relation between risk perception on the one hand and the factors contributing to risk perception on the other hand. The *hypothesis* belonging to the multiple linear regression analysis is H0: "*There is **no relation** between the dependent variable on the one hand and the independent variable on the other hand, considered the other variables*". The hypothesis for the F-test is H0: *"There is no linear relation"*.

The dependent variable in the analysis is risk perception. Three risk perception questions from the questionnaire are used to measure the risk perception. The first question is: *"How do you feel regarding the chance of a flood?"*. The second question is: *"How do you feel about the following six measures on a scale of 1 to 10? (1= very unsafe, 10= very safe)."*, the following measures were part of the question: dike elevation, dike widening, dike shifting, floodplain excavation, deepening of the summer bed, secondary channels. The third question is: *"How do you feel about safety at this moment and what is the effect of Room for the River on this feeling?"*.

The independent variable in the analysis are the factors contributing to risk perception, according to the literature. Factors contributing to risk perception are: **gender, age, level of education, distance to the river, experience, insurance and house-ownership.**

The multiple linear regression has been performed three times due to the *three point Likert scale* of risk perception (unsafe-neutral-safe). The results for Zwolle and Kampen can be found in the following two sections.

4.4.1 ZWOLLE

The results of the multiple linear regression will be outlined in three sections according to the risk perception (unsafe-neutral-safe). The used multiple linear regression method is *"enter"*, all independent variables are added at the same time.

4.4.1.1 UNSAFE

The F-test is insignificant (α=0,564) with F=0,862 (Appendix V, table 50). The null hypothesis of the F-test is accepted which says that *there is no linear relation*. The variable "higher education" is significant regarding the secondary education as reference category. Concluding, the null hypothesis is rejected for "higher education" and the alternative hypothesis is accepted which says that *there is **a relation** between feeling unsafe on the one hand and higher education on the other hand, considered the other factors*. For all the other factors, the null hypothesis is accepted which says that *there is **no relation** between feeling unsafe on the one hand and a factor on the other hand, considered the other factors* (Appendix V, table 51). Table 3 is showing an overview of the relation and the factors involved in this relation.

4.4.1.2 NEUTRAL

The F-test is insignificant (α=0,471) with F=0,974 (Appendix V, table 56). The null hypothesis of the F-test is accepted which says that *there is no linear relation*. Besides the F-test, none of the variables are significant. Concluding, the null hypothesis is accepted which says that *there is **no relation** between feeling not unsafe/not safe on the one hand and a factor on the other hand, considered the other factors* (Appendix V, table 57).

4.4.1.3 SAFE

The F-test is insignificant (α=0,704) with F=0,703 (Appendix V, table 62). The null hypothesis of the F-test is accepted which says that *there is no linear relation*. Besides the F-test, none of the variables are significant. Concluding, the null hypothesis is accepted

which says that *there is **no relation** between feeling safe on the one hand and a factor on the other hand, considered the other factors* (Appendix V, table 63).

4.4.2 KAMPEN

The results of the multiple linear regression will be outlined in three sections according to the risk perception (unsafe-neutral-safe). The used multiple linear regression method is *"enter"*, all independent variables are added at the same time.

4.4.2.1 UNSAFE

The F-test is insignificant (α=0,449) with F=1,011 (Appendix V, table 68). The null hypothesis of the F-test is accepted which says that *there is no linear relation*. Besides the F-test, none of the variables are significant. Concluding, the null hypothesis is accepted which says that *there is **no relation** between feeling unsafe on the one hand and a factor on the other hand, considered the other factors* (Appendix V, table 69).

4.4.2.2 NEUTRAL

The F-test is insignificant (α=0,676) with F=0,748 (Appendix V, table 74). The null hypothesis of the F-test is accepted which says that *there is no linear relation*. Besides the F-test, none of the variables are significant. Concluding, the null hypothesis is accepted which says that *there is **no relation** between feeling not unsafe/not safe on the one hand and a factor on the other hand, considered the other factors* (Appendix V, table 75).

4.4.2.3 SAFE

The F-test is insignificant (α=0,083) with F=1,829 (Appendix V, table 80). The null hypothesis of the F-test is accepted which says that *there is no linear relation*. The variable "no education" is significant regarding the variable "secondary education" as reference category. Concluding, the null hypothesis is rejected for "no education" and the alternative hypothesis is accepted which says that *there is **a relation** between feeling safe on the one hand and no education on the other hand, considered the other factors*. For all the other factors, the null hypothesis is accepted which says that *there is **no relation** between feeling safe on the one hand and a factor on the other hand, considered the other factors* (Appendix V, table 81). Table 3 is showing an overview of the relation and the factors involved in this relation.

4.5 COMPARISON BETWEEN ZWOLLE AND KAMPEN

A comparison between Zwolle and Kampen can be found in Table 3.

Perception		Zwolle	Kampen
Unsafe	*F-test*	insignificant	insignificant
		"no linear relation"	"no linear relation"
	Significant variables?	**yes**	no
	variable	**higher education**	-
Neutral	*F-test*	insignificant	insignificant
		"no linear relation"	"no linear relation"
	Significant variables?	no	no
	Variable	-	-
Safe	*F-test*	insignificant	insignificant
		"no linear relation"	"no linear relation"
	Significant variables?	no	**yes**
	Variable	-	**no education**

Table 3: comparison output multiple linear regression Zwolle and Kampen

5. CONCLUSION

The aim of this thesis was to find out what the effect of a Room for the River project is on the risk perception of people living in Zwolle and Kampen.

First, the Room for the River measures have been outlined by the use of an interview and a document analysis. Measures implemented in Zwolle are the excavation of floodplains and the construction of secondary channels on two location in Zwolle. These two measures establish a decrease in water-level of respectively 14 and 8 centimetres. In Kampen, at first instance, the deepening of the summer bed between Zwolle and Kampen would be sufficient enough to reach the Room for the River task settings. Due to soil pollution near the central station of Zwolle, a part of the IJssel could not be deepened between Zwolle and Kampen. Due to this, the task setting would not be reached and a second measures was needed. Therefore, a bypass between the IJssel and the Drontermeer, named the Reevediep, has been constructed. Next to this, five floodplains have been excavated. Together, these three measures establish a decrease in water-level of 41 centimetres in Zwolle.

An academic literature study outlines what risk perception is and which factors contribute to risk perception. Risk perception is defined as a person's judgements and evaluations of hazardous events where the person is or might be exposed to (Rohrmann, 2008). Factors that contribute to risk perception are, according to the literature, gender, age, level of education, distance to the river, experience, insurance and house-ownership (Baan & Klijn, 2004; De Boer et al., 2015; Botzen et al., 2009; Burningham et al., 2007; Bubeck et al., 2012; Fox-Rogers et al., 2016; O'Neill et al., 2016; Scolobig et al., 2012; Sjöberg, 2000).

These factors are tested to the risk perception of people living in Zwolle and Kampen by the use of a multiple linear regression analysis. Risk perception has been measured on a *three point Likert scale* with the three categories unsafe, neutral and safe. For all the results, the F-test was insignificant what means that there is no linear relation. While having a closer look at the variable, two variables were significant and thus showing a relation. The first variable showing a relation was level of education, category "higher education". A relation has been found in Zwolle between higher education and feeling unsafe. The second variable showing a relation was level of education as well, category "no education". A relation has been found in Kampen between no education and feeling safe. Concluding; a small relation has been found between risk perception on the one hand and the factor level of education on the other hand. This relation does not count for every category of the level of education and not for every category of risk perception.

For all the other factors, the output level of significance was insignificant and thus showing no relation between risk perception and the independent variables gender, age, distance to the river, experience, insurance and house-ownership. Therefore, this research concludes that there is, apart from level of education, no relation to be found between risk perception and the factors contributing to risk perception, as stated in the academic literature.

The descriptive statistics are showing that the traditional "resilient" measure of *dike elevation* is perceived as the safest by the respondents of both Zwolle and Kampen. This is an extraordinary finding since the idea behind resilience, and therefore Room for the River as a resilient strategy, is to get from "fighting against water" towards "living with water", in which *dike elevation* is part of Room for the River projects but is seen as a traditional "fighting against water" method. The outcomes are thus showing that the paradigm shift, which is part of the transformability aspect of resilience, is not yet established within the population or will probably never establish.

Additional to this is the outcome of the question in which the respondents were asked about their opinion of the organizations held responsible for the avoidance of floods and the evacuations during floods. Flood risk management forms the connection between the theories of resilience and Room for the River and the factors of risk perception and is of great importance to this research as can be seen in the conceptual model. One of the ideas behind the paradigm shift from "fighting against water" towards "living with water" is the participation of inhabitants in flood risk management (Restemeyer et al., 2015). Participation in flood risk means that inhabitants are partly but actively responsible for the avoidance of floods and the evacuation during floods. According to the transformability aspect of resilience the expectation is that the respondents will answer with "inhabitants" as one of the main responsible organizations. However, the results are showing that the respondents graded "inhabitants" as the least responsible organization. This is contradictory to the expectations.

A possible explanation for this might be the lack of knowledge or interest of the citizen of Zwolle and Kampen about the Room for the River measures. The descriptive results are showing that 29,4% of the respondents in Zwolle and 17,1% of the respondents in Kampen are not familiar with Room for the River. The outcomes of this research are not showing to what extent the 70,6% of the respondents in Zwolle and 82,9% of the respondents in Kampen who familiar with Room for the River are familiar. This might be interesting to investigate in further research.

It seems that the changing theory of resilience has not arrived yet in the minds of the respondents, who do not see the necessity of resilience yet. The Dutch government has made the transition to "living with water" in their top-down policies in which responsibility is given to the inhabitants. These inhabitants are currently not aware of their responsibilities and the way in which they should accomplish this responsibility. Responsibility in the way of resilience requires collaboration between inhabitants and full commitment, and can therefore be seen as a policy that is mandatory to the inhabitants. The inhabitants should be aware of the fact that they cannot form an exception on this policy or oppose against it, deviation from the policy by inhabitants can jeopardize the idea of resilience. The weakest link determines the strength of the chain of measures taken. The local government is responsible for the inhabitants and should support the inhabitants in their responsibility with a bottom-up approach what contains support for the implementation of measures. On the other hand, the local government will be dependent on the total commitment of the inhabitants. In other words, the local government is responsible in a bottom-up way for the implementation of the top-down policy. The outcomes of this research are showing a discrepancy between the top-down policy of the government and the perspective of the inhabitants, who do not see themselves as essential factor in the theory of resilience yet. For further research, it could be interesting to investigate what both the government and the inhabitants expect and in what way the inhabitants could be made aware of their responsibilities and the complete chain of the responsibility according the theory of resilience. One thing is made clear from this, with the climate change kept in mind, people should not take their safety for guaranteed and should actively participate in keeping their surroundings as safe as possible or as required. Resilience has the potential to be very successful, but this success is dependent on the total commitment of all partners within the chain of resilience also known as the "chain of responsibility".

6. DISCUSSION & REFLECTION

In this section, a discussion about the process of the research is outlined.

In this research, the main research method has been a questionnaire. In this questionnaire, a division has been made between people who are familiar with Room for the River and people who are unfamiliar with Room for the River. Both groups got almost the same set of questions. Afterwards, during a conversation with Dr. Viktor Venhorst, one of the risk perception questions asked to both groups turned out to measure different risk perception. The question asked to the group of people familiar with Room for the River was: "I changed my thoughts about my safety due to Room for the River", this question is measuring thoughts. The question asked to the group of people who were unfamiliar with Room for the River was: "Now I am aware of Room for the River, I am going to indulge myself into the topic", this question is measuring opinions. Unfortunately, both questions were not measuring the same and could not be included in the risk perception questions. This could have affected the research outcomes since these questions were measuring the effect of Room for the River on the risk perception of the respondents, the main research question of this thesis. This also weakens the main research question in being answered. An unambiguous answer to the main research question cannot be given due to this.

The effect of a Room for the River project on the risk perception of people has been measured in this research. The results are showing that there is hardly any relation between the factors being outlined in the academic literature as contributing to risk perception and risk perception. For this research, a questionnaire has been spread in Zwolle and Kampen. The response rate was n=176, with n=98 in Zwolle and n=78 in Kampen. Risk perception has been measured in a five point Likert scale (very unsafe – unsafe – neutral – safe – very safe) and is rescaled into a three point Likert scale in unsafe, neutral and safe. Risk perceptions has been rescaled because of the small division over the five options. This could affect the results. With a three point Likert scale, the division would be greater due to the less options. The results still show no relation; this could be due to an inferior amount of responses. Therefore, it would be further recommended that further research in this topic will be done with more cases in both cities to see if there is a relation between the in the literature mentioned factors of risk perception and risk perception itself. To get more response, it would be recommended to ask people in an active way with request, for example at a supermarket instead of distributing request notes in letterboxes to increase the response rate.

In this research, the cities of Zwolle and Kampen have been compared. The city centre of Kampen is situated directly next to the IJssel whereas the city centre of Zwolle is situated on a distance of approximately 3 kilometres to the IJssel. It would be interesting to see if the difference in distance to the IJssel is affecting the risk perception of the inhabitants. Room for the River projects have been done in several cities in the Netherlands. The city of Deventer situated in Overijssel has had a Room for the River project. The city centre of Deventer is situated directly next to the IJssel as in Kampen. For further research, it could be interesting to compare the cities of Deventer and Kampen considered the recommendation of the number of responses.

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