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Case Study

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An explorative study of the risk management of people with a sensory disability; A case study in the Netherlands.

Eileen Focke-Bakker[1,*], Pieter van Gelder[2]

[1]Faculty of Technology, Policy and Management, Delft University of Technology, The Netherlands
[2]Faculty of Technology, Policy and Management, Delft University of Technology, The Netherlands

*Corresponding author: egabakker@gmail.com

Abstract: The mission and purpose of this engaged inclusive research, for and with persons with a visual- and/or hearing impairment (VI and/or HI) as experience experts, is to diminish the number of victims due to flooding. The study aims to investigate if and how these impaired persons are managing the risk of flooding in their various environments, influenced by their own background and by the 'optimal quality' of public authorities' flood risk-handling. And indicate, if applicable, improvements for optimizing public authorities' flood measures.

The results show that some of the impaired respondent's background, their public authorities' quality assessment and their own risk management give cause for concern. Being older, living in flood sensitive land parts, and not going outside if there are too many obstacles are hindrances when the risk of flooding becomes a real incident. The impaired respondents' family structure is not suitable for implementing the public authorities' 'together-reliance' measures against flooding and their income might not be enough for flood resistance measures. Public authorities' measures against flooding, at the national and local level, are perceived by the impaired respondents, as not optimal. Self-efficacy and respect, values of utmost importance for the impaired respondents, are, from a non-inclusive able-bodied perspective, different from that of an impaired person's point of view. This could cause misunderstandings during flood rescue missions. Raising awareness on flooding, providing more specific information and making the information more accessible is needed.

In 'utilization of the results', improvements are suggested. The impaired respondents capabilities of self-reliance, resilience and not privacy focused during incidents (COVID-19) could be of use.

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Our study added value to quality data of persons with an impairment and to the research on their flood risk management. The findings could result in less casualties and death in flooding events.

One sentence summary: This study presents an explorative approach on flooding for sensory impaired persons and findings show that respondents' background, their authorities' quality assessment and their risk management give cause for concern.

Keywords: Sensory disability, Risk of flooding, Risk-management framework, Risk environments, Risk assessment, Intended risk-handling

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1 Introduction

People are exposed to multiple risks; in particular vulnerable persons with a disability often find themselves in risky situations. Persons with disabilities, when compared to the general population, face higher risks in emergency situations and are disproportionately affected by natural disasters (United Nations, 2015).

This study's mission is to develop an engaged inclusive approach on disability and risk management from a capability point of view (Keates & Clarkson, 2001; Keates & Clarkson, 2002; Mitra, 2006; Schippers, 2021). Capabilities of a person, according to Sen (1993), depend on a variety of factors, namely, personal characteristics and social arrangements (Kuhumba, 2018; Saigaran et al., 2015; Stewart, 2013). Our overarching study on the abilities of persons with a sensory disability and risk management included several risks, being natural (flooding), safety (traffic accidents) and security (theft /robbery) risks respectively.

The current study researched aspects of the capabilities of persons with a sensory disability and how they manage the risky situation of flooding by heavy rainfall, in various environments, in relation to the national and the local authorities' ability to manage flooding. Heavy rainfall, due to climate change, can stretch the capabilities of persons with a disability and may cause them financial damage, and physical and psychological harm. By designing a framework of risk management for sensory disabled persons with an 'environmental' lens, understanding will be reached with the goal to prevent future casualties and death of persons with a disability, caused by severe weather events like flooding.

The study on flooding risks in the context of the capabilities of persons with a sensory disability is of importance. The sensory disabled population is rapidly growing and climate change enhances the risk of flooding. Above named subject matter has been underrepresented in research and not much data is available in the Netherlands.

Experts on sensory disabilities from Bartimeus and of the Eye and Ear Association, organizations for visual and hearing impaired in the Netherlands, have suggested researching sensory disability, in this study persons with a visual and/or hearing impairment (VI and/or HI), in relation to their safety and security risk management since there is hardly any literature on these topics. Understanding the flood management of persons with these impairments will contribute to more and better risk response strategies; for the persons with the sensory disability themselves and for the public authorities. The current study helps to redress the balance in literature and 'data,' and in research methodology regarding risk management of flooding for persons with a sensory disability and other vulnerable persons or groups. Much information available, constitutes of general checklists of preventive and repressive measures, but in-depth research on users' wants, needs, perception and cognition has not yet been done. No experience expert participation of persons with sensory impairments was found in research on flooding in the Netherlands. The measures taken by the authorities are designed with able-bodied persons in mind (Rijkswaterstraat et al., 2021). Research on vulnerable populations in topic areas other than flooding has found that targeting and working with specific groups can provide support to such populations and help change attitudes and behaviors in a positive way (Howat et al., 2001; Woelfer & Hendry, 2009; Wyche et al., 2006). Our research will help to get additional insight

in the risk measures based on non-inclusive, able-bodied bias and will indirectly (try to) raise awareness of policymakers.

Therefore, the study's aim is to inventories and gain an understanding of the context and capabilities of persons with an impairment (objective 1), to research the optimality of public authority's management on flooding (objective 2) and to map the flooding risk management of these impaired persons (objective 3), and to indicate, if applicable, improvements for optimizing flood risk measures.

No objective data analysis of the flooding incidents for persons with the impairment could be performed, since overall, systematic, and structured data of persons with this disability are practically non-existent and the exact number of persons with the impairments is hard to obtain (Duijf & Van den Berg, 2020). This is in part due to different definitions and partly because there is no exact registration of persons with the impairment. Therefore, only a 'subjective' risk analysis, based on how a small population of persons with a sensory disability perceives the risk, could be performed. Koradecka emphasizes the importance of the distinction between both methodological approaches (Koradecka et al., 2010) and Rundmo et al. (2011), explain that "risks analysis adds logic, reasoning, and reflection into the handling of risks. It should be distinguished from "risk as feelings."

Given the risk and the disabilities of the research participants, and the need to avoid exposing participants to physical, emotional or psychological harm, it would not have been in line with protecting the rights and welfare of the participants to expose them to the risk of flooding and to observe how they would act in reality (American Psychological Association, 2020). Due to these ethical implications, only the intended risk management of the research participants is studied, and consent has been asked of all participants to ensure that they are aware of the ethical approach put into practice in the research (Arifin, 2018).

Interdependencies between safety and security risks.

Although this paper focuses on the issue of flooding, many interdependencies exist between safety and security aspects; e.g. the study of Ando, Higuchi, and Mimura (2018) indicates that many underlying factors affect the occurrence of traffic accidents and urban violence/crime like theft/robbery. For example, narrow streets have a negative effect on both traffic accidents and urban crime. Persons with a disability might experience this situation as extremely risky.

The interrelationships between flooding and theft/robbery is also present. For example, Gaherity and Birch (2022) researched looting behavior during natural disaster incidents. Their findings indicate that three themes are of importance; the types of looters, the motivations for looting and crime prevention responses on looters and looting. Berrebi, Karlinsky and Yonah (Berrebi et al., 2021) conclude that natural disasters affect crime negatively contrary to the general idea regarding looting. In 'Changes and Challenges in Crime and Criminal Justice After Disaster,' Frailing, Harper Jr., and Serpas (2015) state that while prosocial behavior is widely observable after disasters, there is undisputable evidence that antisocial behavior also occurs in the direct and longer-term disaster aftermath. Zahnow, Wickes, Haynes and Corcoran (2017) conclude that, although the study's results suggest that the flood across Brisbane (Australia) was perceived as a significant increase in property

crime, closer analyses indicated that rises in crime were determined by a property crime shift to no-flooded, affluent neighborhoods.

Although no literature on flooding and theft (looting) was found for the Netherlands, e.g., after the recent flooding in Limburg (2021), it will be of great interest to interrelate natural risks to security risks for the Netherlands, specific for persons with a disability. In the overarching analysis, safety and security related, these subjects will be addressed.

Disability.

To comprehend the context of persons with a disability, further understanding is needed of the historical development within the global community of persons with a disability. The terminology, as described in the disabled world (Disabled World, 2022), shows the euphemisms and changing fashions that have caused disability terms to rise or fall in status. Currently "disability or impairment" are commonly used terms, as are sometimes more specific terms such as blind or deaf (to describe having no vision or hearing capabilities at all) or visually or hearing impaired (to describe having limited vision or hearing function).

The International Classification of Functioning, Disability and Health describes disability as a limitation in a functional domain that arises from the interaction between a person's health conditions, and contextual factors, both personal and environmental (World Health Organization, 2001). The "Person-First" Movement (People First, 1974) has added another view to the discourse stressing that people with disabilities should be identified first as individuals; e.g. 'a person who is blind', rather than 'a blind person'. However, not all people with disabilities acknowledge the "Persons-First" movement. In this study both 'streams of language-preference' are accommodated.

The UN Sustainable Development Goals (SDG 4, 8, 10, 11, and 17) (United Nations, 2015, 2018) include paragraphs on disability. The Convention on the Rights of Persons with Disabilities, a UN international human rights treaty entered into force on 3 May 2008, intends to protect and enhance the rights, dignity and opportunities of persons with disabilities. The Convention states: "By focusing on obstacles for the disabled, the member-states were convinced to take special measures to address these obstacles" (Convention on the Rights of Persons with Disabilities, 2006; Mittler, 2015). Countries that have signed the Convention are required to adopt national laws and remove old ones. To ratify this Convention, the Netherlands has adapted two laws: the law of equal treatment for people with a handicap or chronic illness and the Elections Act (The Netherlands Institute for Human Rights, 2022). The Report on the Committee on the Rights of Persons with Disabilities of the Netherlands Institute for Human Rights is monitoring the Netherlands's implementation of the UN Convention on the Rights of Persons with Disabilities. One of the main conclusions was that the Dutch government must take more steps towards including people with disabilities in decision-making procedures (The Netherlands Institute for Human Rights, 2020). In January 2023, the Dutch Constitution Article 1 has been adapted so that discrimination on the grounds of disability is no longer permitted (Rijksoverheid, 2023).

In 2011, the WHO and the World Bank (2011) conjointly published their "World report on disability" stating that "Disabilities is an umbrella term, covering impairments, activity limitations, and participation restrictions, denoting the negative aspects of the interaction between an individual (with a health condition) and that of individual's contextual factors (environmental and personal factors)". Their report suggests that many of the barriers faced by people with disabilities are avoidable, and the disadvantages associated with disability can be overcome. To make significant improvements, they acclaim nine recommendations. The recommendations to involve people with disabilities and to conduct more research on the lives of persons with disabilities are of utmost importance for this research (Disabled People in the World, 2021).

In the last decades, the focus of disability studies and its models (The Union of the Physically Impaired against Segregation & The Disability Alliance, 1975) moved from more medical (physical/psychological impairments) aspects to the broader approach of inclusion. UPIAS, the Union of the Physical Impaired Against Segregation states, "Disability is something imposed on top of our impairments by the way we are unnecessarily isolated and excluded from full participation." In the medical approach, the impairment condition is the disabling focus, the social reactions to it are justified, and the barriers are unavoidable. UNPAIS (Finkelstein, 2007; Levitt, 2017; Oliver, 2004) and the 'Human rights and disability' model (Mitra, 2018; Ntlatlapa, 2011; Rohwerder, 2015) all emphasize that participation in society depends both on the impairments and on the interaction with society; that is why they use the term disability to place the physical and psychological impairments in their appropriate context. An individual may be impaired by a condition that requires daily living adaptations, but the centre of the problem¬ — the sensory disability—can be found in the attitudinal and physical barriers erected by society. To be able to participate in society has an important meaning in people's lives. Insufficient participation in society often leads to loneliness and is therefore a major social problem (Kappen et al., 2018). Both the medical and the social models agree, up to a point, that facilities and opportunities should be made as "accessible" as possible to individuals who require adaptations. WHO's key-fact reports on blindness and vision impairment (2019) and deafness and hearing loss (2021), state that globally around 2.2 billion people have a vision impairment or are blind, and the majority of¬ people with vision impairment are over 50 years of age and that, through population growth and ageing, the risk on vision impairment will increase. They predict that in 2050 2.5 billion people will have some degree of hearing loss and young adults are at risk due to unsafe listening practices (World Health Organization, 2019, 2021). It is estimated that in the Netherlands around 3.6 million people have an impairment to a lesser extent (Duijf & Van den Berg, 2020). The latest estimate by the authorities in the Netherlands (Rijksoverheid, 2022) is that 2 million people have a sensory, motion or cognitive impairment. It is also estimated that 220.000 to 320.000 Dutch people have a visual impairment in both eyes, of whom 33.000 to 45.000 are blind and the others have sight loss (Limburg et al., 2005). In this study on sensory disability, our respondents are persons with a vision impairment (VI) and/or a hearing impairment (HI) and also include persons with no vision and/or hearing impairments. This terminology is derived from Zhang et al. (2022a, 2022b). Depending on the text the "persons-first" approach is used, in other contexts the impairment is mentioned first or the term 'disability'.

The risk of flooding.

Flooding, a major overflow of water due to heavy rainfall that submerges land that is usually dry, is the most common and widespread natural severe weather event and is becoming a higher risk due to climate change. For persons with disabilities the chance and impact might be perceived as even higher due to their impairment. “Not seeing or hearing water coming creates a feeling of fear”, one of the respondents stated.

The United Nations International Strategy for Disaster Reduction (UNISDR) (2013, 2014) in its report on living with disabilities and disasters, states that worldwide flooding is the highest hazard risk (57%), followed by extreme weather, drought, tornados, earthquakes and cyclones. UNISDR states that persons with disabilities are rarely consulted about their needs in potential disaster situations and people with a disability state that they do not participate in risk reduction processes. Persons with disabilities are often excluded from decision-making and planning of such processes and almost three-quarters have no personal disaster preparedness plan (United Nations International Strategy for Disaster Reduction, 2014). The data differ globally; in Europe, 59% of the survey participants state that they have a personal preparedness plan. In these plans, family is vital in their risk-handling. 8% know about national risk/disaster management programs and 13% know about programs at local level. 57% want to be involved in the programs. Two of the UNISDR report recommendations state that the authorities should be aware of persons with a vulnerability and that emergency workers should be trained in augmentative and alternative communication skills. Van Gelder et al. (Gelder et al., 2017) state: “The Netherlands has reliable precipitation measurements since 1906 which facilitate trend analyses”. “We are observing an increase in extreme cases”. “In the current warmer climate, extreme precipitation events are now approximately twice as common as they were a few decades ago”. “We also see events during which the average rainfall for an entire month falls in just one hour”. Kolen and Van Gelder (2018) describe the considerations (economic cost-benefit and loss of life costs) of the authorities regarding evacuation due to heavy flooding. They concluded that they had expected that, in the decision-making, more value was given to the loss of life costs. In 2021, Kolen, Dannenberg and Van Gelder (2021) researched the effectiveness of evacuation in times of flooding. The model they used divides the large-scale population into several ‘victim categories’ that are based on the expected location of the ‘victim’. Although mentioned in one victim category, the needs of vulnerable people have not been thoroughly considered in previous research. Flooding of streets occurs quite often but severe flash flooding such as in the south of the Netherlands in 2021 occurs only once in several decades. In the Netherlands, the amount of flooding is currently measured by the “precipitation index” where cities are ranked by rainfall (Krijger et al., 2018). In our research, the cities where most respondents live are in the top 10 of the index: The Hague, Utrecht, Zwolle, and Groningen. Terpstra (2010), investigating flood preparedness of the general public in the Netherlands, notes that the fact of high-level protection against floods and the lack of large floods in the Netherlands, made people much less aware of the possibility of flood disasters. People in the Netherlands strongly believe in the public authorities’ ability to manage the flood defenses. Dutch citizens regard collective flood protection as a ‘moral obligation’ of the government. In general, people experience little feelings of fear when thinking about their exposure to a flood risk. Terpstra (2010) states: “Only few people are aware of a national disaster reduction plan and a somewhat greater percentage (17%) knows the local disaster plans. Only 21% think they

can be evacuated immediately and without difficulty in case of a disaster. They count on the support of their family. The most influential determinant of the intentions of the public to prepare for floods is the extent to which they perceive that flood preparations increase their own and their family's safety in the case of flooding. Terpstra's findings indicate that large parts of the Dutch population are open to the suggestion that they should undertake some personal action to prepare for a flood disaster. Some psychological theories, according to Terpstra (2010), predict that people's intentions to act may be lowered if people perceive themselves as having insufficient resources (such as money, time, knowledge/skills, and cooperation from other persons) to make preparations. It also depends on their action perspective. Terpstra's own findings, however, do not support this. As for the government's risk policy, focused on self/together-reliance, and its measures, it appeared that risk communication recommends the same flood preparations (e.g., an emergency kit) for different populations (e.g., persons with a disability) in different flood risk areas. Terpstra (2010) concludes: "There are complex interdependencies between collective disaster response plans and people's individual opportunities to prepare for flood disasters." Doorn (2018) in "Values in Water" states: "When we look at water, we are dealing with systems with both a human and a material side". She addresses the ethical issues in water engineering and distinguishes between two components: a 'what,' referring to what values are incorporated into the system, and a 'who,' meaning who should make choices in water policy, and who is affected by them. The last two questions are of importance to persons with a disability and their inclusive risk measures needs as they are often not included in the 'who's.' Becker et al. (2015) state that focus on vulnerable or 'at risk' groups should be included in measures against flooding. Dow and Cutter (2001) examine the relationship between household evacuation decisions and official emergency management practices. Research indicates that there are differences in terms of priorities and preferences about (hurricane) evacuations; the public demands more information about the (hurricane) threat and officials place more emphasis on planning evacuation routes and public safety measures. Babcicky and Seebauer (2021) researched psychological indicators such as perceived flood probability and protection intention, alongside physical and social indicators influencing vulnerability outcomes. The psychological indicators have an added value; e.g. fear of flooding and self-efficacy are most relevant. They state: "Household level data should be disaggregated to capture the variability between households in the same area." Lumping indicators and measuring outcomes into a single index obscures most likely the essentials for effective risk management. This is of importance for targeted support to disadvantaged groups. Self-, collective- and political efficacy is of utmost importance in protective actions. Irresponsiveness of authorities to citizens' concerns and side-lining them in risk governance instead of involving them can lead to inferior (flood) policy decisions (Babcicky & Seebauer, 2021). Many of these issues are incorporated into the research design of this study.

2 Research Design

As a result of the study's mission –developing an engaged inclusive research approach on risk management and disability from a capability point of view– (Keates & Clarkson, 2001; Keates & Clarkson, 2002; Kuhumba, 2018; Mitra, 2006; United Nations, 2015; Saigaran et al., 2015; Schippers, 2021; Stewart, 2013), and of the research aim to investigate if and how impaired persons are

managing the risk of flooding in their various environments, influenced by their own background and by the 'optimal quality' of public authorities' flood risk-handling, three research questions are developed.

To address these questions, an 'integrated' framework of risk management for persons with a visual and/or hearing impairment (VI and/or HI), is designed. The framework, consisting of three building blocks, integrates a variety of capability factors, both personal characteristics as well as social arrangements of persons with a VI and/or HI that might influence their risk management. It helps to create an understanding and highlights social practices that might limit their ability, e.g., to manage the risk of flooding, and it aims to understand the obstacles, obvious and obscure, that they might encounter. Some relationships between the various elements of the framework are assumed (presupposed relationships I. and II.), but for now no causal model has been developed and tested.

In order to explore, in more detail, the risk management of the authorities as perceived by the respondents and of the respondents themselves, five participation areas, relevant to the impaired, are distinguished. These five environments of importance, –home, outdoors (as pedestrian and/or as non-pedestrian traffic participant), work/school and where their leisure activities take place–, are used as a 'magnification glass' to analyze their risk management.

Research questions.

The following three research questions were formulated including not only medical or technical but also social/psychological indicators.

> (A) What is the background (context and capabilities) of the respondents with a VI and/or HI?
>
> (B) How do they assess the public authorities' management of the risk of flooding within their environments?
>
> (C) How do they themselves manage the risk of flooding within their environments?

Derived from these three general questions, more specific research questions have been formulated and a 'reference' group of respondents without a VI and/or HI is included. This group is "a reflection group" matched with a selection of respondents with the impairment.

- What is the contextual background (A.1) and the living context (A.2) of the respondents with/without a VI and/or HI?
- Do they think that the public authorities take optimal (effective and efficient) measures at the national (B.1) and local level (B.2) to address the risk of flooding in the five environments? Effective and efficient in this context mean useful and well organized.
- How do they assess (C.1) the risks of flooding they are running, in the five environments and do they intend to take measures (C.2) to address the risk of flooding and if so, what is their risk-response strategy?
    - C.1 Are the respondents with/without a VI and/or HI aware (conscious) of the risks of flooding they are running and how do they perceive (identify) the risk of flooding they

are running, in the five environments? Have they been exposed (subjected) to the risk of flooding (and maybe other risks) in the five environments?

- C.2 Do the respondents with/without a VI and/or HI anticipate to take measures to address the risk of flooding in the five environments and if so, what is their risk-response strategy?

Presupposed relationships

Derived from these three more specific questions two presupposed relationships were postulated.

I. Presupposed is that background (context and capabilities factors) elements of the respondents with/without a VI and/or HI have an influence on how these respondents manage the risk of flooding within their various environments.

II. Presupposed is that the more the respondents with/without a VI and/or HI assess that the public authorities take optimal (effective and efficient) measures to address the risk of flooding, the less risk management, especially risk measures (risk-handling), they will undertake themselves.

Framework design of risk management for persons with a VI and/or HI; building block A, B and C.

The designing starts by focussing on the capabilities of persons with a VI and/or HI (Kuhumba, 2018; Mitra, 2006; Saigaran et al., 2015; Stewart, 2013); what personal characteristics, social arrangements and other indicators (Bijl et al., 2013; Elsman et al., 2017; Ustun, 2006; Rijksinstituut voor Volksgezondheid en Milieu, 2002; World Health Organization, 2002) do persons with a VI and/or HI have? From there the first building block (A) of the framework: the background of persons with a VI and/or HI is developed (see Table 1).

- **Building block A of the framework: the background of persons with a VI and/or HI.**

The background characteristics of the respondents have been operationalized with two elements: the contextual background and the living context. The elements are composed of features of the domains of the International Classification of Functioning, Disability and Health (ICF) (World Health Organization, 2002); a framework for describing and organizing information on functioning and disability. It integrates the major models of disability from solely health orientation to an activity and to overall participation levels. It recognizes the environmental factors that make up the physical, social, and attitudinal setting in which the people with disabilities live, and live their lives. ICF is a tool to study disability in all its dimensions (Ustun, 2006). In the Netherlands, RIVM, the National Institute for Public Health and the Environment, and the WHO-FIC translated the ICF into Dutch and adapted it to the Dutch context and terminology (Rijksinstituut voor Volksgezondheid en Milieu, 2002). The RIVM/ICF describes human functioning using three perspectives; the human organism

(its functions and anatomic properties), the human handling (activities) and as participant in society (participation). In "See and be Seen" (Kappen et al., 2018) three main participation areas for people who are blind or who have low vision are indicated; mobility (travel and moving), feelings, time and energy, education, work, and money. Next to above named two approaches, features of the conceptual framework of the Netherlands Institute for Social Research (SCP) (Bijl et al., 2013) with its objectives (wellbeing and welfare), its aiding sources such as income and education, and the subjective experience of happiness and satisfaction, have been, if applicable, incorporated (Bijl et al., 2013) and together with insights of the 'concept-mapping' (Elsman et al., 2017) of life aspects of young visually impaired, they are the basis for the first building block of the framework. Dowling and Staelin (Dowling & Staelin, 1994) suggest that in future studies "a more general wealth construct [*should be included*] that incorporates both monetary and non-monetary aspects as a determinant for risk-reduction activities". Therefore, in this research not only monetary but also non-monetary wealth aspects have been included. Bourdieu's non-monetary objectified cultural capital (Bourdieu, 1986; Murdok, 2010) −acquisition and consumption of cultural goods− has been included via the indicator 'playing an instrument'. Also demographic factors like sex, age, and geographic living situation features, are incorporated (Prawiro-Atmodjo et al., 2016).

In our research we use the term sex as the biological characteristics of males and females for the selected sample and in the framework the term gender is used. Gender includes more than sex and is an indicator of an individual's personal and social position. WHO defines sex as "genetic/physiological or biological characteristics of a person which indicates whether one is female or male" and defines gender as referring to "women's and men's roles and responsibilities that are socially determined." It is assumed that there are differences in 'women's and men's' socially determined roles and responsibilities and in an individual's personal and social position, so the term 'gender' is used in the framework's design (Institute of Medicine (US) Committee on Understanding the Biology of Sex and Gender Differences, 2018; Mazure, 2021).

Table 1: Background features derived from the "ICF" and "See and be Seen" studies, and some "SCP" and "concept mapping" perspectives, resulting in building block A of the framework for risk management' for persons with a VI and/or HI and their environments.

ICF; International Classification of Functioning, Disability and Health.	**'See and be Seen'.**	**Building block A of the framework for risk management for persons with a VI/HI and their five environments.**
Domains; *A. the body functions and structures of people, and impairments thereof (functioning at the level of the body);* *B. the activities of people (functioning at the level of the individual) and the activity limitations they experience;* *C. the participation or involvement of people in all areas of life, and the participation restrictions they*		***Background;*** *A.1 Contextual background; demographics, geographical features and personal surroundings (indoor & outdoor).* *A.2 Living context; family structure, education, work and income, cultural capital, participation and wellbeing.*

ICF; International Classification of Functioning, Disability and Health.	**'See and be Seen'.**	**Building block A of the framework for risk management for persons with a VI/HI and their five environments.**
experience (functioning of a person as a member of society); *D. the environmental factors that affect these experiences (and whether these factors are facilitators or barriers).*		
Activities and participation in domains; *1. learning and knowledge application* *2. general tasks and demands* *3. communication and mobility* *4. self-care and domestic life* *5. interpersonal relationships* *6. major life themes; profession & work, education, economic situation* *7. important societal and community themes*	*Participation areas;* *1. travel and mobility* *2. education, work, and money* *3. feelings, time, and energy* *4. communication and ICT* *5. household* *6. relations with others* *7. leisure* *8. reading and writing* *9. self- care*	***Environments;*** *- indoor; at home* *- outdoor; as road users; pedestrian, traffic participants* *- at work/school* *- at a place of leisure*
Influencing factors; *- The body functions* *- External factors; house-features, aiding tools, work environment, friends, social norms, and laws.*	*Background features;* *10. Sight Impairment* *11. Personal factors; age*	

- **Building block B of the framework: the risk management of the public authorities.**

The second building block addresses the quality of the measures, from the impaired person's perspective, against flooding by the public authorities at the national and local level. These measures, for example due to non-inclusive value tensions (Poel, 2009), might be assessed as not optimal by them. Dowling (Dowling, 1986) and Dowling and Staelin (Dowling & Staelin, 1994) investigated the cost-benefit aspect of a perceived risk-reduction activity and Alhakami and Slovic (Alhakami & Slovic, 1994) researched the relationship between 'perceived risks and benefits'. In both studies the perception is of foremost importance. Of significance is also the credibility of the risk-managing institutions and agencies. Only if the population is confident that the lack of individual control to manage the risk is compensated by institutional control, people accept the institutional risk management. The measures of the public authorities are being judged as efficient and effective or not. Effectiveness is the degree to which the measure fulfills its desired function and efficiency is the ratio between the degree to which the measure fulfills its desired function and the effort required to achieve that effect. Planning the most efficient risk-handling of flooding could mean an ineffective design for persons with a disability. As Van de Poel (Poel, 2020) observes, 'a well-defined notion of optimal design requires a solution to the [above named] potential conflict'. In relation to the two concepts, Van de Poel notes, "effectiveness and efficiency are different values that might well conflict" and "they are often difficult to measure." Both notations are important for this research. Having to estimate the cost-benefit of the public authority's risk-handling measures by the impaired persons might present difficulties, so the concepts of efficiency and effectivity were operationalized in the

general term ‘optimal’; optimal equivalents organized and useful and non-optimal equivalents not-organized and useful.

- **Building block C of the framework: the risk management of persons with a VI and/or HI.**

The third building block addresses the risk management of persons with an impairment and has two elements: their risk assessment and their anticipated risk handling (their mitigation measures).

The risk assessment comprises three indicators: risk awareness, perception (Maredia, 2020), and exposure and has a cognitive (think) as well as an emotional, affective (feel) and consequential (encounter) attribute (De Oliveira Vilela da Silva & Gnecco de Camargo Braga, 2017). Risk perception can have two main features: the cognitive, which relates to how much people know about and understand the risk, and the emotional feature, which relates to how they feel about the risk (Paek & Hove, 2017). Gustafson (Gustafson, 1998) indicates a different risk perception in 'men and women' and states that gender differences in risk may be a matter of unequal power distribution. As described, in the current research a distinction has been made between the demographic term of ‘sex’ and the ‘gender’ concept. Renn (Renn, 1990) states that: “knowing the risk perception [process] is essential for improving risk management and also its risk communication. Managing risks must relate to the people affected and the options must reflect these concerns. Risk perception insights can help to identify public concerns and help to create solutions; it explicates the risks characteristics that matter to the public. This is not an all-inclusive rationale for assessing and evaluating risks though. It also depends on the risk context and the individual’s social context. Renn and Levine highlight aspects of risk perception that are situational or influenced by personal characteristics and risk experiences and through what the perception is influenced; e.g., controllability, exposure to the risk, familiarity with the risks, and perception of the benefits. Confidence in risk management institutions relies on perceived competence and trustworthiness (Renn & Levine, 1988). Dowling and Staelin (Dowling & Staelin, 1994) study the determinants of the perceived risk and how overall perceived risks affect the information search behavior and conclude that perceived risk influences intended information search actions.

Risk handling is the second element of the risk management building block C. After performing a risk assessment, risk-handling strategies aim to establish risk-handling priorities and develop risk-handling plans (risk-response). The main risk-response strategies are avoiding, transferring, actively or passively accepting, and escalating the risk. Seebauer and Babcicky (2020) state that when they measured what type of behavior their respondents would engage in, they researched the anticipated risk-reduction measures instead of monitoring their actual risk-reduction behavior. In this study, only the intended risk-reduction behavior will be explored due to the type of risk, the population, and research ethics (American Psychological Association, 2020).

- **The ‘integrated’ framework design −building block A, B and C− for risk management of persons with a VI and/or HI.**

Integrating the three building blocks into the 'framework of risk management' paves the way for a structured risk management analysis of how persons with an impairment manage the risk of flooding and what might influence their risk-responses (see Table 2).

Table 2: The 'integrated' framework of risk management with its three building blocks: the background (A), assessment of risk management of the public authorities (B) and the risk management for persons with a VI and/or HI (C) .

A. Background of persons with a VI and/or HI; Contextual background (A.1) and living context of the respondent (A.2) with their indicators.		**B. Risk management of authorities; Assessment of public authority's risk management at national (B.1) and local level (B.2) by persons with a VI and/or HI.**		**C. Risk management of persons with a VI and/or HI; Risk assessment (C.1) and intended risk handling (C.2), with their indicators.**
Building block: A.1 and A.2		**Building block: B.1 and B.2**		**Building block: C.1 and C.2**
A.1 Contextual Background Demographics; nationality, age, gender.		B.1 Optimal risk measures by public authorities; national level.		C.1 Assessment; awareness
A.1 Contextual Background Geographic's; land-parts, urban & other areas, water-sources.		B.2 Optimal risk measures by public authorities; local level.		C.1 Assessment; perception
A.1 Contextual Background Personal surroundings; indoor-outdoor				C.1 Assessment; exposure
A.2 Living context; family structure				C.2 Anticipated risk-handling; intention
A.2 Living context; education				
A.2 Living context; work & income				
A.2 Living context; cultural capital				
A.2 Living context; social participation				
A.2 Living context; personal wellbeing				

Participant recruitment and data collection

In order to recruit respondents, the Eye and Ear Association and the "WeZoDo" organizations were approached, and they brought in, through their bulletins and personal contacts, participants for the research. Also, people with sight and/or hearing loss asked their acquaintances to participate. It resulted in a small sample (n=13), partly selected, partly snowball. As explained in the introduction, data on hearing and sight impaired in the Netherlands are hard to find since no structural official records are available (CBS Stateline) and organizations, rightly, are guarding their members' privacy. Vulnerable people are challenging to recruit in large numbers and are often underrepresented in larger studies. Though research analyses with few cases have been done before (Etz & Arroyo, 2015; Knevel et al., 2022), it is important to emphasize that, in this in-depth qualitative explorative study, no extensive statistics between various groups are performed since this might produce a misleading picture. Risk and resilience aspects might be otherwise overlooked as Etz and Arroyo (2015) observed. No intersectional analyses (gender, age) are performed due to the small sample. The current research focusses on increased and better understanding of the context, e.g., the special contextual knowledge and information process of the disabled. Participatory observation, planned to be used as a supporting

technique, could not be carried out due to the pandemic, but participatory interaction originated during the interviews.

The total number of respondents (n=18) consists of a sample of people with a visual and/or hearing impairment (n=13) and a 'reference group' of persons without these impairments (n=5). The thirteen impaired persons responded to the calls, sometimes encouraged by their friends, and were all personally interviewed. The 'reference group', snowball selected, was matched on three demographic criteria – origin (place of birth), age and sex– with persons with the disability (precision matching). Although precision matching was intended, the demographic indicators differ significantly. Therefore the 'reference group' was separately, not matched, included in the framework analyses.

In total, eighteen interviews were conducted. The interview sessions, planned to start in April 2020, started in September/October 2020, due to COVID-19, and continued in 2021. The in-depth semi-structured questionnaire was designed in the context of the literature studied and the research design. The interviews were held on a voluntary basis, were not paid, and took 1½ -2 hours. The privacy rules, e.g. coding of names, and participation conditions, e.g. recording, (informed consent) were explained and discussed beforehand. The questions and answers, sometimes 'translated' by (sign) interpreters and visual aids or with help of relatives, were registered by the researcher. All respondents were asked to approve the written report of the interview; they all did. After agreement on the day, time, and the program to be used, the researcher conducted the interviews on Zoom, Teams, and FaceTime. The questions were asked in Dutch and translated into English for the analyses. Using this individual personal technique in times of the pandemic was much appreciated. Techniques like 'online mapping brainstorms' or online 'creative workshops' (Elsman et al., 2017, Sergeant et al., 2021) are more group-oriented. The 'reference group' was interviewed in person during the pandemic breaks. During the pandemic, it was hard to enlarge the sample groups. Below, in Tables 3 and 4, the sample is presented by impairment, sex and age and origin.

Table 3: The respondents by specific impairment and starting age of impairment.

Disability	**Respondents with specific impairment**
Blind and deaf	8%
Blind and hearing impaired	15%
Blind	8%
Visually impaired	23%
Deaf	15%
Deaf and visually impaired	8%
Hearing and visually impaired	8%
Hearing impaired	15%
Age of recognition of disability	
From birth	54%
In youth	31%
Later in life	15%

Some of the respondents had a double impairment; for example, being blind and deaf/hearing impaired. In the analysis the main impairment, as stated by the respondent, is leading. Also, the age period when the impairment was recognized was questioned. Adapting to the impairment later in life might be of influence in the overall risk management process. This has not been further analysed in this study since most respondents had their impairment from birth or early youth. Also, no distinctions were made between the specific impairments due to the small sample sizes. With a larger sample, the influence of these specific aspects could be further researched.

Table 4: The respondents with/without a VI and/or HI by sex, age and origin.

Respondents with a VI and/or HI (n=13) by age and sex			
Age	total	men	women
15-44 years	3	3	0
45-64 years	6	5	1
65+ years	4	2	2
Origin	total	men	women
Dutch origin (place of birth)	11	8	3
Other	2	2	0
Respondents without a VI and/or HI (n=5) by age and sex			
Age	total	men	women
15-44 years	0	0	0
45-64 years	3	2	1
65+ years	2	1	1
Origin	total	men	women
Dutch origin (place of birth)	4	3	1
Other	1	0	1

3 Findings

Due to the small sample, the presupposed relationships I. −between respondents' background and their risk management− and II. −between authorities' measures optimality and respondents' risk management−, could not be verified. No gender, age or other intersectional analyses, except for disability, on the contextual background and living context, and on the risk management could be performed because of the small sample. When, in future research, the sample of the population of persons with the impairment is larger, other techniques can be used to statistically test the 'framework of risk management' as a coherent relational model. Therefore the findings for the three separate research questions, investigated through the risk management framework building blocks (A, B and C), its elements and indicators, are presented with basic statistics.

The framework of risk management; building block A related to research question A.

The building block A of the framework comprises two elements: the contextual background A.1 and living context A.2 of the respondents with/without a VI and/or HI in relation to the risk of flooding. The results are presented in Table 5.

A.1 The contextual background of respondents with and without a VI and/or HI.

The respondents with a VI and/or HI are predominantly native Dutch males and older of age. Some of them are living in land parts at or below sea-level, in (sub)urban areas, have no larger water sources in their vicinity and have most probably less 'water experience'. They are outdoor-oriented (walking, biking etc.) and are public transport users. Summer, mainly due to the temperature and the clear sight, is experienced as the most pleasant season by 46%, closely followed by spring. One of the problems with these two seasons is the quantity of light; the light is rather strong for the visually impaired. 38% experiences the morning as most pleasant since they are less tired. The remaining respondents choose the afternoon or evening or have no preference. The impaired respondents tend to walk less in the dark. For them it is far more important to know the surroundings and that there are recognizable leads in their environments. If they know of obstacles, they go outside less than they usually do. This is consistent with what was anticipated (Kappen et al., 2018). Of the persons without a VI and/or HI the majority is native Dutch, two are women and two are above 65 years of age. All are living in the west/middle land-parts of the Netherlands with a large water-source in the vicinity. For them it is less important to know the surroundings, to have recognizable leads and too many obstacles are no problem to go outside. The personal surrounding indicators, special lightning, colours or signs for the impaired are not applicable to these non-impaired respondents.

A.2 The living context of the respondents with and without a VI and/or HI.

The second element of the respondent's background, the living context, consists of several indicators. In total, 46% of the impaired respondents is married, has a domestic partnership or a LAT relationship, 8% is divorced and 46% is single. 23% of them has children and 46% has a "more persons" household living arrangement with a partner, in a community or co-habiting. No one is living in an institution. 46% of the respondents with a VI and/or HI and 80% of the ones without a VI and/or HI, have a 'stable family' structure.

This indicates that a significant group of the impaired respondents do not have a 'stable family' structure. As indicated in literature (Kolen & Gelder, 2018; Terpstra, 2010; United Nations International Strategy for Disaster Reduction, 2013) having a 'stable family' structure (having structurally and physically a 'family person' in the vicinity) is of importance for handling flooding risks and of importance for being able to implement the public authorities' 'self/together-reliance' measures against flooding. A small percentage of the respondents have family members in the vicinity to help during flooding and some of these family members have their own impairments (e.g. impact of age). As mentioned, none of the respondents with the impairment lived in a nursing home. Here, other measures are applicable such as those of the Emergency Response Service and of safety coordinators (Bartimeus, 2021).

Of the persons with a VI and/or HI, 54% has followed some form of higher education: either university or higher vocational education. So, the majority reached a higher educational level which might be due to the sampling (selected and snowball) procedure, but this cannot be checked due to the non-existence of relevant data to compare. 100% of the non-impaired respondents reached a higher educational level. 23% of the impaired respondents has a paid job, mostly as a teacher or trainer, and 60% of the non-impaired have jobs, mostly in technical sectors.[1] 54% of the respondents with a VI and/or HI and all of the non-impaired respondents have a salary/pensioner's income. The remaining impaired respondents receive financial assistance from the state. 23% of the persons with

[1] Three of the 13 impaired and three of the 5 non-impaired had a paid job.

and 60% without a VI and/or HI is playing an instrument. Playing an instrument appeared to be difficult, so in the future another indicator for objective cultural capital should be developed, using Bourdieu's embodied or institutionalized capital (Bourdieu, 1986; Murdok, 2010), although the last 'capital' already has been, to some extent, addressed in the educational level indicator. Including 'cultural capital' in the living context of the respondents was used as an indication for capability (Kuhumba, 2018; Mitra, 2006; Saigaran et al., 2015; Stewart, 2013). Only two of the 13 impaired respondents are part of a spiritual community (e.g., church, humanism, etc.) and the majority of them participates in a sport and/or other social organization (77%). 85% percent of the impaired and 100 % of the non-impaired engages in physical exercises. All the respondents with a VI and/or HI use an aiding tool for their specific impairment (some use a guide dog and/or a blind guide cane, others use a special doorbell transmitter), and 85% is known to –impairment related– patient organizations and they are known to relevant public authorities.

By means of an "open" question, all interviewees, impaired and non-impaired, were asked what they valued most in life. The quality-oriented answers provided insight into the world the respondents are living in and the context to which they refer. The group of impaired respondents value justice, own responsibility, self-reliance, and honesty whilst they dislike patronizing, interfering and not being treated with respect. Discussing the diverse values during the interviews brought up two key values: 'being self-reliant/self-efficacy (value involving oneself) and getting respect (value involving others)'. The respondents with an impairment want to steer their own future and want to be treated respectfully. They prefer to be as much self-reliant as possible and value respectful behavior (American Psychological Association, 2020; Arifin, 2018). Mentioned was for example the disrespectful behavior of scooter drivers and public authority's civil servants. The respondents without a VI and/or HI stated quite diverse values (family, good health, freedom) and they disliked "–interference of others and complaining people–". The values negatively evaluated are more or less the same between the two groups: they dislike interference. The value concept of 'self-reliance', as used by the impaired respondents, might imply another meaning than the one mentioned in the public authorities' measures of 'together-reliance' during flooding (Setz & Van den Berg, 2017; Van Popering-Verkerk, 2019).

In the interview sessions, also an "open question" about the COVID-19 pandemic (Uldry & Leenknecht, 2021) and its effect on the lives of the respondents was inserted. The pandemic had for 85% of the impaired respondents a positive or mixed (positive and negative) impact, among others, due to decreased traffic and fewer people on the streets and they experienced enough privacy. Being used to dealing with hurdles and obstacles in life might make the persons with an impairment more resilient. Only 40% of the respondents without a VI and/or HI experienced the pandemic having a positive or mixed impact on their lives mainly due to school closures and travel restrictions. The personal well-being of the non-impaired group during the COVID-19 pandemic was also negatively influenced by experiencing less privacy. These two aspects, the pandemic's impact and privacy, had a much less effect on the well-being of the respondents with than those without the impairment.

The results in Table 5 compare respondents with and without the impairment. The five specific environments, mentioned in the research design, are not relevant for this building block. They are only relevant for the risk-handling of the public authorities and for the risk management of the impaired respondents themselves.

Table 5: Results of building block A of framework of risk management; contextual background A.1 and living context A.2 elements and their indicators of the respondents with/without a VI and/or HI.

A.1 Contextual background	Contextual background of respondents with a VI and/or HI.	Contextual background of respondents without a VI and/or HI.
Demographic indicators		
Yes, Dutch background (place of birth)	85%	80%
Yes, age, young (<45 years)	23%	0%
Yes, gender, male	77%	60%
Geographic indicators		
Yes, living in east (middle) and west land-parts	77%	100%
Yes, living in an urban & suburban area	69%	100%
Yes, living near sea/river/lake	31%	40%
Personal surrounding; indoor and outdoor indicators		
Yes, special lighting in the house for recognition in the house	31%	not applicable
Yes, special colours or other signs for recognition in the house	62%	not applicable
Yes, walk alone outside	100%	100%
Yes, walk with others	100%	100%
Yes, walk alone in the dark	85%	100%
Yes, important to know your surroundings	77%	40%
Yes, important that there are recognisable leads in your environments	77%	40%
Yes, not go outside because of too many obstacles	54%	40%
Yes, use public transport (train, tram, metro, bus)	92%	100%
Yes, summer most pleasant (the temperature and the clear sight)	46%	60%
Yes, the morning most pleasant time of the day (less tired).	38%	60%
A.2 Living context	Living context of respondents with a VI and/or HI.	Living context of respondents without a VI and/or HI.
'Stable Family' structure indicators; family structure and household setting		
Yes, family structure; married + partnership (LAT included)	46%	80%
Yes, household setting; more person living arrangement	46%	80%
Education indicator		
Yes, higher education level	54%	100%
Occupation indicator		
Yes, paid job	23%	60%
Income indicator		
Yes, salary and/or pension	54%	100%
Cultural capital indicator		
Yes, playing a musical instrument	23%	60%
Social participation indicators		
Yes, membership spiritual organization (church, humanism)	15%	40%
Yes, membership in other organization	77%	60%
Yes, disability known to patient association/authority.	85%	not applicable
Personal well-being; physical and social indicators		

Yes, using of aiding tools	100%	not applicable
Yes, doing physical exercises	85%	100%
Yes, experienced enough privacy during COVID-19	85%	40%
Yes, positive/mixed (positive and negative) impact of COVID-19	85%	40%

The results of building block A of the framework give indications that understanding the background (context and capabilities) of the impaired respondents is of importance (research question A and objective 1). Some elements, e.g. demo- and geographic but also the impairment and income indicators, give cause for concern for managing the risk of flooding.

B. The framework of risk management; building block B related to research question B.

Building block B of the framework comprises two elements: the assessment of the optimality (effective and efficient) of public authority's risk management at the national B.1 and at the local level B.2 by the respondents with/without a VI and/or HI in relation to the risk of flooding. The results are presented in Table 6.

Some of the respondents did not know risk-handling measures of the authorities at national and/or at local level in all the specific environments so could not judge their quality. Therefore the findings shown are judgement averages of the environments. Verbal elaboration during the interviews indicated that they sometimes 'trusted' the measures to be optimal not that they 'knew' them to be optimal, especially at national level.

The quality of the authorities' measures, both at the national and local level, are relatively positive judged, but not all respondents think they are optimal. The measures taken at the national level by the public authorities to address the risk of flooding are perceived by 84% of the non-impaired respondents as optimal and at a local level 61% assesses them as optimal. The measures are judged by 69% of the impaired respondents as optimal; at a local level, 63% of the impaired respondents assesses them as optimal.

Remarks of the respondents during the interviews on the public authority's risk management sometimes relate to a lack of trust, 'no confidence, no trust (see COVID-19), chaotic, no prevention measures and no enforcement. There are too many budget cuts and different priorities. The measures should be understandable and strict monitoring is needed.' Some stated that flood related issues reported to the public authorities, proved that civil servants do not know how to facilitate people with a VI and/or HI. According to some of the impaired respondents is being aware of the difference in the risk-response the public authority develops and how it is perceived/valued by the respondents of great importance. Self-efficacy from an able-bodied perspective is different from that of an impaired person's point of view. The same applies to respect. As one of the impaired respondents remarked, "I want measures for flooding that I myself am able to implement".

The public authorities' measures on flooding lack these features; they lack –inclusiveness related– values and might therefore not be effective (useful) for the impaired persons. Various flood guideline measures do not address non-able bodied alternatives (Rijkswaterstraat et al., 2021).

The results in Table 6 compare respondents with and without the impairment and, as explained, only the judgement averages of the five specific environments.

Table 6: Results of building block B: the optimality of flood risk-handling of public authorities at national B.1 and local B.2 level as assessed by the respondents with/without a VI and/or HI with the averages of the five environments.

B. Optimality of risk-handling of flooding by the public authority as perceived by the respondents with/without a VI and/or HI. Between brackets respondents without a VI and/or HI.	
Environments	**Average of the environments; home, pedestrian, traffic participant; no pedestrian, work/school[2] and leisure activities.**
B.1 Yes, optimal risk measures by the public authorities at **national level** as perceived by the respondents with a VI and/or HI.	69% (84%)
B.2 Yes, optimal risk measures by the public authorities at **local level** as perceived by the respondents with a VI and/or HI.	63% (61%)

Although understanding of the assessment of the public authorities' flood risk measures by the impaired respondents is gained, further research is needed (research question B and objective 2).

C. The risk management framework building block C related to research question C.

Building block C of the framework comprises two elements: the assessment C.1 and intended risk-handling C.2 in the five environments by the respondents with/without a VI and/or HI in case of flooding. Here the respondents were able to relate their own measures against flooding to their five environments, so the risk assessment and risk-handling are shown with the specific environments. To be comparable to building block B, also the averages of the environments are shown (see Table 7).

C.1 Risk assessment indicators –awareness, perception and exposure– of the respondents with/without a VI and/or HI.

All respondents (100%) want to take measures to address the risk of flooding in the environments, but not all think they have the ability; on average, the non-impaired respondents think they are somewhat more able (77%) than the impaired respondents (69%). The impaired respondents have less specific knowledge of flooding measures in de environments (42%) than the non-impaired respondents (100%). Of all five environments the impaired respondents participate in, the specific knowledge of measures against flooding at home is the highest. Specific knowledge is an important enabler for intended risk-handling, as came out of the interviews and the risk-awareness indicators. All non-impaired respondents had more general knowledge of the risk of flooding (100%) than the non-impaired (69%). "I did not know there was a site of the public authorities for flooding measures", one of the impaired respondents stated. Looking for information is done more often by respondents with than without a VI and/or HI. This is mostly in line with what was assumed (Bartimeus, 2021;

[2] Three of the 13 impaired and three of the 5 non-impaired had a paid job.

Disabled People in the World, 2021; Kappen et al., 2018; Terpstra, 2010; World Health Organization & World Bank, 2011; Zhang et al., 2022a, 2022b).

Due to the very small number of respondents (n=6) who have a job, three of them impaired, no conclusions could be drawn about this environment. It seems though that for the impaired respondents the 'accessibility to information on flooding' is easier in the job/school environment than in the other environments.

Most respondents feel safe (74% impaired and 96% non-impaired respondents) in general and do not think much about the risk of flooding (81% and 78% non-impaired respondents), probably because most respondents have not encountered flooding yet. Flooding is not a real issue (yet) for the respondents. Enhancing the "damage" perspective of da Silva and Braga (De Oliveira Vilela da Silva & Gnecco de Camargo Braga, 2017) for a natural hazard, as a concept of damage induced by water, by emphasizing not only the financial, but also the psychological and physical impact, might change the risk awareness perspective of the respondents. Persons with a VI and/or HI might interpret damage and harm in a different way. Further research on damage impact (harm/damage) is needed (United Nations International Strategy for Disaster Reduction, 2013).

The exposure to the risk of flooding differs somewhat between the two groups in the environments. None of the respondents had experienced flooding incidents at home or at work/school, but they did encounter flooding in the outdoor environments. Some were involved in flooding incidents; flooded streets and station squares were mentioned. Respondents with and without a VI and/or HI were also exposed to other risks than flooding. They encountered incidents like being intimidated, discriminated against, being violently attacked (impaired respondents), and also safety incidents like a football or fall accidents were mentioned. This indicator was included in the questionnaire to get a more elaborate risk-encounter impression.

C.2 Anticipated risk-handling of the respondents with/without a VI and/or HI.

The second element of respondents' risk management is their anticipated risk-handling. Risk handling, in this context, is a broad concept indicating how the persons with and without a VI and/or HI not only would like to take measures but actually anticipate to take measures against the risk of flooding.

An "open question" to research if and if so, how the respondents intend to take measures against flooding showed that far-out the majority anticipate to take measures and many intended risk-handling measures were suggested by the respondents. The intended measures are rendered into risk-response strategies. Some risk-response strategies of the respondents with/without a VI and/or HI to address the risk of flooding are to reduce or to avoid the risk. For example, they reduce the risk by going to higher places if flooding should happen and avoid going outside in case of heavy rainfall. Sometimes they already took flood resistant measures. "I never thought about the flooding risk of sleeping in the lower level of my house almost next to the sea, now I moved to a higher floor in my house", one respondent stated. All respondents, with and without a VI and/or HI, intend to take measures though many expect the public authorities to have implemented optimal measures at the

national level. This is in line with the results in building block B. Some of the preventive measures the respondents had in mind to address flooding include:

- *using the radio in case of failure of internet,*
- *rescuing the cats,*
- *at home, going higher in the building (vertical evacuating),*
- *at work, call for the Emergency Response Services,*
- *at home, using the internal intercom,*
- *outside, always have telephone with me,*
- *I have the emergency numbers ready and will call 112,*
- *I have rescue arrangements with neighbors,*
- *I need a preventive training how to escape,*
- *I follow the crowd,*
- *I always remember where the doors and exits are,*
- *I make sure my family is okay.*

Table 7: Results of building block C of the risk management framework; risk-assessment C.1 and risk-handling C.2 elements and their indicators, in their five environments, of the respondents with/without a VI and/or HI.
Between brackets: respondents without a VI and/or HI. Only the respondents with a job (3 impaired and 3 non-impaired) judged the work/school environment. No respondent went to school.

Environments	**averages of the environments**	**home (n=13 impaired and between brackets the non-impaired n=5)**	**pedestrian (n=13 impaired and between brackets the non-impaired n=5)**	**traffic participant; no pedestrian (n=13 impaired and between brackets the non-impaired n=5)**	**work/school (3 of 13 impaired have a job and 3 of 5 non-impaired have a job)**	**leisure (n=13 impaired and between brackets the non-impaired n=5)**
C.1 Risk assessment dimension; awareness, perception and exposure indicators						
Awareness indicators						
C.1 Awareness of risk measures: yes, want to take measures	100% (100%)	100% (100%)	100% (100%)	100% (100%)	100% (100%)	100% (100%)
C.1 Awareness of risk measures: yes, ability to take measures	69% (77%)	69% (80%)	69% (80%)	69% (80%)	67% (67%)	69% (80%)
C.1 Awareness of risk measures: knowledge measures; yes, general knowledge of flooding	69% (100%)	69% (100%)	69% (100%)	69% (100%)	67% (100%)	69% (100%)
C.1 Awareness of risk measures: knowledge measures; yes, specific knowledge of flooding	42% (100%)	69% (100%)	38% (100%)	38% (100%)	33% (100%)	31% (100%)
C.1 Awareness of risk measures: knowledge measures; yes, look for information for flooding	63% (39%)	62% (40%)	62% (40%)	62% (40%)	67% (33%)	62% (40%)

C.1 Awareness of risk measures: knowledge measures; yes, information on flooding easily accessible	50% (71%)	46% (80%)	46% (80%)	46% (80%)	67% (33%)	46% (80%)
Perception indicators						
C.1 Sensitivity of risk: yes, feeling safe in general	74% (96%)	77% (100%)	31% (100%)	77% (80%)	100% (100%)	85% (100%)
C.1 Sensitivity of risk: yes, thinking of flooding	19% (23%)	31% (20%)	31% (20%)	23% (20%)	0% (33%)	8% (20%)
Exposure indicators						
C.1 Experience to risk: yes, encounter of flooding	5% (12%)	0% (0%)	8% (0%)	8% (60%)	0% (0%)	8% (0%)
C.1 Experience to risk: yes, encounter of other risks/incidents (excluding flooding)	69% (32%)	69% (100%)	69% (20%)	69% (20%)	67% (0%)	69% (20%)
C.2 Intended risk-handling dimension						
C.2 Yes, anticipated risk-measures on flooding by the respondents with/without a VI and/or HI	75% (96%)	77% (80%)	77% (100%)	77% (100%)	67% (100%)	77% (100%)

The management of flood risks by respondents with a VI and/or VI themselves is mapped (research question C and objective 3) and some indicators, e.g. having not much specific knowledge about measures against flooding outdoors and information on flooding being less accessible both indoors and outdoors, give cause for concern.

Utilization of the results.

Local and national authority's flood risk management was not considered optimal all respondents; at the national level, they were more considered optimal than at local level. The impaired respondent's answers on public authority's measures showed that insights into the world these respondents live in and the context they refer to, are of foremost importance to determine the 'optimal quality' of the measures. 'Optimal quality' for them is not just that the measures are well-organized but that they are also valued as useful to them. Some of the public authorities' measures against flooding lack – inclusiveness related– values and will consequently not be effective for the impaired respondents. Therefore, further research is recommended into the optimization of existing measures from a disability, values of concern, perspective. The redesign for optimizing the measures for addressing the risk of flooding should result in a more efficient (more realistic organized) and more effective (with a universal impact) risk management of the public authorities. Embedding the key values, self-

reliance/self-efficacy and being treated respectfully, by the public authorities into their measures could enhance the quality. Incorporating these values in an inclusive way that will cause less to no psychological or physical stress, in line with civilized conduct, should be the ambition of the redesign. It will need an inclusive redesign approach by taking away conflicting values and reaching the best possible values compromise (Poel, 2020). The key values are used as inclusive leading principles for the redesign of the measures. In this inclusive process, persons with a disability are not only participative stakeholders but should also partake, if possible, as experiential experts.

This redesign ambition could be reached by means of the Value Sensitive Design (VSD) (Boenink & Kudina, 2020; Davis & Nathan, 2015; Friedman et al., 2001) and the Inclusive Design (ID) (Keates et al., 2000; Morales, 2011; Tanuwidjaja et al., 2020) methods and by performing the research process in a responsible, inclusive and value-sensitive way (RRI) (Marschalek et al., 2021; Owen et al., 2012; Simon, 2016). With the redesigning of existing measures of the authorities against flooding in this manner, they will become optimal for persons with an impairment and most probably also for the entire population. This utilization of the research's findings will enhance the mission of this research −developing an engaged inclusive approach on risk management of flooding and disability −and indirectly to the study's objective 2, the assessment of the quality of public authority's management on flooding.

4 Conclusion

This study is a first pilot, an exploration, to investigate if and how persons with a VI and/or HI manage the risk of flooding in their various environments, in relation to their own background and to the 'optimal quality' of public authorities' risk-handling.

We developed an engaged inclusive approach on risk management and disability from a capability point of view by constructing a framework with personal characteristics and social arrangements of impaired persons and performed the research process in a committed responsible way. We included respondents with an impairment not only as interviewees in the research but also as experts by experience in order to co-construct inclusive social responsible knowledge, e.g. their 'values in life'. The ethical principles, part of a responsible research process, were carefully observed by the researchers. The respondents were approached with an open-minded attitude, respect for confidentiality and accountability and reckoning with personal dignity. Participants' identities and characteristics were protected throughout the recruitment and dissemination process (Paek & Hove, 2017) and only the anticipated risk-handling was explored.

Insights were obtained into the capabilities, context and obstacles of the impaired respondents in relation to the risk of flooding and into the public authorities' flood related measures as perceived by the respondents. Therefore the aim of this study to inventories and gain understanding of the background context and capabilities of persons with a visual and/or hearing impairment (objective 1), to research their assessment of the optimality of authority's risk measures on flooding (objective 2) and mapping their own risk management on flooding (objective 3) was reached.

The understanding of some of the background, assessment and risk management indicators of the impaired respondents gave causes for concern in case of flooding. Personal and in- and outdoor related features could be obstacles when the risk of flooding becomes a real incident, e.g. being older, living in flood sensitive land parts (Krijger et al., 2018) and not going outside if there are too many obstacles. The family structure of the impaired respondents, of importance for being able to implement the public authorities' 'self/together-reliance' measures against flooding, is rather 'unstable', indicating that there will be no relative in the vicinity to assist during flooding incidents. The difference between the public authorities risk-response measures for flooding and how they are perceived and valued by the respondents should be taken into account to make these measures optimal; well organized and useful. Respect and self-efficacy, values of utmost importance for the impaired persons, are, from an non-inclusive able-bodied perspective, different from that of an impaired person's point of view. The public authority's risk measures, e.g. no animals (guide dogs) can be brought to the assembly location' and 'you will hear from the radio's disaster broadcast' are non-inclusive and able-bodied and are reasons for concern. The impaired respondent's income, mostly financial assistance from the state, does not give much room for extra, flood resistance, measures. Improving specific information on flooding risks and making the information more accessible might enhance the optimality of the public authorities' risk management from the impaired respondent's perspective. "Cognitive (beliefs) and affective (feelings) factors are important predictors of attitudes". ''These are influenced by the way risk information is framed in communication messages", Boersma et al. states (Boersma et al., 2017). The optimality of public authority's measures, as assessed by the impaired respondents, needs to be further researched since some measures might not have been known to the impaired respondents.

These and other findings are sources for concern in case of flooding incidents, and need to be addressed. The 'utilization of the results' chapter gives suggestions for improvement. Using capabilities of the impaired like valuing self-reliance, being resilient and not being much disturbed by less privacy during incidents (COVID-19) could be of use.

Firm relationships between the three building blocks of the framework, as specified in the presupposed relationships I. and II., could not be established, but results gave indications as to what could be expected; e.g. between the level of income and the gathering of flood related information, and the intention to take risk measures by the respondents.

We found that some concepts of the framework might need revision and the framework should be tested on a larger and more diverse impaired population. Concepts like 'cultural capital' and adapting the framework with even more indicators for the visual and/or hearing impaired, e.g. indicators regarding ways of information collection on flooding, should be further studied. Drawing, statistically substantiated, generalizations is not sound due to the small sample of respondents and the results should be treated with care. Persons with a VI and/or HI from another contextual background, e.g. with lesser socio-economic resources, or persons with lesser digital skills, might not have reacted to the call to be interviewed. The limitation of the study, ‒no objective data on flood incidents of persons with a VI and/or HI exist and only the intended risk-handling could be researched‒, was borne in mind in the analyses. The government should register, in a structured and systematic way, data of

flood related incidents of persons with a disability so the objective incident statistics could be analyzed versus the subjective risk assessments of the impaired respondents.

Our study added value to the research on flooding and disablement and to quality data (no large scale data) of persons with a VI and/or HI. It's contribution is the proposed utilization of the results, especially of the topics that are causes for concern. In future, this could result in less casualties and death in flooding events.

CRediT authorship contribution statement

The first author was guest researcher of TU Delft (2019-2022) and of the University of Humanistic Studies, The Netherlands (2023-2024). The co-author, dr.ir. P.H.A.J.M. van Gelder, is professor at TU Delft, Safety and Security Science Section, Faculty of TPM, The Netherlands.

Data Access Statement

It is deposited in a database on the computer's C partition of the corresponding author and on two separate hard-disks (as part of the consent). On request, relevant data will be sent.

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Declaration of competing interests

We have no conflicts of interest to disclose.

References

Alhakami A. S., Slovic P. (1994). A Psychological Study of the Inverse Relationship between Perceived Risk and Perceived Benefit. Risk Analysis, 14(6), 1085–1096. https://doi.org/10.1111/j.1539-6924.1994.tb00080.

American Psychological Association. (2020). Publication manual of the American Psychological Association (7th ed.). https://doi.org/10.1037/0000165-000

Ando, R., Higuchi, K., & Mimura, Y. (2018). Data analysis on traffic accident and urban crime: a case study in Toyota City. International Journal of transportation science and technology, 7(2), 103-113. https://doi.org/10.1016/J.IJTST.2018.01.002

Arifin, S.R. (2018). Ethical Considerations in Qualitative Study. Project: Recognition of perinatal depression: Exploring healthcare professionals and women's knowledge and awareness. International Islamic University Malaysia. https//doi.org/10.31436/ijcs.v1i2.82

Babcicky, P., Seebauer, S. (2021). People not just places: Expanding physical and social vulnerability indices by psychological indicators. Journal of flood risk management, 14. https://doi.org/10.1111/jfr3.12752;14:e12752.

Bartimeus (2021). Kwaliteitsrapport 2021 Samen ertegenaan, op weg naar slagkracht, focus en eenvoud. https://bartimeus.nl/wonen-bij-bartimeus.

Becker, J.S., Taylor, H.L., Doody, B.J., Wright K.C., Gruntfest, E., & Webber, D. (2015). A review of people's behavior in and around floodwater. American Meteorological Society, Weather, Climate, and Society. 7(4), 321-332. https://doi.org/10.1175/WCAS-D-14-00030.1

Berrebi, C., Karlinsky, A., & Yonah, H. (2021). Individual and community behavioral responses to natural disasters. Nat Hazards, 105, 1541–1569. https://doi.org/10.1007/S11069-020-04365-2.

Bijl, R., Boelhouwer, J., Pommer, E., & Sonck, N. (2013). De sociale staat van Nederland 2013. Sociaal en Cultureel

Planbureau (SCP).
Boenink, M., Kudina O. (2020), Values in responsible research and innovation: from entities to practices. Journal of responsible Innovation, 7(3), 450-470. https://doi.org/10.1080/23299460.2020.1806451
Boersma, F.K., Allen, D., Comes, T., Stanciugelu, I., Terpstra, T. (2017). Communicating Disaster Risk. Science for Disaster Risk Management 2017 – Knowing better and loosing less–, (pp.387-440). Chapter: Communicating Disaster Risk. Eds. Karmen Poljansek.
Publisher: JRC Ispra. https//doi.org/10.2788/688605
Bourdieu, P. (1986). The forms of capital. In Richardson, J., Handbook of Theory and Research for the Sociology of Education. Westport, CT, Greenwood: pp. 241–58.
Convention on the Rights of Persons with Disabilities, (2006). The Convention on the Rights of Persons with Disabilities and its Optional Protocol (A/RES/61/106).
https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.
Davis, J., Nathan, L.P. (2015). *Value Sensitive Design: Applications, Adaptations, and Critiques*. Van den Hoven, J., Vermaas, P., van de Poel, I. (eds.) Handbook of Ethics, Values, and Technological Design, pp. 11-40, Springer, Dordrecht. https://doi.org/10.1007/978-94-007-6970-0_3
De Oliveira Vilela da Silva, L., Gnecco de Camargo Braga, M. (2017). Violent events on the road: Risk perception of traffic-related and non-traffic-related situations. Accident Analysis & Prevention, 114, 55-61.
https://doi.org/10.1016/j.aap.2017.05.028
Disabled People in the World, (2021). Facts and Figures. https://www.inclusivecitymaker.com/disabled-people-in-the-world-in-2021-facts-and-figures.
Disabled World, (2022). Disability Benefits, Facts, Statistics, Resources. Updated/Revised Date: April 5th 2022. www.disabled-world.com.
Doorn, N. (2018). Values in water. Inaugural address spoken in acceptance of the chair 'Ethics of water engineering' at the Faculty of Technology, Policy and Management of Delft University of Technology.
Dow, K., Cutter S.L. (2001). Public orders and personal opinions: Household strategies for hurricane risk assessment. Environmental Hazards, 2 (4), 143-155. https://doi.org/ 10.3763/ehaz.2000.0220
Dowling G.R. (1986). Perceived risk: The concept and its measurement. Psychology & Marketing, 3(3), 193-210. https://doi.org/10.1002/mar.4220030307
Dowling, G.R., Staelin, R. (1994). A Model of Perceived Risk and Intended Risk-Handling Activity. Journal of Consumer Research, 21(1), 119-134. https://doi.org/10.1086/209386
Duijf, M., & Van den Berg, L. (2020). Feiten en cijfers over het aantal mensen met een beperking Feiten en cijfers, 2015, actualized 2020. https://www.allesoversport.nl/thema/meedoen-door-sport-en-bewegen/feiten-en-cijfers-over-het-aantal-mensen-met-een-beperking/
Duijf, M., Van den Berg, L. (2020). Feiten en cijfers over het aantal mensen met een beperking. Feiten en cijfers. https://www.allesoversport.nl/. Updated/Revised Date: Nov. 1st 2022.
Elsman, E.B.M., Bartholomeus van Rens, G.H.M. & Nispen, van R.M.A. (2017). Impact of visual impairment on the lives of young adults in the Netherlands: a concept-mapping approach. Disability and Rehabilitation 39(26) 2607-2618. https://doi.org/10.1080/09638288.2016.1236408
Etz, K.E., Arroyo, J.A. (2015). Small Sample Research: Considerations Beyond Statistical Power. Prevention science, 16(7), 1033–1036. https://doi.org/10.1007/s11121-015-0585-4
Finkelstein, V. (2007). The Social model of disability and the disability movement. https://disability-studies.leeds.ac.uk/wp-content/uploads/sites/40/library/finkelstein-The-Social-Model-of-Disability-and-the-Disability-Movement.pdf, 1-15.
Frailing, K., Harper, Jr, D.W., & Serpas, R. (2015). Changes and challenges in criminal justice after disaster. American behavioral scientist, 59(10). https://doi.org/10.1177/0002764215591184
Friedman, B., Kahn P.H. jr. & Borning, A. (2001). Value Sensitive Design: Theory and Methods. UW CSE Technical Report, Dec. 2th 2001. University of Washington.
Gaherity, C. & Birch, P. (2022), A criminologically informed examination of looting behaviour during natural disaster incidents. Safer communities, 21(1), 19-30. https://doi.org/10.1108/SC-05-2021-0017
Gelder, van P.A.H.J.M, Kolen B. & Mendel, M. (2017). Opinion: Public Perception of Extreme Rainfall in the Information Age. Centre for Safety and Security Leiden-Delft-Erasmus.
Gustafson, P.E. (1998). Gender Differences in Risk Perception: theoretical and methodological perspectives. Risk Analysis, 18, 805-811. http://dx.doi.org/10.1023/B:RIAN.0000005926.03250.c0
Howat, P., Cross, D., Hall, M. et al. (2001): Community Participation in Road Safety: Barriers and Enablers. Journal of Community Health, 26(4), 257-270. https://doi.org/10.1023/A:1010304511244
Institute of Medicine (US) Committee on Understanding the Biology of Sex and Gender Differences (2018). Exploring the Biological Contributions to Human Health: Does Sex Matter? Wizemann T.M., Pardue, M.L. (eds.): National Academies Press (US). Washington (DC). https://doi.org/10.17226/10028
Kappen, H., Verkaik, R., Langelaan, M., & Boeije, H. (2018). Zien en gezien worden: aard en omvang van ervaren

belemmeringen, behoeften en gewenste oplossingen voor participatie van mensen met een visuele beperking. Utrecht: NIVEL.
Keates, S. & Clarkson, P.J. (2001). Combining utility, usability and accessibility methods for Universal Access. https://citeseerx.ist.psu.edu/pdf/5d40e0509e78f57a5531ff74cd8e3e56883bcc3a
Keates, S. & Clarkson, P.J. (2002). Countering design exclusion through inclusive design. ACM SIGCAPH Computers and the Physically Handicapped, (73/74, pp.69-76). https://doi.org/10.1145/960201.957218
Keates, S. et al (2000). Towards a practical inclusive design approach. CUU '00: Proceedings on the 2000 conference on Universal Usability, November 2000, 45–52. https://doi.org/10.1145/355460.355471
Knevel J, Wilken J.P., Schippers A. Experiences of Inclusive Action and Social Design Research with Social Workers and People with Intellectual Disabilities. Social Sciences. 2022; 11(3), 121. https://doi.org/10.3390/socsci11030121
Kolen, B., Dannenberg, P. & Gelder, van P.H.A.J.M (2021). Quantitative assessment of evacuation measures in flood-prone areas. Conference: FLOOD-risk 2020 - 4th European Conference on Flood Risk Management. https://doi.org/10.3311/FloodRisk2020.19.6
Kolen, B., Gelder, van P.H.A.J.M. (2018). Risk-based decision-making for evacuation in case of imminent threat of flooding, Water 10 (10), 1429. https://doi.org/10.3390/w10101429
Koradecka, D., Pośniak, M., Widerszal-Bazyl, M., Augustyńska, D., & Radkiewicz, P. (2010). A Comparative Study of Objective and Subjective Assessment of Occupational Risk. *International journal of occupational safety and ergonomics,* 16(1), 3-22. https://doi.org/10.1080/10803548.2010.11076826
Krijger, T., Kolen, B, & Vuren, van S. (2018). Neerslagindex duidt risico's wateroverlast op straat. Vakblad Land & Water, December 1st. 2018.
Kuhumba, S. (2018). Amartya Sen's capability approach as theoretical foundation of human development. Journal of Sociology and Development Studies, 16(1), 127-145.
Levitt, J.M. (2017). Exploring how the social model of disability can be re-invigorated: in response to Mike Oliver. Disability & Society, 32 (4), 589-594. https://doi.org/10.1080/09687599.2017.1300390
Limburg, H et al. (2005). Avoidable visual impairment in The Netherlands: the project "Vision 2020 Netherlands" of the World Health Organization. Nederlands tijdschrift voor geneeskunde. 149, 577-82.
Maredia, M. (2020). Awareness, Risk Perceptions and Safety Behavior: How are Men and Women in Rural and Urban Africa Responding to COVID-19? Analysis of a recent mobile phone survey that looked at perceptions of the COVID-19 pandemic in 12 African countries.
Marschalek, I., Unterfrauner, E., Focke-Bakker, E., & Cohen, J. (2021). Social Labs as Transformative Approach to Implement Responsible Research and Innovation. Paper presented at the 16th International Conference on Public Communication of Science and Technology (PCST), virtual Retrieved from the PCST Archive of Conference Papers. https://www.pcst.network/wp-content/uploads/2022/02/Social-labs-as-transformative-approach-to-implement-Responsible-Research-and-Innovation.pdf
Mazure, C.M. (2021). What Do We Mean By Sex and Gender? Yale school of medicine.https://medicine.yale.edu/news-article/what-do-we-mean-by-sex-and-gender
Mitra, S. (2006). The Capability Approach and Disability. Journal of Disability Policy Studies, 16(4), 236-247. https://doi.org/10.1177/10442073060160040501
Mitra, S. (2018). Disability, Health and Human Development. Palgrave Studies in Disability and International Development, 1-29, 153-162. https://doi.org/10.1057/978-1-137-53638-9.
Mittler, P (2015). The UN Convention on the Rights of Persons with Disabilities: Implementing a Paradigm Shift, 12(2). Cohen l.G., Brown, R.I., and McVilly, K.R. (eds.), Special Issue: World Report on Disability. https://doi.org/10.1111/jppi.12118
Morales, J. (2011). What is Inclusive Design? Principles and Examples.https://xd.adobe.com/ideas/principles/design-systems/what-is-inclusive-design-principles-and-examples
Murdock, G. (2010). Pierre Bourdieu, Distinction: a social critique of the judgement of taste. International Journal of Cultural Policy, 16(1) 63-65. https://doi.org/10.1080/10286630902952413
Ntlatlapa, M.Z.A.C. (2011). Disability; a rights-based social issue that is fundamentally about breaking down the many barriers in society. Critical Disability Studies, History of Human Rights, Public Administration and Policy, 1-161.
Nussbaum. In Hooi Hooi Lean et al. (eds.) (2015). Touching Lives, Bridging Society, pp. 1-9. [USM International conference on Social Sciences (USM-ICOSS).
Oliver, M. (2004). The Social Model in Action: If I had a Hammer. Chapter 2. Barnes, C. and Mercer, G. (eds.) Implementing the Social Model Disability: Theory and Research, pp.18-31.
Owen, R., Stilgoe J., & Macnaghten, P. (2012). Responsible research and innovation: From science in society to science for society, with society. Science and Public Policy, 39(6), 751–760. https//doi.org/10.1093/scipol/scs093
Paek, H-J., Hove T. (2017). Risk Perceptions and Risk Characteristics. https://doi.org/10.1093/acrefore/9780190228613.013.283

People First, (1974). The People First Movement. https://peoplefirstwv.org/disability-etiquette/.
Poel, van de I.R. (2009). Values in engineering design. Meijers, A.W.M. (ed.), Philosophy of technology and engineering sciences. Handbook of the Philosophy of science, 9, pp.973-1006. https://doi.org/10.1016/B978-0-444-51667-1.50040-9
Poel, van de I.R. (2020). Values and Design. The Routledge Handbook of the Philosophy of Engineering, 1, pp. 300-3015, Routledge London.
Prawiro-Atmodjo, P., Langendoen M. & Tijsseling, C. (2016). Literatuurstudie naar de Leefsituatie van Vroegdove Volwassenen. Commissioned by Deafness and GGMD, Royal Kentalis.
Renn, O. (1990). Risk perception and risk management: a review. Part. 1, Risk perception. Risk abstracts 7(1), 1-9. http://dx.doi.org/10.18419/opus-7299
Renn, O., Levine, D. (1988). Trust and credibility in risk communication. Cited in: Renn, O. (1990), Risk perception and risk management: a review. Part. 1, Risk perception. Risk abstracts 7(1), 5.
Rijksinstituut voor Volksgezondheid en Milieu, (2002). De ICF, een classificatie voor het beschrijven van het functioneren van mensen inclusief factoren die op dat functioneren van invloed zijn, WHO-FIC (Family of International Classifications; Collaborating Centre in the Netherlands International Classification of Functioning, Disability and Health. RIVM, Bilthoven.
Rijksoverheid, (2022). https://www.rijksoverheid.nl/onderwerpen/rechten-van-mensen-met-een-handicap/positie-mensen-met-een-beperking-verbeteren-vn-verdrag-handicap
Rijksoverheid, (2023). https://www.rijksoverheid.nl/onderwerpen/grondwet-en-statuut/herziening-grondwet.
Rijkswaterstaat et al. (2021). Hoe hoog komt het water bij jou? https://overstroomik.nl/
Rohwerder, B. (2015). Disability inclusion: Topic guide. Governance and Social Development Resource Centre, University of Birmingham, Birmingham, UK. https://assets.publishing.service.gov.uk/media/57a0899ee5274a31e00001a2/DisabilityInclusion.pdf
Rundmo, T., Nordfjærn, T., Iversen, H.H., Oltedal, S., Jørgensen, S.H. (2011). The role of risk perception and other risk-related judgements in transportation mode use. Safety Science, 49(2), 226-235. https://doi.org/10.1016/j.ssci.2010.08.003
Saigaran, N.G., Karupiah, P. & Gopal, P. S. (2015). The Capability Approach: Comparing Amartya Sen and Martha
Schippers, A. (2021). Gouden verbindingen: Kennis ervaren, herkennen en erkennen. University of Humanistic Studies. www.uvh.nl
Seebauer, S., Babcicky, P. (2020). The Sources of Belief in Personal Capability: Antecedents of Self-Efficacy in Private Adaptation to Flood Risk. https://doi.org/10.1111/risa.13531
Sergeant., S., Peels, H., Joosa, E., Brown, R., van Hove, G., Schippers, A. (2021). Reflections on the results of a roundtable on creative methods in disabilities research. Murmurations Journal of Transformative Systemic Practice, 3(2). https://doi.org/10.28963/3.2.09
Setz, I., Van den Berg, I. (2017). Handreiking Samenredzaamheid bij overstromingen en ernstige wateroverlast. Strategische agenda Water & Evacuatie. https://nipv.nl
Simon, J. (2016), Value-Sensitive Design and Responsible Research and Innovation. Hansson, S.O. (ed.) The Ethics of Technology - Methods and Approaches, pp. 219-236. Rowman & Littlefield International, London. Springer, Berlin, Heidelberg. https://doi.org/10.1007/11853565_3
Stewart, F. (2013). Nussbaum on the capabilities Approach. Journal of Human Development and Capabilities, 14(1), 156-160. https://doi.org/10.1080/19452829.2013.762175
Tanuwidjaja, G., Rieger, J. & Franz, J. (2020). Understanding the differences between universal design and inclusive design implementation: The case of an Indonesian public library. Australian Universal Design Conference, (4th), Melbourne, Australia.
Terpstra, T. (2010). Flood Preparedness Thoughts, feelings and intentions of the Dutch public. (Publication No. ISBNs9789036529549) [PhD Thesis, University of Twente]. https://doi.org/10.3990/1.9789036529549
The Netherlands Institute for Human Rights (2020). Participatie van mensen met een beperking bij de totstandkoming van wetgeving en beleid. Jaarlijkse rapportage over de naleving van het VN-verdrag handicap in Nederland 2020. https://publicaties.mensenrechten.nl/publicatie/1bab7360-2467-478c-8815-304ea46353bd
The Netherlands Institute for Human Rights, (2022). Written submissions to the Office of the High Commissioner for Human Rights in relation to the call for inputs with regard to Human Rights. Council resolution 49/12 (A/HRC/RES/49/12) on the rights of persons with disabilities.
The Union of the Physically Impaired against Segregation & The Disability Alliance, (1975). Fundamental Principles of Disability. A summary of the discussion held on 22nd November, 1975 and containing commentaries from each organization. In 1997, Mark Priestley, in consultation with Vic Finkelstein and Ken Davis, electronically scanned this unabridged version and reformatted it from the original document.
Uldry, M., Leenknecht A.S (2021). Impact of COVID-19 on persons with disabilities: European Leaders must act now. Extract from the EDF Human Rights report 2020, European disability Forum, Naughton, C. (ed.). On COVID-19.

United Nations International Strategy for Disaster Reduction, (2014). Contribution to the 2014 United Nations Economic and Social Council (ECOSOC), Integration Segment, Achieving sustainable development: integrating the social, economic and environmental dimensions.
United Nations International Strategy for Disaster Reduction, (2013). Panel discussion on disaster resilience and disability: ensuring equality and inclusion. ECOSOC Chamber, UN Headquarters, New York.
United Nations International Strategy for Disaster Reduction, (2014). Living with disability; UNISDR 2013 Survey on living with disabilities and disasters- key findings.
United Nations, (2015). #Envision2030: 17 goals to transform the world for persons with disabilities. https://social.desa.un.org/issues/disability/disability-issues/inclusion-saves-lives
United Nations, (2015). #Envision2030: 17 goals to transform the world for persons with disabilities. https://www.un.org/development/desa/disabilities/envision2030.html
United Nations, (2018). The United Nations and disability: 70 years of work towards a more inclusive world. Division for social policy and development, United Nation department of Economic and Social affairs. https://www.un.org/development/desa/dspd/united-nations-commission-for-social-development-csocd-social-policy-and-development-division.html
Ustun, T.B. (2006). The ICF: an overview. https://www.cdc.gov/nchs/data/icd/icfoverview_finalforwho10sept.pdf
Van Popering-Verkerk, J. (2019), Helpende handen bij overstroming Verkenning spontaan hulpaanbod bij overstroming Alblasserwaard Vijfheerenlanden. https://a5h.nl/onderzoek
Woelfer, J. P., & Hendry, D. G. (2009). Stabilizing Homeless Young People with Information and Place. Journal of the American Society for Information Science and Technology, 60, 2300-2312. https://doi.org/10.1002/asi.21146
World Health Organization & World Bank, (2011). World report on disability. WHO Library Cataloguing-in-Publication Data World report on disability 2011. ISBN 978 92 4 068800 1 (PDF) ISBN 978 92 4 068636 6 (e-PUB). This publication was originally published under ISBN 978 92 4 068521 5 (PDF) 2011.
World Health Organization, (2001). International Classification of Functioning, Disability and Health (ICF). https://www.who.int/classifications/international-classification-of-functioning-disability-and-health
World Health Organization, (2002), Towards a common language for functioning, disability and health. WHO/EIP/GPE/CAS/01.3, Geneva.
World Health Organization, (2019). Blindness and vision impairment. https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment.
World Health Organization, (2021). Deafness and hearing loss. https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss
Wyche, S., Sengers, P., & Grinter, R.E. (2006). Historical Analysis: Using the Past to Design the Future. Dourish, P., Friday, A. (eds.) UbiComp: Ubiquitous Computing. Lecture Notes in Computer Science, 4206, pp. 35-51.
Zahnow, R., Wickles, R., Haynes, M., Corcoran, J. (2017). Disaster and crime: the effect of flooding on property crime in Brisbane neighborhoods. Journal of urban affairs, 39(6), 857-877. https://doi.org/10.1080/07352166.2017.1282778
Zhang, A., Wroblewski, K.E., Imbery, T.E., McClintock, M.K., Hawkley, L.C., Pinto, J.M. (2022). Can digital communication protect against depression for older adults with hearing and vision impairment during COVID-19? The Journals of Gerontology, Series B, gbac193. https://doi.org/10.1093/geronb/gbac193
Zhang, A., Wroblewski, K.E., McClintock, M.K., Hawkley, L.C., Pinto, J.M. (2022). Video calling reduces loneliness for hearing impaired older US adults during the Covid-19 pandemic. Innovation in Aging, 6(1), 31–32. https://doi.org/10.1093/geroni/igac059.117