

Exploring the influence of Urban Climate Adaptation on
Dutch Pluvial Flood Risk Management via stakeholder
perception of responsibilities: An exploratory case study

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Exploring the influence of Urban Climate Adaptation on Dutch Pluvial Flood Risk Management via stakeholder perception of responsibilities: An exploratory case study.

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Abstract

Flooding due to rainfall has increased in the Netherlands, both in frequency and intensity. It is a source of rising costs in urban areas, as well as innovations shaping the future of Dutch Pluvial Flood Risk Management (P-FRM). Urban Climate Adaptation (UCA) has been cited as a notable strategy to bring innovations to the advancement of climate change practice, particularly through new and potentially transformative growth. Previous studies support the rising status and nature of UCA; however, its impacts remain nebulous. Moreover, the degree of impact UCA has potentially had on Dutch P-FRM at this point has yet to be thoroughly examined. Prominent shifts promoted by UCA are innovation arising from bottom-up action, and through these ventures, the transfer of responsibilities in P-FRM from stakeholder groups who have historically yielded greater control, to those who are currently rising. Stakeholder groups included in this research include State, Market, Academia, and a Mixed-Profession group consisting of professionals who engage in two or more fields of work concurrently. This thesis provides an exploratory analysis of stakeholder perceptions of UCA and P-FRM in the Netherlands, including their responsibilities and subjective evaluations of who should be responsible for what. Specifically, which stakeholders should be responsible for what roles in Dutch P-FRM. Results showed a high rate of respondents suggesting that, while change is observable via acknowledgement and indirect communication between stakeholder groups, it is not occurring in a manner or fashion deemed transformative, but incremental by their own self-reporting. The key principle finding was the established lines of communication, some of which exist between stakeholder groups that are new and previously understudied, which detail specific stakeholder relationships, either strong or weak in nature.

Key words: Pluvial flood risk management, Urban climate adaptation, Responsibility, Perception, Adaptive capacity, Civil society

Abbreviations:

P-FRM: Pluvial flood risk management

FRM: Flood risk management

UCA: Urban climate adaptation

DPRA: Delta Program on Spatial Adaptation

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Introduction

Anthropogenic activities and associated climatic changes have resulted in increasingly hazardous flood events in urban areas in the Netherlands (Schoeman et al., 2014). Storm-associated pluvial flooding is a major incidence in which flooding is reported in urban areas (Restemeyer et al., 2015). Climate Adaptation approaches such as greening paved areas and building with nature have been undertaken to manage the increasing pluvial flood risk (Derkzen et al., 2017). The inclusion of Climate Adaptation, specifically in an urban context (hereon referred to as Urban Climate Adaptation or UCA), in Dutch Pluvial Flood Risk Management (hereon referred to as P-FRM) has been acknowledged as important and supportive of positive action to manage climate change related impacts in the Netherlands (Werners et al., 2009, Brockhoff et al., 2019). One of the foundational goals of UCA is the inclusion of all stakeholders (Preston et al., 2015 pg. 10)

Recent studies on UCA, applied to P-FRM, have highlighted a distinction between stakeholder groups (van Herk et al., 2011). This concerns predominantly state followed by market and then academia, who hold established roles and responsibilities in the study or implementation of P-FRM on several scales and in several areas, and emerging stakeholder groups, namely civil society, who are beginning to become involved in P-FRM (Trell and van Geet., 2019, Wiering., 2019). A continuously evolving P-FRM landscape has been credited with fostering increased dialogue regarding stakeholder inclusion and coordination and rapprochement between core and emerging stakeholder groups (a Forrest et al., 2020). The Delta Plan for Spatial Adaptation, with its associated mandatory risk dialogues and stress tests for Dutch municipalities, has been lauded for its innovative solutions and forward thinking, part of which involves breaking historical precedent and crossing stakeholder boundaries (Delta Program 2020., pg. 64. Laudien et al., 2019).

Although recent inroads have been made, prevailing dominant factors such as the lack of communication between state, market, academia and civil society stakeholder groups inhibit a more robust and overarching implementation of UCA (Dai et al., 2018). Information regarding the degree of involvement and coordination between and within these groups, moreover, is relatively sparse (Kaika., 2017 pg 96. Kaufmann, 2018, pg. 254). Beyond the scope of a few academic research papers, relatively little has been published on the breadth, depth and perception of changes to the P-FRM system in the Netherlands.

Within this subject area, perception of stakeholders has been cited as important for obtaining a clear picture of the P-FRM system, including possible changes and how stakeholders perceive roles and responsibilities in P-FRM (Molenveld et al., 2020). Building a stakeholder profile, however, as it pertains to roles and responsibilities in P-FRM, including the degree to which they perceive a change occurring, requires

baseline research. Due to its importance and relevance to P-FRM, exploratory research into the topic of UCA and stakeholder perceptions of responsibility in P-FRM is warranted.

In order to establish an understanding of the present status of P-FRM framework, including stakeholder perceived responsibilities; this research covers the identification and perception of instrumental and normative responsibilities in UCA within P-FRM in Dutch stakeholders. By so doing, this research seeks to understand the perception of responsibilities of Dutch P-FRM stakeholders, and furthermore uncover the degree of influence that UCA has had on Dutch P-FRM.

1.1 The pertinence of P-FRM and UCA in the Netherlands

The Netherlands is located in the north west of Europe, bordering the North Sea. It has a population of 17 million, and is considered a highly developed country, according to UN statistics (United Nations., 2019 pg. 866). Over the years, several highly urbanized areas have become increasingly inundated with pluvial flooding (Klijn et al., 2015). Contributing to this is the large concentration of concrete and stone in urban areas, which have very little permeability. Concurrently, due to previous land reclamation and associated activities, several urban areas in the Netherlands sit meters below sea level. This not only exacerbates their vulnerability, but in combination with poor building practices, there is now less space to accommodate runoff water of pluvial origin.

A long history of flooding and land reclamation has formed the collective societal Dutch perspective and attitude towards flooding. The Delta Works, as part of the larger Dutch Delta Plan, was constructed after the devastating flooding of 1953 (Correljé and Broekhans, 2015). Following the near-river floods of 1993 and 1995, the Delta Plan was updated to reflect a deeper focus on fluvial flooding (Tol and Langen, 2000). The historic threat of coastal and fluvial flooding, which brought about heavy economic and societal loss, has led to a lower degree of concern surrounding pluvial flood risk.

Several high-profile pluvial floods have occurred in recent years however, highlighting the need for more effective P-FRM (Brockhoff et al., 2019 pg. 1, a Forrest et al., 2020, pg. 7). The city of Arnhem, for example, has suffered several pluvial flood events, which have left neighborhoods inundated and homes flooded (b Forrest et al., 2020). Furthermore, the trend of pluvial flooding is projected to increase, carrying increasingly more destructive flood events (Restemeyer et al., 2015). With this increase in pluvial flood risk, the Ministry of Water and the Environment (Rijkswaterstaat), an enforcement arm of the national state, has issued the Delta Program of Spatial Adaptation (Dutch acronym DPRA) (Bloemen et al., 2019). Particular aspects include mandated risk dialogues and stress tests in Dutch

municipalities, which stimulate context-specific awareness and innovation by multiple parties.

Following increasing pluvial flood events in Dutch urban areas in recent years, efforts have been undertaken to study, engage in, and implement UCA ideas and practices by academics, private market parties, state authorities on multiple levels, and civil society individuals and organizations (De Groot et al., 2006 pg. 64, Runhaar et al., 2012, Trell and van Geet., 2019 pg. 383, Tompkins and Eakin., 2012 pg. 10, Uittenbroek et al., 2019, Urwin and Jordan., 2008 pg. 187, Werners et al., 2009, Wesselink., 2007, van de Ven et al., 2016 pg. 433). These groups represent a mixture of stakeholders who are involved in P-FRM to varying degrees. National and municipal representatives have held a majority of governance duties in P-FRM, while civil society, both individual citizens and community groups, have garnered less responsibility in P-FRM. Market representatives, who are peripherally included in P-FRM, are also beginning to be incorporated with greater autonomy (Schneider., 2014), with division of responsibilities occurring between but not limited to consulting firms, land development companies and insurance companies. Academic representatives are understood as involved in P-FRM through research, with a limited role in advising the state in policy implementation (Dieperink et al., 2018).

The UCA discourse, pertaining to the appropriate integration of stakeholders, use of natural building processes and taking holistic, long-term points of view supports the incorporation of these stakeholders into the system of P-FRM policies and practices, as well as the integration of communicative, bottom-up FRM solutions (Neuvel and Van Den Brink., 2009, Preston et al., 2015, van Herk et al., 2015, van Ruiten and Hartmann., 2016). Recent developments in urban areas includes shifting of responsibilities from state stakeholders to civil society stakeholders in the context of P-FRM, albeit very new and partially the subject of national state documents rather than on the ground occurrences (a Forrest et al., 2020, Rözer et al., 2016). Civil society in the context of this research refers to individual households and citizens, as well as citizen groups at the neighborhood and city levels. While a shift in responsibility may be occurring in isolated incidents, it is not proceeding in an organized manner as of yet. A key point in the shift in responsibilities is the allocation of sufficient resources to undertake such responsibilities (Nalau et al., 2015 pg. 95). With regard to civil society stakeholders, Terpstra and Gutteling (2008) cite that “when personal responsibility for disaster preparedness was more obvious, this responsibility was only accepted when individual coping resources were assessed as being sufficient relative to the perceived threat.”

Resources allocated to civil society stakeholders are scant in some urban areas, as the municipal authorities themselves do not have enough resources to share (Meijerink and Dicke, 2008). Van Popering-Verkerk and van Buuren (2017, pg. 232) note, “the availability of additional resources is not only about budget, but also about staffing.” “Additional financing,” they continue, “motivates people to collaborate, but at least as important is the involvement of people with access to knowledge and other

resources.” Impeding this effort is the fact that some civil society stakeholders (i.e. private citizens) are not interested in engaging in P-FRM, seeing it instead as the duty of the state. Terpstra and Gutteling (2008 pg. 564) found that FRM “characterized by a strong emphasis on flood prevention under complete government control,” coupled with a “relatively low level of ‘sense of urgency’ in terms of risk perception,” were motivating factors for civil society in the perception of the state as responsible.

UCA is an approach that embodies several main ideas. Concepts such as ‘keeping water out’ and ‘protection’ are gradually being replaced by bottom-up innovation, inclusion of a wider variety of stakeholders, ‘living with water,’ risk reduction and adaptive capacity (Klijn et al., 2015, Ward et al., 2017, Uittenbroek et al., 2019 pg. 2537). UCA has been promoted by the Dutch national state in the Delta Program for Spatial Adaptation as a new method of increasing resilience in urban areas facing threats from pluvial flooding. Importantly, this integration of UCA in P-FRM in the Netherlands should be viewed as a combination of traditional engineering and technical measures with innovative spatial and communicative measures, as opposed to a separate transfer from one to the other. The purpose of UCA is to create resiliency in areas experiencing high risk and vulnerability to climate change stresses (Geneletti and Zardo, 2016). Under the umbrella of resilience, it is viewed alongside hazard mitigation as a holistic approach to successfully manage the uncertainty of climate change. However, as Gilissen (2015, pg. 24) states, “adaptation in the short term becomes the most realistic approach for combating the adverse effects of climate change.”

This research, as an exploratory study, is an attempt to create a framework with of the current P-FRM system, including understanding the degree to which civil society stakeholders have been included in P-FRM and thus revealing the extent to which UCA has influenced P-FRM. Namely individual citizens and community organizations, these stakeholders are situated in urban areas, and year after year, are experiencing pluvial flooding with greater frequency and intensity (b Forrest et al., 2020, Kokx and Spit, 2012). Their role within P-FRM has been relatively non-existent in the Netherlands as a whole. As their flood risk and vulnerability continues to increase, however, state stakeholders have begun to push for their incorporation to greater degrees in the planning and implementation of UCA in P-FRM.

Do to the exploratory nature of this research, the subsequently small size of interviewees and time constraints, this research will not include civil society stakeholders as interviewees. Instead, data collection activities-efforts will focus on stakeholders who currently garner responsibilities, either studying or implementing P-FRM. These stakeholders are state, market, academia and professionals working in these two of these fields concurrently, called mixed-profession stakeholders. While academics may not be responsible for the implementation of P-FRM and UCA in policy and practice, their role in researchers provides a potentially interesting perspective

due to their close proximity to the subject in scientific literature. Mixed-profession stakeholders are not well researched in Dutch P-FRM; however, evidence suggests this phenomenon is not uncommon in the Netherlands (Reinders et al., 2018 pg. 376).

1.2 Civil society involvement in Dutch P-FRM

Several key reasons support the inclusion of civil society in P-FRM. Among these are state stakeholders' realization that P-FRM must be achieved holistically, coupled with recent budgetary cuts at the national level, as well as increasing context-specific uncertainty of pluvial flooding in combination with other adverse weather events such as heat stress, has thus prompted state authorities to rethink their strategies (Delta Program 2021., pg. 69. Koopmans et al., 2020. van Popering-Verkerk and van Buuren., 2017). One overarching strategic shift is the inclusion of 'above ground' measures, such as Wadi's and greening areas which emphasize spatial planning, alongside existing 'below ground' measures, such as combined sewage and drainage systems emphasizing engineering and technicality (Trell and van Geet., 2019). This is part of a broader ongoing combination of technical, engineering strategies and innovative, aboveground spatial strategies, titled the "spatial turn", which spans the entirety of spatial planning in the Netherlands (Thorne et al., 2018. White and O'Hare, 2014. van Ruiten and Hartmann, 2020)

The division of land ownership is another motivating factor for the incorporation of citizens and community organizations in P-FRM. Although private land ownership varies across Dutch municipalities, a significant percentage is accounted for via private ownership (van Oosten et al., 2018 pg. 831). Moreover, Dutch municipalities have used both active and passive measures in maintaining control over spatial developments; however, they do not have the jurisdiction to intervene in cases of non-severe flooding on private land (a Forrest et al., 2020, Holtslag-Broekhof., 2018). Therefore, full and effective P-FRM cannot be achieved unless citizens and community organizations are incorporated into P-FRM at the local level, whereby effective collaboration can then take place. "An open and interactive process," van Popering-Verkerk and van Buuren (2017, pg. 232) write, "is positively related to the development of collaborative capacity."

Although UCA has come into the spotlight in recent years as a formidable option in managing pluvial flood risk, the influence it has had on P-FRM is still understudied (Bergsma et al., 2019, Haasnoot et al., 2018, Howell and Whitmarsh, 2016). The proper integration of UCA methodology into mindsets of stakeholder groups in Dutch P-FRM, including proper understanding of the reallocation and redirection of responsibilities and resources, is key for the efficient and effective planning and implementation of P-FRM. Studies suggest that some stakeholders do not have sufficient understanding of these shifting responsibilities, however, which results in

systematic inefficiencies in the planning and implementation of UCA in P-FRM (Jordán et al., 2019). To this point, Thaler et al. (2019 pg. 1079) state, “if the understanding and planning phases cannot encourage a societal transformation process, transformation will fail to materialize from the beginning.”

With the increasing risk pluvial flooding poses in highly inhabited urban areas, Dutch P-FRM must guarantee reliable and safe assurances in decreasing vulnerability, both in protecting property and lives, via successful management pluvial flood risk. Inefficiencies and gaps in communication between stakeholder groups, if left unchecked, can grow and ultimately cause harm to the system and multiply the impact of a flood event by weakening the collective response. The division of responsibilities among state, market, academia and civil society is a point of interest that this research seeks to expand upon, in order to uncover the impact that UCA has had on P-FRM. To study this, this research analyzes the perceptions of stakeholders regarding their and other stakeholders’ responsibility in P-FRM, in order to capture a picture of the situation as it stands currently and deduce if there are in fact significant and or relevant changes occurring with regard to the division of responsibilities in P-FRM. In order to understand the changes occurring within the P-FRM system with respect to UCA, it is key to understand the perception of stakeholders within the system.

By researching stakeholder perspectives of those with current responsibility in the study and implementation of Dutch P-FRM, it can be determined 1) if there exists a consensus about the changing division of responsibilities between stakeholder groups, 2) to what degree do these stakeholders agree or disagree about the current division of responsibilities, 3) what barriers exist to the fair and efficient division of responsibilities in P-FRM in urban areas, and ultimately, 4) the perceived influence that UCA has had on Dutch P-FRM. This research is societally relevant, as it will help to uncover any possible inefficiencies in P-FRM, reveal vulnerabilities and identify areas of improvement, as well as possible solutions. With worsening impacts of pluvial flooding in Dutch urban areas, and increasing uncertainty regarding modeling of future impacts, it is imperative that the system of P-FRM is working efficiently and effectively. Not only will efficient P-FRM prevent increasing public and private property damage, it can also save lives and create greater resilience to pluvial flooding in vulnerable areas.

Furthermore, since less attention has been paid to pluvial flooding, compared to coastal and fluvial flooding, and less policy and practical measures surround it, there is a window of opportunity for planners to shape its perception and perhaps mold P-FRM practices in the Netherlands to fit UCA and holistic stakeholder integration. Studies suggest that an inhibitor to the change in perception of coastal and fluvial flooding in civil society is the long-standing tradition, supported by constitutional writing, that it is the state’s job to “keep people’s feet dry” (de Moel., 2011, Wiering and Arts., 2006 pg. 330). While this may be the case, it creates a difficult situation whereby civil society stakeholders are less likely to change given the strong precedent

for the state to protect them. With a weaker precedent supporting pluvial flood risk, this may pave the way for greater citizen involvement in P-FRM. To facilitate the study of this subject, one primary and four secondary research questions have been developed.

1.3 Primary research question

Does UCA impact Dutch-PFM, and, if so, in what ways; particularly through perceived responsibilities on the part of stakeholders?

1.4 Secondary research questions

Theory: What motivations are present for stakeholders to support their assuming of responsibilities in P-FRM?

Theory: Is there increasing use and focus on UCA, and what is the degree with which it is reflected (i.e. either incrementally or transformative) in Dutch P-FRM?

Practice: What are the core stakeholder perceptions on UCA, Dutch P-FRM and the responsibilities that are attributed to them?

Practice: In what ways are the stakeholder perceived responsibilities of UCA reflected in their duties of P-FRM?

Theory

2.1 Pluvial flooding

In this research, urban pluvial flooding, hereon referred to as pluvial flooding, is a form of flooding that occurs as the result of the individual or combined effect of heavy rainfall and/or the inability of drainage systems to manage large volumes of flood water released during an extreme rainfall event (Brockhoff et al., 2019). Until recently, pluvial flooding has often occurred at smaller spatial and temporal scales than its coastal and fluvial flooding counterparts have experienced in the Netherlands (Bloemen et al., 2019 pg. 6, Correljé and Broekhans, 2015 pg. 110, De Bruijn and Klijn., 2009 pg. 63, de Moel et al., 2011). Fast onset and minimal warning are characteristic features of pluvial flooding, resulting in the overwhelming of water infrastructure, fiscal damage to buildings, and remaining stagnant pools afterwards.

An important difference is the specific vocabulary distinguishing Wateroverlast (Water Nuisance) and Overstroming (Flooding), the former being a common reference to non-dangerous pluvial flooding and the latter referencing strong and destructive flooding characteristic of coastal and fluvial flood events (Groothuijse et al., 2009 pg. 1). Most frequently, pluvial flooding results in material and fiscal damages, often occurring on private property, as well as social and infrastructural disruptions and delays (Brockhoff et al., 2019 pg. 1). People's safety, however, is generally not threatened by pluvial flooding as it has been with other flood situations in the Netherlands.

2.2 Growing pluvial flood risk

2.2.1 Climate change, increasing pluvial flood probability

Anthropogenic climate change is increasing around the world, with the Intergovernmental Panel on Climate Change (IPCC) citing greenhouse gas emissions and nature degradation as contributing factors (Pachauri and Reisinger, 2007). Increasing levels of uncertainty continue to surround the short and long-term future of atmospheric weather and climate events. The melting of large ice concentrations, and thus higher volumes of atmospheric moisture content, have contributed to this uncertainty and increasing impacts of pluvial flooding. Climate change affects a variety of contexts in rural and urban environments, with the main affects being sea level rise and rising year-round temperatures. Atmospheric moisture content, along with increasing atmospheric temperature and changing weather patterns contribute to increasing pluvial flooding. Instances of pluvial flooding in Dutch urban areas are rising with the Dutch Meteorological Agency (Dutch acronym KNMI) recording increasingly frequent and intense rainfall events (Klein Tank et al., 2014, pg. 12).

2.2.2 Socioeconomic development, increasing potential damage

Climate change and weather-related impacts are causing severe damage to both property and livelihoods worldwide (Geneletti, D. and Zardo., 2016, Runhaar et al., 2018). Research suggests that socioeconomic development plays a major role in the increasing severity of climate change (Rözer et al., 2016 pg. 2). Curiously, this trend of urban development and expansion is actually resulting in higher infrastructural damage to public and private spaces, a kind of negative feedback loop that exacerbates pluvial flooding (b Forrest et al., 2020). In their case study, b Forrest et al. (2020 pg. 6) state, “changes to the urban environment have increased place vulnerability to floods in Arnhem, for example, changes to transport infrastructure... have enhanced rainfall flood risk.” Other factors, including population growth, concentration of population and businesses, urban sprawl, expanding numbers of satellite cities, excessive use of concrete and stone materials, and growing single person households are also cited as exacerbating inhabitants’ vulnerability to pluvial flood risk as well (Hoppe et al., 2014 pg. 10, Penning-Rowsell and Korndewal., 2019, Swart et al., 2014).

2.3 Climate adaptation

2.3.1 Climate adaptation vs. Hazard mitigation

It is understood that two approaches exist within the FRM narrative, each of which achieves different aspects of climate change impact reduction (Davoudi et al., 2012, Laeni et al., 2019). The first, climate adaptation, is cited as reactive and preparing for inevitable consequences of climate change (Gomez, 2016). Originally, adaptation in conjunction with transformation were used to transcend a previously one-dimensional perspective of strength and, in combination with robustness, a three-dimensional flood resilience concept emerged. Although it has gained attention in recent years, adaptation in the form of climate adaptation, however, is still less common than other, more ingrained strategies, such as multi-layer safety, which makes adaptation attractive to study and present findings (Hoss et al., 2011 pg. 61). Its use in other forms of FRM, in this case coastal, is observed by Gersonius et al. (2011 pg. 28), who note, for successful integration of dikes with transportation infrastructure, “they generally require adaptation for their new function as compartmentalization dikes.”

The second approach, hazard mitigation, takes a proactive stance in combatting the exacerbating factors of climate change. Critique of climate adaptation, in favor of hazard mitigation, cites the latter as more effective in its message of not backing down from climate change, and that adaptation presents a defeatist attitude. Although on the surface it may appear so, the IPCC notes that humanity is minimally locked in to

1.5 degrees of temperature rise, which will occur even in the event of full emission reduction (King and Karoly, 2017, Tollefson, 2018). Now, therefore, adaptation appears to be just as important in the battle against ensured climate change and increased climatic uncertainty.

2.3.2 FRM and UCA in the Netherlands

The Dutch FRM landscape is changing from strictly resistance-based approaches to a mixture of resistance and risk-based approaches. In the past, many cities have used grey infrastructure methods, such as building with concrete, and the combination of water drainage and sewage systems underground (Runhaar et al., 2012). Complete with top-down authorization, implementation and oversight by core groups of experts, these methods relate to resistance-based approaches taken under the umbrella of the technical engineering paradigm (Holling et al., 1973). Discourse supporting this paradigm portrays humans as having risen above natural calamities and supports a narrative of near-complete protection and untouchability. Increasingly devastating storms and floods would, however, disprove this thought process and reveal the stark truth of continual human-nature interdependence. The severe 1953 North Sea flooding of Dutch coastal areas exemplified the instability of grey infrastructure, of which the Zeeland dikes experienced severe damaged, as well as their inability to provide appropriate protection for citizens. The resulting loss of life and economic damage proved to be a major turning point in Dutch FRM (Correljé and Broekhans, 2015 pg. 102)

The Dutch FRM landscape would undergo change, but not before the near river floods of 1993 and 1995 sent more shockwaves through the system (Tol and Langen, 2000). Likewise, in the United States of America (USA), technical measures took a particularly hard hit during the 2005 Hurricane Katrina, which left thousands dead and resulted in the equivalent of an aggregate of billions of euros in damages (Baade et al., 2007). More recently, pluvial flooding in the Japanese province of Kumamoto and the Chinese province of Anhui have resulted in the equivalent of an aggregate of billions of euros in damage and hundreds of lives lost (Picheta., 2020, Wakatsuki and Westcott., 2020).

In the aftermath of each of these events, urban planning experts have come to realize that the traditional technical, top-down approaches are not sufficient against the increasing frequency and intensity of storm-associated flooding (Wesselink, 2007 pg. 5, Bergsma, 2019). What transpired has been a profound and overarching reframing of Dutch FRM policy and practice, including the integration of spatial adaptation and communicative approaches (Busscher et al., 2019, Butler and Pidgeon, 2011, Goosen et al., 2014 pg. 12). Table 1. Dieperink et al. (2016 pg. 3) depicts five common FRM strategies. UCA is not listed, as it is still new, but resembles a mixture of

flood risk prevention, mitigation and flood preparation. These share characteristics reflective of aboveground, spatial planning measures, as opposed to flood defense.

Table 1 Five types of Flood Risk Management Strategies (FRMSs)

Strategy	Characteristics
1. Flood risk prevention	Prevention measures aim to decrease the consequences of flooding by decreasing the exposure of people/property etc. via methods that prohibit or discourage development in areas at risk of flooding (e.g. spatial planning, re-allotment policy, expropriation policy etc.). The main focus of the strategy is on “keeping people away from water”.
2. Flood defence	Flood defence measures aim to decrease the probability of flooding areas through infrastructural works, such as dikes, dams, embankments and weirs (so called “structural measures”), through measures that increase the capacity of existing channels for water conveyance or the creation of new spaces for water retention outside of the area to be defended. The focus is on “keeping water away from people”.
3. Flood risk mitigation	Flood risk mitigation focuses on decreasing the consequences of floods through measures inside the vulnerable area. Consequences can be mitigated by a smart design of the flood-prone area. Measures include constructing flood compartments, or (regulations for) flood-proof building as well as measures to retain or store water in or under the flood-prone area (e.g. rain water retention).
4. Flood preparation	Consequences of floods can also be mitigated by preparing for a flood event. Measures include developing flood warning systems, preparing disaster management and evacuation plans and managing a flood when it occurs.
5. Flood recovery	This strategy facilitates a good and fast recovery after a flood event. Measures include reconstruction or rebuilding plans as well as compensation or insurance systems.

Table 1. Five types of Flood Risk Management Strategies. Dieperink et al. (2016 pg. 3)

2.3.3 Current state of UCA

In conjunction with these changes, moreover, the Dutch stance has shifted to one that views pluvial flooding as dangerous and requiring greater attention (Brockhoff et al., 2019, Rözer et al., 2016). The western, northern and central parts of the country have experienced increasing frequency and intensity of pluvial flooding, with rates of damages following suit (a Forrest et al., 2020, Penning-Rowsell and Korndewal, 2019). Specifically, Brockhoff et al. (2019 pg. 2) found that combined sewage and runoff drainage systems are “more vulnerable to surface water flooding,” and that “growing precipitation extremes together with a large percentage of impermeable urban surfaces and an increasingly obsolete drainage system call for more advanced urban flood adaptation.”

With this changing landscape and rising uncertainty has come new terminology that more appropriately reflects the necessary changes, including ‘living with water,’ risk reduction and adaptive capacity, along with complementary strategies (Klijn et al., 2015, Trell & van Geet, 2019). Ward et al. (2017 pg. 5) support this, citing, “in many regions floods disproportionately affect poor people, so risk reduction is commensurate with overall development goals.” The collective response to these

experiences has led to an integration of spatial adaptation approaches as part of an overarching communicative paradigm shift.

Although there is a broad consensus about the nature of climate adaptation, definitions vary throughout literature. In the 2007 IPCC report, adaptation is defined as “the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (Parry et al., 2007 pg. 6). A similar definition by the US Government Accountability Office adds to this by specifying, “increases in the frequency or severity of weather-related disasters” (Gomez, 2016 pg. 4). These definitions serve as the understanding of climate adaptation in this research. Climate adaptation has been applied to several areas within the urban landscape, effectively forming a distinct field of urban climate adaptation (UCA) (De Groot et al., 2006).

Since its inclusion in the Dutch Delta Plan for Spatial Adaptation in 2016, UCA has gained attention as an approach taken to manage pluvial flood risk (Bloemen et al., 2019 pg. 68. Delta Program 2021, pg. 71. Van Buuren et al., 2016). These include increasing capacity of storm water systems, specifically increased pumping and storage capacity, the installation of permeable pavements and green roofs to absorb excess rainfall, the elevation of street levels, and relocating or paying out homeowners residing in flood prone areas (Derkzen et al., 2017, Meet et al., 2013 pg. 809).

Some studies suggest transformative adaptation is reflected by Dutch P-FRM, with Bloemen et al. (2018 pg. 20) citing several “possibilities for adaptation pathways to pave the way for transformative interventions.” In Table 2. Pahl-Wostl et al. (2013 pg. 4) depicts a method of understanding “governance systems and their expected influence on transformative change.”

Table 1. Characteristics of governance systems and expected influence on transformative change.

Characteristic	Management and transition framework (MTF) based representation	Influence on transformative change (Pahl-Wostl 2009, Pahl-Wostl et al. 2012)
Link between formal and informal processes	Linkages between formal policy and informal learning processes and degree of subsequent influence of learning on the policy process through: (1) flow of knowledge from informal to formal processes, i.e., knowledge generation in informal platforms and integration in formal management; and (2) bridging organizations or individuals, e.g., social entrepreneurs, who participate in both formal and informal processes.	Higher levels of learning require informal settings but are only effective, i.e., leading from reframing to transformation, if connected to formal processes (Fig. 1).
Degree of centralization	The multilevel governance structure is characterized by the kind of activities, i.e., phases in the policy cycle and in learning processes, that occur at different spatial levels. Centralization is high if strategic goals and policy are only formulated at the national level, and regional levels implement according to orders from the top. Actors from the national level have the lead role in most action situations (AS), even at lower levels.	Centralized regimes have lower adaptive and transformative capacity than polycentric systems, which are characterized by a decentralization of power combined with effective coordination and a balance between bottom-up and top-down processes.
Vertical coordination	Linkages between spatial levels, i.e., institutions, knowledge, and operational outcomes are generated in an action situation (AS) at a certain spatial level and influence an AS located at another level; actors operating at more than one level; degree of participation of actors between levels, e.g., actors from regional levels participate in AS at national level; and top-down policy trajectories and bottom-up processes influencing higher level policies.	Effective vertical coordination with regard to the involvement of actors from different levels in policy development and implementation, and with regard to knowledge integration is essential for high adaptive and transformative capacity.

Table 2. Characteristics of governance systems and expected influence on transformative change. In studying the decentralization of responsibilities in P-FRM, this research focuses on middle box to the right. (Pahl-Wostl et al., 2013 pg. 4)

Other studies, however, caution that is too early to decide and that more research is required to make such a statement. “When focusing on the distribution of resources and impacts of climate adaptation” Trell and van Geet (2019 pg. 16) write, “... neither is distributed equally among the actors.” “The interests and ‘stakes’ of the key actors,” they continue, “as well as their ability to be involved in climate adaptation can radically differ.” Kates et al. (2012 pg. 1) understands “incremental adaptations to change in climate as extensions of actions and behaviors that already reduce the losses or enhance the benefits of natural variations in climate and extreme events.” Studies focusing on UCA promote the inclusion of civil society, a historically absent stakeholder group, at local levels in a more direct and consolidated manner, by way of bottom-up initiatives in coordination with top-down initiatives by national stakeholders (Edelenbos et al., 2017 pg. 60, a Forrest et al., 2020, Wamsler and Riggers, 2018).

To this point, Howell et al. (2016 pg. 15) say, “policymakers and organizations seeking to involve individuals or groups who are disengaged with climate change might do better to begin by discussing adaptation as this potentially could engage this particular public more.” Communication between stakeholders is also cited as a key stimulus of successful UCA, as it reduces complexity and uncertainty posed by increasing impacts of pluvial flood risk (Thorne et al., 2018 pg. 9). In the Netherlands, pluvial flooding is one area in which adaptive strategies have been centered, although

more research is required to make definitive statements regarding the relationship between P-FRM and UCA and the extent to which civil society has been involved.

Moreover, strict limitations are present in the division of public and private land, so much so that municipalities are limited in their advances to implement aboveground approaches, such as greening and separating sewage and drainage systems. A longer, but informative passage by Dai et al. (2017 pg. 18) follows, saying “urban space in the Netherlands is often privately owned and residents are legally obliged to collect rainwater on their own plot of land. Consequently, a lack of awareness concerning this private responsibility hampers effective adaptation. This problem becomes worse when municipalities act beyond their formal duty of care by taking additional measures to avoid flooding.” If any reasonable development of aboveground approaches is to be had, civil society must, willingly, include themselves in these plans.

In a study exploring adaptation in academic literature, Preston et al. (2015 pg. 11) state, “given the lack of empirical evidence to track the benefits and outcomes of participation, confusion as to which actors and stakeholders should be involved and how, and potential fear of policymakers to involve the public, placing invalidated faith in the utility of broad participation in adaptation appears premature.” This research therefore seeks to understand stakeholders’ perceptions of responsibility, as a reflection of the status of the current P-FRM system, in order to delineate the extent of stakeholder participation, particularly civil society, and more generally the influence of UCA in P-FRM.

2.4 Perceived responsibility and its role in defining stakeholder buy-in

2.4.1 Assuming responsibility under legal, moral and ethical considerations

There are several ways to define responsibilities. First, there is a general division into two categories, those being instrumental (legal) and normative (moral and ethical) (Mees et al., 2012, Valentinov and Haidu, 2019 pg. 7). Often defined as extrinsically motivated by a country’s law, governing body or legal stipulation in a professional contract, legal responsibility represents what is required according to written law or contract (De Poorter., 2013 pg. 2). As such, in this context legal responsibility is assumed in the duties ascribed to a person’s occupation, wherein failure to carry out these duties would result in reprimand. Kaufmann (2018 pg. 258) recognizes this in his statement regarding the assurance of defense infrastructure quality, “an informal or semi-formal technical standard became a legally formalized rule accompanied by particular responsibility distributions, which are now difficult to change.”

Moral responsibility is defined as intrinsically motivated (Braham and Van Hees., 2012 pg. 605). With respect to climate change mitigation, Adger et al. (2017 pg. 4)

state, “moral arguments have greater potential for motivating change,” and that “if issues are not perceived as moral, then the impetus for action is significantly diminished.” Assuming responsibility under subjective moral motivations may be used to frame a person’s attitude towards UCA, to identify how they view P-FRM, and thus the degree with which UCA has influenced change in the Dutch P-FRM system. In their findings, Doran et al. (2019 pg. 622) reinforce “the argument that morality plays a central role in explaining acceptance of environmental policies, and for mobilizing public action on climate change in particular.”

Moreover, Klepp and Chavez-Rodriguez (2018 pg. 66) postulate that, “in rethinking adaptation, the relationship between authority and subjectivity needs to be seen as one where subjectivity serves to legitimize marginalized groups.” Absent groups, in this case, are understood as civil society stakeholders who have, up until recently, either by choice or circumstance, been uninvolved in climate change adaptation. The findings of Trell and van Geet (2019 pg. 390) lend support to this, stating, in the Netherlands, “private responsibility by individual citizens in FRM has not existed and flood risk has never been a subject of public debate.”

Ethical responsibility, also known as social responsibility, is defined as extrinsically motivated by a person’s perception of a group of people who hold influence over them (Frunză, 2011 pg. 156, Windsor, 2006 pg. 99). This group ranges from immediate peers, such as family, friends and neighbors, to the overarching society of the country in which a person lives. Ethical responsibility has the least amount of research supporting it and, as such, serves as the least theoretically supported part of this research. Moral and ethical responsibilities are seen as unique and innovative methods to understand a person’s perception of a subject, including when paired with the established legal precedent (Adger et al., 2017 pg. 17).

It should be noted that there exists overlap between these types of responsibility. Frunză (2011 pg. 160) postulates, “ethical responsibility is related to the deep resources of the individual and the interpersonal relations, while the legal one pertains to public decision and legal regulations at its foundation.” “Failure to observe professional obligations,” they say, “inadequate observance of orders, laws, regulations and instructions may generate not only a moral responsibility for the violation of deontological norms, but also a legal one.” Thus, an overlap can be observed between moral and legal responsibility.

There are also several differences between these types of responsibilities. First, previous research states that professionals can be held accountable largely under the guise of legal responsibilities, than with moral or ethical responsibilities as the latter may reflect dynamic societal trends and experience less institutional support (Adger et al., 2017, Howell, 2016). Because of this, assuming moral and ethical responsibility in UCA is also harder to track, since they are either justified under the persons own subjective ‘moral compass,’ in which they define right from wrong, or under the perceived account of what society expects of them. As such, it is difficult to both instill

and hold people accountable for ethical and moral responsibilities. In addition, moral and ethical responsibilities are viewed as informal compared to legal responsibilities.

The separation of responsibilities into these three categories allows the researcher to understand more nuanced perceptions with which stakeholders may assume responsibilities within P-FRM. Furthermore, they can reveal the perceptions and views of stakeholders, with regard to P-FRM, as to what extent they respond to perceived societal expectations and therefore the relevance of smaller or larger groups as a motivator for stakeholders, and how far P-FRM has reached into the societal conscience and perception of importance as it relates to P-FRM. If ethics are cited as the motivating factor for assuming P-FRM responsibility, these notions support the theory of society as a strong motivating force for stakeholders in P-FRM. In the event that intrinsic perception of P-FRM as important is a strong motivator, that would support the theory of intrinsically originating thoughts and feelings as a strong motivating force for stakeholders to act in assuming responsibility in P-FRM. Furthermore, the inclusion of UCA characteristics in the stakeholders' perceived responsibilities would support the theory of UCA as having influence in P-FRM, either incremental or transformative in nature.

This therefore answers the secondary research question, "What motivations are present for stakeholders to support their assuming of responsibilities in P-FRM?"

2.4.2 Responsibility in UCA in the Netherlands

Stakeholders hold responsibilities, assumed under formal or informal circumstances, which dictate their role in P-FRM. Because of the Dutch Spatial Planning Act, Neufel and Van Den Brink (2015 pg. 866) argue, "the spatial policies of higher-level authorities influence the spatial policies of lower-level authorities." Implemented in 2008, however, the Dutch Spatial Planning Act differs from its predecessor in its fulfilment of a safeguarding function, "providing a legal base for the government, citizens and the business community, regarding the legal possibilities in an area" (Buitelaar and Sorel, 2010 pg. 1). Essentially, local-state and non-state stakeholders have seen their position increase in spatial planning in recent years. Moreover, as costs associated with climate change action rise, and become coupled with increasingly context-specific challenges such as heat stress and drought, this assuming of responsibilities by national state stakeholders, removed from localities, has become a point of contention. Support for context-specific solutions has grown, with Kaufmann (2018 pg. 258) summarizing, "an increase in costs may trigger societal debates regarding the efficiency and legitimacy of current FRM approaches leading to a demand of alternative strategies."

The historically one-sided view of responsibility under a legal framework has resulted in a significant dearth in research surrounding normative motivations for assuming responsibility. An innovative analysis of Dutch stakeholder perceptions under normative guidelines, however, is crucial to capture a holistic understanding of

the current state and adaptive capacity of Dutch P-FRM, and the possible influence of UCA. A theory-practice gap arises here, when theory does not have enough information to make sense of the relationship between two or more variables, in this case the degree by which stakeholders assume responsibilities under normative motivations, any possible influence of UCA on P-FRM and the implications this has for Dutch P-FRM moving forward.

The comparative lack of attention for pluvial flooding is associated with both costs and benefits. The costs include increasing awareness of pluvial flooding in the collective Dutch mindset, as already exists with coastal and fluvial flooding. This awareness currently embodies policies and practices taken by state organizations, such as Rijkswaterstaat and Waternet (Albers et al., 2015). As such, a larger and more diverse mix of stakeholders are now becoming involved in P-FRM, which includes a shifting mix of state, market, academic and civil society stakeholders (Dai et al., 2018, Hoppe et al., 2014, Molenveld et al., 2020). Several changes in the greater FRM and Dutch policy landscape, which partially reflect the narrative of UCA, are responsible for the instigation of these shifts.

One of the most profound changes is the national state reducing their roles in local areas and the formal provision of responsibilities to local state actors such as regional water authorities and municipalities (Hoppe et al., 2014 pg. 7). An increasing trend of bottom-up initiatives supports this action, and is seen as a reformulation of the historic perspective of top-down implementation (Dieperink et al., 2018 pg. 4). Incentives, so called 'soft-power', provided by the national to municipal state, and civil society stakeholders to a lesser extent, are seen as a formal invitation to assume greater responsibility in P-FRM in urban areas (Werners et al., 2009). While conducting their case study on Rotterdam, Root et al. (2015 pg. 711) found that "adaptation to climate change is linked to broader values associated with a stronger economy, local employment and the city's international reputation as a pioneer in technological innovation." While these actions are seen as positive steps in effectively adapting to climate change, it is unclear their degree on the adaptability of local urban systems. "According to one development manager, the focus on creative and innovative strategies has generated ... all sorts of measures, but they have not yet made a plan on how we do it" (Root et al., 2015 pg. 711).

Moreover, research suggests that civil society stakeholders do not have the ability to successfully implement UCA practices in their homes and neighborhoods because they lack resources and greater assistance from the municipal state (Uittenbroek et al., 2019). In their case study of Arnhem, b Forrest et al. (2020 pg. 17) note, "there was a variation in the neighborhoods with some having active and capable citizens who were willing and able to contribute to local pluvial FRM, while in others this did not happen."

Preston et al. (2015 pg. 15) postulate, arguing in favor of adaptation as local phenomenon, that local adaptive capacity must be high enough to allow these goals to be reached. In order for the evolving P-FRM framework to achieve success, moreover, roles and responsibilities of all stakeholders, including expectations and accountability, must be transparent and understood. Increasingly opaque borders have brought into question the responsibility of which stakeholder group for what activity, and furthermore whose responsibility it should be.

Furthermore, while “civil society is taking responsibility into its own hands and seems to be seizing control of the gap the Dutch central government created” (Hoppe et al., 2015 pg. 8), “urgency among civilians to adapt to pluvial flooding still appears to be in its infancy” (Trell and van Geet, 2019 pg. 389). Thus, in terms of civil society involvement, this disagreement in literature points to the influence of UCA in P-FRM as incremental. This therefore answers the secondary research question, “Is there increasing use and focus on UCA, and what is the degree with which it is reflected (i.e. either incrementally or transformative) in Dutch P-FRM?”

This, however, may also be viewed as a window of opportunity. Since there is an under developed societal understanding and pre-defined contextual premise and norms surrounding P-FRM, it may be beneficial for current and future initiatives if the structure of P-FRM can be molded in a manner conforming to UCA discourse. This way, UCA may be able to take a greater influence of the Dutch P-FRM context, thus integrating civil society stakeholders more readily and increasing local adaptive capacity.

Academically, this thesis will contribute to the growing field exploring responsibility attribution within P-FRM (Mees et al., 2012 pg. 322, Nalau et al., 2015, Runhaar et al., 2016, Schneider, 2014 pg. 7). The focus of this research on legal, moral and ethical motivations will help flesh out the picture of what stakeholders from each group deem important, and what influences them. While legal motivations are ingrained in Dutch spatial planning, “it is essential to devote attention to the normative aspects because they,” Driessen and van Rijswijk. (2011 pg. 580) argue, “help to determine the choice between the various policy instruments to be deployed and the measures that need to be taken.” Normative responsibilities are also important in that “there is scope to engage people with climate change adaptation by mobilizing diverse forms of moral reasoning and frames” (Adger et al., 2017 pg. 387).

2.4.3 Shifting responsibility in Dutch P-FRM

The partial transition of responsibilities from national to local state stakeholders has been observed within integration of UCA measures and strategies (Roth et al., 2014 pg. 243). National state stakeholders have become aware of the context-dependent nature of climate change and that their historically dominant role in Dutch

FRM is a hindrance to successful adaptive measures (Mees et al., 2013, Swart et al., 2014). As certain areas suffer from a different combination of climate change impacts, context specificity is one factor promoting the increasing authority of local state stakeholders, in conjunction with market, academia and civil society stakeholders. These stakeholders are better equipped, with context-specific knowledge, to properly understand and adapt to their environments.

Moreover, since they have more localized and specific responsibilities than their national counterparts do, they are able to invest more time and resources per capita to adaptation. This may also include a more nuanced understanding of the social dynamics involved in communicating with specific individual stakeholders operating in their area. At the same time, however, Molenveld et al. (2020 pg. 248) found that “the perceptions on appropriate ways of organizing adaptation are highly divergent.” They go on to state that the establishment of a governance mix goes beyond effectivity, to one that “has the best fit with society, groups of stakeholders, or regions.”

Following this, there are several drawbacks to the allotment of responsibility and authority to local state, market, academic and civil society stakeholders. Because of the budget restraints by the national state, municipalities and regional water authorities are less likely to receive full financial support and accommodation for their adaptation projects. In a chain reaction, the local state would then have fewer resources to contribute to a strong adaptive capacity to ensure appropriate representation of civil society stakeholders. In the absence of support from local state stakeholders, citizens who either are unfamiliar with municipal projects or are not informed of their own potential may fall back on the historical idea of the state as the main facilitators (Hegger et al., 2017). This decreases the likelihood of success for local initiatives, and may lead to an exponential increase in vulnerability for civilians.

In effect, citizens’ true vulnerability to flooding is masked, which leaves them in a position of false perceived security that, in the event of a flood, is likely to decrease response and recovery action, increase property damage and potentially endanger lives. Collaboration and clear understandings become crucial here, as civil society stakeholders may be more familiar with increased flood potential of certain urban areas that they have greater experience with, while municipal stakeholders have greater resources to appropriately implement adaptive measures. Crucially, throughout stakeholder engagement, communication between local stakeholders is essential for UCA, as Trell and van Geet. (2019 pg. 388) describe, “throughout the interviews the relevance of communication and the municipality explaining responsibilities to other actors was brought up.” The lack or poor quality of communication between stakeholders in certain areas is therefore increasingly problematic and, if left unaddressed, flood risk may be compounded.

The complexity of UCA, occurring on multiple levels, and trying to become integrated into the P-FRM system, which includes both older engineering measures

and newer spatial measures, has become apparent. Coordination among state, market, academic and civil society stakeholders is therefore necessary in order to maximize the integration and usefulness of these measures and the overall P-FRM system. Studies suggest, however, that coordination between these stakeholder groups is lacking, which has resulted in a less efficient and less effective P-FRM system (Wiering, 2019). With shifting roles and responsibilities among these stakeholder groups, it is imperative to ensure that all stakeholders are fully aware of their current position within this system, as well as what trends are occurring. Uncertainty is a motivator for this research since the persistence of uncertainty decreases the ability of stakeholders to communicate effectively. To this end, commitment, investment and buy-in are all factors that can be used to ensure the clarity of division of responsibilities, including the boundaries of the responsibilities.

With regards to market inclusion, a number of hybrid governance arrangements have emerged that bridge the public-private divide. These include public-private partnerships, policy networks and co-management (Molenveld et al., 2020). These arrangements between state and market parties have become incorporated into the FRM landscape and, as it currently stands, signify an integral and well-known commodity that allows market parties a greater role in FRM, and gives the state more flexibility in the planning and development of FRM policies and practices. These arrangements are becoming more commonplace and is representative of the movement towards the incorporation of communicative measures.

In their case study on Rotterdam, Root et al. (2015 pg. 714) cite climate adaptation as a market opportunity in overcoming “reduced financial resources and a shifting role of the public sector in spatial planning” facing Dutch planners. In this context, the applicability of market involvement via investment becomes clear. Thus, market stakeholders are slowly but steadily seeing their roles and responsibilities in FRM increase. Whether this is understood as such by other stakeholder groups has yet to be fully determined, and this research will contribute to this.

Academics, meanwhile, have remained on the forefront of research concerning the topics of P-FRM, UCA and responsibility perception and attribution. There persists, however, a science-policy gap whereby academics and state stakeholders lack communication and collaboration regarding the effective transference of scientific research to the policy and practice domain. For this reason, academics are included in this research for their unique perspective on the research topic to which they can contribute. Furthermore, Dutch professionals who work in two of the aforementioned stakeholder fields at once can offer a perspective that accounts for two stakeholder groups, which they travel between dynamically.

2.5 Syntheses and Conceptual model

Adaptive capacity within pluvial flood adaptation

Adaptive capacity is understood in this research as the ability of stakeholders in an area to provide services that appropriately handle unavoidable and increasing pluvial flood risk, wherein incremental or transformative adaptation are assigned depending on the degree of adaptive measures. The relationship between adaptive capacity and responsibility is understood as; the greater reported stakeholder motivation in accepting responsibility connected to UCA, as well as the greater shift towards inclusion of civil society stakeholders, the more transformative the adaptation (Roggema et al., 2012, Wamsler and Riggers., 2018 pg. 86). In addition, adaptive capacity can be measured by the connectivity established by stakeholders. Connectivity between stakeholders, associated with the allotment of greater responsibility to stakeholder groups such as citizens and their subsequent integration into P-FRM discourse on local levels, is another measure used for adaptive capacity.

In general, the more the system has evolved to include elements that belong to the UCA discourse, including the above mentioned scenarios, then the stronger the adaptive capacity of the Dutch P-FRM system is and the greater weight it holds toward transformative adaptation. However, the less integration that stakeholders experience with each other, based on their perceptions, as well as the amount of responsibility that still lies with state organizations, then the Dutch P-FRM system has lower adaptive capacity and thus is weighed towards incremental adaptation. It should be noted that singularity does not exist in adaptive capacity, meaning that one variable cannot account for a system experiencing either high or low adaptive capacity, and instead it is the confluence of numerous variables and the degree by which they are measured.

Furthermore, any conclusive remarks surrounding the degree of adaptive capacity of Dutch P-FRM are done so under the guise of their exploratory nature. The exploratory nature of this thesis makes it impossible to reach a definitive conclusion where this relationship stands, as only a few points are studied in detail. The incremental-transformative dichotomy is purposely placed within the conceptual model, however, in order to present a full picture of the nature of UCA in P-FRM as it is understood at this time. Responsibility is understood as a key variable of this relationship, and as such is used in the determination between incremental and transformative adaptation. While this research seeks to understand the relationship between UCA and P-FRM, it also seeks to present the most accurate and complete understanding of the subject, even if that means leaving gaps for future research to continue.

Responsibility and perception

Instrumental and normative responsibilities (i.e. legal, moral and ethical), cited and perceived by stakeholders, will reveal the degree of adaptation within Dutch P-FRM, and thus the influence that UCA has had on it. The perception of these

responsibilities under normative guidelines currently experiences a dearth of research and, as such, may reveal insights that have yet to be discovered. The current research recognizes the context-specific aspect of UCA and that, even in a small country such as the Netherlands, practices vary considerably under the influence of economic, social, environmental, cultural and governmental factors. The exploratory nature of this research, therefore, must be stressed.

This research will promote academic understanding of the impact UCA has had within P-FRM, as well as general stakeholder views on responsibility and their motivations. Importantly, this thesis seeks to deliver a baseline with which further research may use as a foundation. Any conclusions made in this research concern only the data collected, as part of an exploratory study, contributing to expanding dialogue, which may be useful to larger quantitative studies. What follows is a conceptual model that combines the previously described factors into one coherent figure, which will set the stage for readers to understand the findings, the discussion and conclusion.

Conceptual model

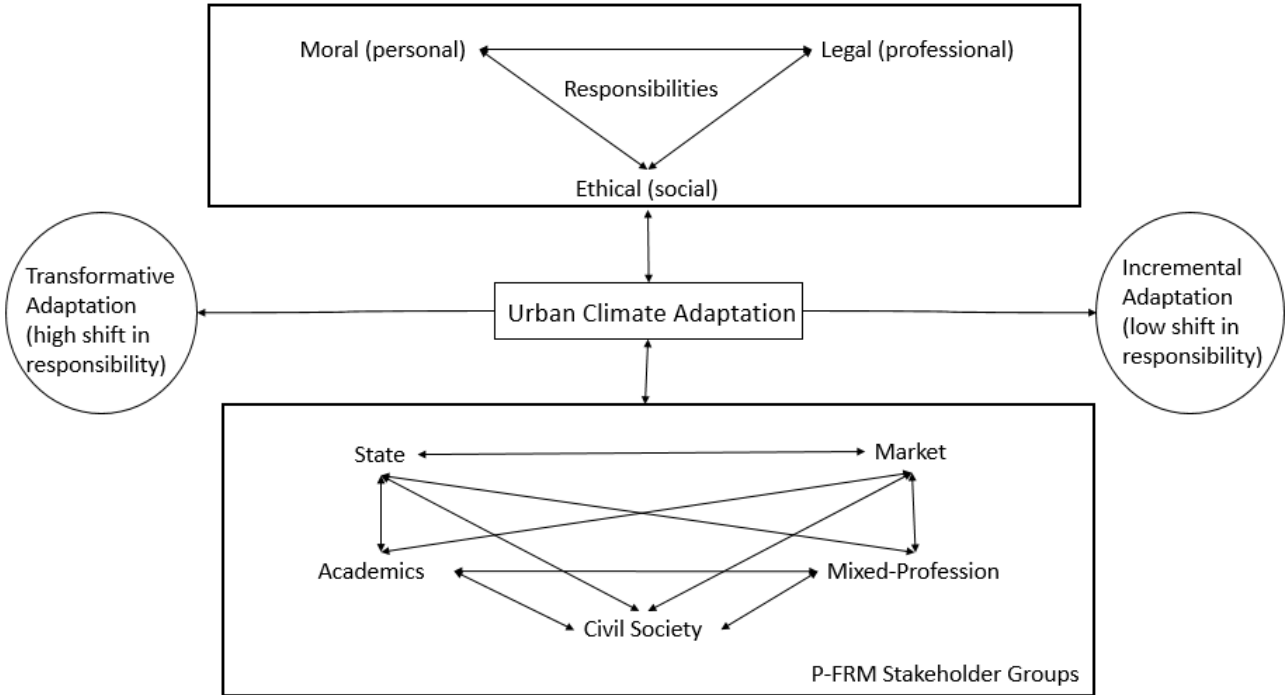


Figure 1. Pluvial Flood Risk Management Conceptual model. (The top box represents connections between the three types of responsibility, while the bottom box represents connections between stakeholder groups. Lines extending from these boxes to the middle box represent the exchange of these areas between UCA, and finally whether it equals transformative or incremental adaptation.)

3. Research methodology

The current research used an exploratory case study approach to undertake a preliminary investigation regarding the impact that UCA has had on Dutch P-FRM, in particular through the perception of the division of responsibilities. In this regard, the findings are used to fulfil the primary goal of determining stakeholder self-perception of responsibilities and thus inform the reader of preliminary impacts on P-FRM via UCA. The subjective value each stakeholder attributes to their responsibilities was determined by self-report, the answers given to the research questions. A case study approach was taken and the data for the thesis comprises a mix of evidence from pre-existing research, presented in the form of a literature review, and semi-structured interviews. This methodology allows a case study to obtain maximum effectiveness in gathering relevant viewpoints necessary for a well-structured research protocol (Yin, 2003 pg. 63). The following section will provide information on the two data collection methods, including how the data was analyzed, thus providing the rationale and justification for this research.

3.1 Case study research approach

This thesis uses a literature review to understand the theoretical base and practical achievement of P-FRM in Dutch urban areas. Within qualitative research, perception of reality as based on sociality and dynamism is strong and emphasizes individual variance (Yin, 2003). There are two reasons supporting the choice to use qualitative data in this research.

- First, background research supporting the understanding of the influence of UCA discourse on Dutch P-FRM, including policy and practice, is sparse. O'Leary (2013) states preliminary case study research at a local level is helpful but uncommon. Factors supporting this insufficiency include a comparatively weaker focus on P-FRM than with coastal or fluvial FRM. UCA is also a relatively new topic within climate change research, policy and practice, and therefore uncertainty persists in its impact on P-FRM (Brockhoff et al., 2019 pg. 11, Penning-Rowsell and Korndewal, 2019 pg. 7).
- Second, by using a qualitative research approach, this research targeted the value that interviewees placed on UCA in P-FRM through their perceived responsibilities. Although smaller sample sizes prevent qualitative research from obtaining statistically verifiable figures regarding general population views of a subject, the depth of material uncovered from each interviewee balances this and allowed the researcher to obtain findings in standing with the research's preliminary and exploratory nature.

The current research utilized information from multiple sources, academic, media and state related, to develop a holistic framework necessary for answering questions of “how” and “why” which are especially relevant in case study research according to Yin (2003). Furthermore, the use of a case study as research methodology was important when studying multi-faceted social phenomenon, such as stakeholder perception of responsibility and its connectedness with UCA impact on the area of work. The focus was to fundamentally understand why a phenomenon is occurring, including underlying notions, beliefs, traditions and norms of the research subjects (Kokx and Spit 2012, 2012 pg. 183).

Having a foundational research question will help focus data collection.

Does UCA impact Dutch-PFM, and, if so, in what ways; particularly through perceived responsibilities on the part of stakeholders?

In order to explore stakeholder perceptions of responsibility in P-FRM, semi-structured interviews were employed as the main method of data collection. Furthermore, three principles supporting the case study protocol from Yin (2003), are provided below.

1) Use Multiple Sources

The motivation of using multiple sources of data is promoted by the idea that several sources and types of data present a holistic representation of the research. By using pre-existing literature and semi-structured interviews, differing perspectives were collected, compared and contrasted, ultimately supporting or disqualifying claims. A literature review was used to promote the theoretical background of the topic, while semi-structured interviews explore the topic in practice, expanding upon previous research. Moreover, different stakeholders with contextually specific backgrounds yielded varying perspectives necessary for a diverse and holistic benchmark study.

2) Create categories and a case study database

Proper organization is critical throughout the process, both before and after data collection. An organized database and code tree allowed for storing raw data and categorizing it using the MAXQDA analytical software, as well as validating findings, thus increasing overall reliability and strength of the study. Using this process, the transformation of data from a raw to an organized and presentable form was formally observed.

3) Maintain a chain of evidence

This enables readers to observe a dialogue, from A to Z, in which each step is explained with full transparency. This is achieved through the use of a clear research design: proper referencing, describing steps and procedures in data

collection, and ensuring the accurate reflection of data in answering research questions. In effect, providing the reader with the path taken from start to finish.

3.2 Unit of analyses

The geographical unit of analysis is the Netherlands, which is represented by Map 1.



Map 1. Geographic map of the Netherlands with emphasis on the pluvial flooding in centimeters. Over 8 million buildings were rated between A (small flood risk) and E (high flood risk) in determining the pluvial flood risk of each area. The maximum flood risk in dark blue is 35 centimeters. (Klein Tank et al., 2014)

This outline forms a spatial boundary of the case study area that will be studied. Due to the exploratory nature of this thesis, the entire country was chosen in order to obtain a snapshot portraying the status of Dutch P-FRM. Future research may be more specific in terms of geographic and stakeholder aims. The choice of the Netherlands is supported by three reasons. First, pluvial flood risk is increasing in urban areas across the Netherlands (Goosen et al., 2014). Second, discourse around transitions and

changes within climate change governance, affecting policy and practice, is ongoing, and represents a level of awareness and openness within Dutch society (Bergsma et al., 2019 pg. 102). Third, the researcher is familiar with the Netherlands and is well connected with several stakeholder groups within Dutch P-FRM. The theoretical scope was defined by means of a literature review, while the practical scope was defined by semi-structured interviews. P-FRM, UCA, responsibility and perception form the key concepts guiding this research. Together, this research and data collection formed a unique snapshot, or time boundary, of the all interviewees' perceptions, thoughts, ideas and actions of P-FRM. The research was conducted from 02-2020 to 08-2020, with data collection performed between 07-2020 and 08-2020.

3.3 Data collection methods

Literature Research

Literature research was the first step taken, allowing the development of an understanding of pre-existing discourse and trends in the subject area (O'Leary, 2013). This was performed between 03-2020 and 06-2020, with the primary source of literature being scientific journals. Analysis of several state documents, in English, was also undertaken to provide a contextual backbone to the literature review. This not only aided the researcher in understanding nuanced specificities of the Dutch context, and therefore follow up in interviews more effectively, but also to successfully disseminate the findings supported by context-specific background research.

Semi-structured interviews

The qualitative method of data collection, with semi-structured interview questions, was chosen for this study. Qualitative research methodology with an emphasis on explaining the intricacies of "how" subjects think and "why" they behave in certain ways was particularly instructive for the topics under study. A semi-structured interview format provided a framework, or scaffolding, to outline and guide the process of exploring the issues at hand without the rigidity commonly found with the structured interview. A semi-structured interview allowed the interviewer to present a theme for exploration, and in turn allowed the interviewee flexibility in answering.

Should any answer stray from the theme too much the interviewer was able to guide the process of data collection through such tools as: follow up questions, asking for details or explanations, having the subject focus with greater precision, among others. By utilizing open-ended questions to guide the interviews, interviewees were allowed to expand on their answers fully and until satisfied; in cases requiring clarification or redirection the interviewer was able to address the subject immediately. As this type of research is useful to uncover the "how" and "why"

questions associated with behavior it can help to reveal underlying details associated with the complex issues of actions and behaviors, and particularly the effect of context on the subject's beliefs and thus answers presented. The framework of a semi-structured interview and open-ended questions provided multiple avenues for exploring and gathering data on an otherwise complex subject matter. The qualitative methodology provided the best opportunity to gather information robust enough to explain the complex issues at hand.

A set of twelve interview questions were developed, some with specific sub-questions which allow for more detailed and nuanced answers in a particular area to be made. The complete interview guide can be found in the appendix. An information sheet was presented before the interview, specifying the research parameters and allowing potential interviewees to prepare their contribution. At the beginning of each interview, interviewees provided a verbal declaration of consent for anonymous data usage. All intentions of the research were made clear, and interviewees were given the option to withdraw their consent at any time. Due to COVID-19 travel and work-related restrictions, seven interviews were conducted using Microsoft Teams, five were conducted using Google Meets and two were conducted in person.

3.4 Interviewees

Core state actors in the P-FRM network

The core state stakeholders this research focused on are officials involved in regulatory and management roles. These stakeholders represented working professionals in the field, standing on the front lines when it comes to decision making at national and municipal levels. The perspective of state stakeholders is also important given their strong position in P-FRM.

Core market actors in the P-FRM network

The core market stakeholder this research focused on are advisory and consultancy professionals. Research suggests that these professionals are in frequent contact with municipal stakeholders and therefore offer a perspective, which allowed them to account for the municipality more directly, through experiences of shared interaction, when stating their perceptions (Francesch-Huidobro., 2015, Van Herk et al., 2011).

Core academic stakeholders in the P-FRM network

The core academic stakeholders this research focused on were university faculty responsible for both instruction and research, whose main concentration in the subject of P-FRM and UCA overlapped with this thesis. Notably, non-partisanship and objectivity, coupled with expertise in their respective subject areas within P-FRM, allowed academics to make unbiased, scientific and informed comments on how UCA

is understood within Dutch P-FRM, and which stakeholders are responsible for what tasks.

Mixed-profession stakeholders in the P-FRM network

The mixed-profession stakeholders comprise a group that has received scant attention in previous research into this subject, but which is a commonly observed phenomenon in the Netherlands (Reinders et al., 2018 pg. 376). Mixed-profession stakeholders are defined as professionals who work concurrently in two or more stakeholder fields, be it state, market and or academia and who may have connections with civil society. These professionals are an integral part of the Dutch workforce and as such, their perceptions offered interesting insight that differed significantly in form and substance from professionals who are employed in one field strictly throughout their career.

Table 1. specifies the organization of the interviewees, their profession, the role they assume and the time the interviews were conducted. Fourteen interviewees in various P-FRM roles were selected. They originate from Academia, Market and State, with some working in a mix of these fields and thus comprising the mixed-profession stakeholder group. Table 1. specifies these categories. The academic stakeholders comprised three university faculty in the fields of Sustainable Development, Flood Risk Management and Environmental Governance, and one PhD fellow in Spatial Planning. The market stakeholders comprised advisors and consultants working in climate adaptation and urban water management for Royal Haskoning DHV.

The state interviewees comprised professional staff members from Rijkswaterstaat (Ministry of Water and the Environment), the Delta Program on Spatial Adaptation (acronym DPRA, issued by the national state), and Waternet (an enforcement arm of the Delta Program). Two mixed-profession stakeholders employed as private consultants and adjunct professors and one is employed in disseminating academic research and in advocacy as a community organizer were interviewed. Together, these interviewees provided a robust cross section of duties, and insight into the perceived responsibilities across various roles involved in the study and implementation of Dutch P-FRM.

Interviewees	Organization	Interviewee role	Date of interview
1-Academic representative A	Utrecht University	Professor	29.07.2020
2-Academic representative B	Delft University	Professor	29.07.2020
3-Academic representative C	Utrecht University	PhD Candidate	28.07.2020
4-Academic representative D	Utrecht University	Professor	16.07.2020

5-Market representative A	Royal Haskoning DHV	Consultant	21.07.2020
6-Market representative B	Royal Haskoning DHV	Advisor	23.07.2020
7-Market representative C	Royal Haskoning DHV	Consultant	21.07.2020
8-Market Representative D	Royal Haskoning DHV	Advisor	03.08.2020
9-State representative A	Waternet	Consultant	05.08.2020
10-State representative B	Samen Klimaatbestendig	Advisor	04.08.2020
11-State representative C	Rijkswaterstaat	Advisor	17.07.2020
12-Mixed-profession representative A	Hanze University, Deltares	Professor, Consultant	06.08.2020
13-Mixed-profession representative B	Royal Haskoning DHV, University of Rotterdam	Advisor	06.08.2020
14-Mixed-profession representative C	Wagneginen University, Amersfoort Community	Project Manager, Community Organizer	10.07.2020

Table 3. Order of interviewees based on stakeholder group interviewed

The interviews lasted between 45 minutes to 60 minutes. They were recorded using the Audacity recording software and later transcribed verbatim into Microsoft Word.

3.5 Data analysis and interpretation

Data analysis and interpretation was conducted to formulate raw interview data into presentable findings and conclusions, which answer the research questions, and concisely portray the interviewee's thoughts and perceptions. This process follows inductive reasoning, where research questions are determined that is used to generate findings. Upon transcription of the interviews in Microsoft Word, interviews were uploaded to the MAXQDA 2020 analysis software. A list of categories, indicators, criteria and sub-criteria were compiled from the literature review beforehand. Furthermore, in case an indicator was discovered during the data analysis that had not been added prior, it was added to the code tree during data analysis. These are marked in red in the code tree table 2.

The conceptual model, a framework for understanding this research, was used as inspiration and grounding throughout data analysis, to keep a sharp sense of the research constant throughout. Coding of the interviews generally took between 45

minutes to 75 minutes depending upon length and depth of answers. Interpretation of the answers was performed by analysing the code tree and highlighting the word or quote under the proper code. Once all of the coding was performed and important passages identified, quotes were added to written text to explain findings of the research.

4. Results

This section presents the empirical findings of the thesis research. An overview of the case study comes first, followed by the understanding that interviewees have on UCA and how it applies to Dutch P-FRM. Then, a description of interviewee perceptions of formal and informal aspects of responsibility within their professions will shed light on the impact of UCA in P-FRM. Interviewee's perceptions of responsibility as applied to their respective colleagues will also be presented, detailing the extent to which matches exist between perceptions of responsibility in self and others.

4.1 Interviewee perceptions of UCA in P-FRM

Academia

Academic institutions and research is predominantly conducted in an objective and bias free environment. This non-partisanship, coupled with expertise in their respective subject areas within P-FRM, allows them to make theoretical and informed comments on how UCA is understood within Dutch P-FRM. Academic A posits, *"While general FRM takes place at the national level and concerns flood safety and related issues that the Dutch have been dealing with for ages, pluvial flooding is much more of a local issue and a responsibility of the local government and citizens to deal with. In that sense, it is one of the core issues of climate change adaptation at the local level."* Academic B and C support this conception as well, with Academic B adding *"the prevention of wateroverlast"* to their perception and that *"the current system is not designed to handle the big flood events."*

Academic D offers a somewhat more abstract view in stating, *"In the Netherlands, everything is water, which also leads to bias... Dutch policy makers can think they are doing a good job in terms of urban climate adaptation, and that everything is being addressed. Pluvial flooding is institutionalized... There is still a lot to win."* Thus, Academic D alludes to the work that lies ahead while, at the same time, the gain that is also available. Several themes reoccur throughout these responses, one of them being the perceived dominant role of policy makers in local P-FRM, which is referred to as *"institutionalized"* in that it is already embedded. General academic perception is that, within policy and governance, UCA is a national issue while P-FRM is a local issue. A more nuanced set of opinions arise as academic interviewees offer varying responses on whether residents or regional water authorities have a role in local P-FRM in collaborating with municipalities to implement solutions.

Market

This category is comprised of consultants whose primary duty lies on the implementation specifically in the areas of UCA in P-FRM. Market A perceives UCA in P-FRM as, *“Giving guidelines to the municipality to take these measures... We must adapt now so we can cope with the situation in 2050, and this is my understanding of urban climate adaptation in general, is to think of the future.”* On a different note, Market B notes, *“The most important item is what you accept and what you do not accept. It is all about norms. There will come a point, due to cost and space, when you must accept that flooding will occur at a higher frequency.”*

Market C somewhat differently cites, *“Using the knowledge we have now, combined with uncertainties, and forming and taking every chance to optimize a messy system,”* paired with a long-term perspective, as how they understand UCA in P-FRM. In a nod towards innovation, Market D observes, *“We are noticing that our clients are purely focused on the flooding aspect, and we try to think of it in a broader, multi-dimensional perspective.”* Here, Market D is saying their clients focus entirely on rainwater flooding and the damage caused, but as consultants, they try to think in terms of broader factors such as heat and drought, which may affect practices. Several trends and reoccurring ideas are present throughout these responses. First, referring to UCA in a future-oriented fashion is observable. Second, acknowledging the dynamic and increasingly uncertain nature and rising risk profile of climate change is also observed. The idea of norms is brought up, owing to the cultural embeddedness and acceptance of P-FRM. Overall, market interviewees perceive UCA as being understood within a larger area of factors and influences, those that must be dealt with in a long-term and holistic manner.

State

State respondents generally focused on the increasing greater and stronger rainfall events and the general belief that the scope of their projects had to grow in scale in order to accommodate greater rainfall events and resulting damage. State A explains, *“Rainfall is heavier and in shorter periods. Something needs to be done to prevent that, and adaptive measures are considered for this.”* State B similarly notes that, *“it is raining more in one particular time. In order to make areas ready, you need to focus on the whole public field, the roads and the green. It is a collective item (they mean that any single rainfall event is increasing in intensity, thereby creating greater damage to the collective of all infrastructure, which includes such structures as roadways, greenspaces, and public fields etc.)”* When asked to speak on the scope of projects, State C believes that, with regard to heavier rainfall, *“it is very diverse. There is an enormous range from incremental adaptation in urban environments up until how do you fundamentally adapt to the urban system.”*

In these responses, there can be observed an overarching understanding that UCA is considered as a strategy to cope with extreme rainfall events. The descriptions used, however, are different with each interviewee. State A, for example, uses “prevent” to describe use of adaptive measures in P-FRM, which reflects the technical

paradigm of keeping water out. State B and C, meanwhile, use terms such as “*make ready*” and “*accept*,” which reflect a more nuanced understanding of UCA. Moreover, the ideas of “*rethinking*” and “*fundamental adaptation*” are used by State B and C, further supporting the foundation of UCA.

Mixed-Profession

When asked about how UCA is understood in P-FRM, Mixed-profession A proposes, “*It is adapting to a changing climate involving more intensive rainfall that we haven’t predicted. We need to give water more space*”. In a supporting statement, Mixed-profession C states, “*The key words (when speaking of UCA within P-FRM), I would say, are concrete, stones and paved areas, in the Netherlands... citizens are becoming aware and transforming their own areas.*” Mixed-profession B takes a slightly different stance in citing the changes that have occurred, “*we have the Delta Program with the secondary Delta Plan on Spatial Adaptation. They are asked to do climate stress tests, and this is the focus in many municipalities. Currently, they are in the risk dialogue part of the process, including challenges and strategies for implementation in urban areas.*” There seem to be several interpretations of UCA in P-FRM, using different points, however an overarching theme of discarding physical barriers for more spatial approaches is observed.

4.2 Stakeholder responsibility in the Dutch P-FRM landscape

The following section provides insight into interviewee responses to questions concerning the P-FRM landscape, including possible changes in connection to climate adaptation discourse. It also includes responses of interviewees concerning the perception of their own responsibility in P-FRM and of others, and how this has been shaped by formal legal motivations, followed by informal ethical and moral motivations.

Academia

Academics perception of changes in P-FRM landscape

When asked if they thought P-FRM is changing in the Netherlands, academic interviewees responded with a resounding affirmation. Academic A echoes their collective response, stating “*there is a clear shift of thinking between grey infrastructure to green infrastructure.... and a much higher emphasis on and room for nature based solutions. This includes Wadi’s, permeable pavements and green roofs. As a result, there is a shift in thinking about whether it is the responsibility of the local government to increase the capacity of the sewage systems, or whether there is a role*

for citizens and other types of actors who own a lot of property and who can, in effect, also contribute to pluvial FRM with their properties.”

Academics perception on the distribution of roles and responsibilities in Pluvial FRM

Municipalities and water boards were perceived as the main proprietor of responsibility in P-FRM on the local level. Academic A noted that municipal governments are the de facto stakeholder in terms of the tasks they perform. They continue by saying that municipalities take responsibility where legal obligation is not present. Academic C says, in a similar vein, *“after heavy rainfall, local governments will help using city systems and financial assistance”* whilst acknowledging that this behavior, which is not necessarily required of municipalities, is the result of traditional 20th century expectations of government. Academic C directly addresses the concepts of Wateroverlast and Overstroming, citing Wateroverlast, as a subject that citizens look to municipalities for.

Academics cite sewage and drainage systems as one of the main areas where municipalities can actively create a difference in local P-FRM. For example, Academic D states *“it used to be combined sewers, and then the sewers were gradually separated. These changes cannot be made overnight and more often need to be made by professionals who have specific professional rating. Of course, I think it is safe to assume that the actual practices on the ground are lagging behind the changes in policy discourse.”* An important distinction is made in addressing the requirement of professional experience, and the apparent knowledge gap between municipalities and citizens in this case. The idea of sewage and drainage systems belonging to the municipal government is supported by Academic C, who says *“improving sewage systems and drainage is on the governmental side. Those systems should be changed and improved in order to increase capacity for pluvial flooding.”* This falls in line with the understanding of public space in local municipalities, where any infrastructure located in the public domain is the responsibility of the local government (a Forrest et al., 2020).

There is an increasing role for citizens as part of the changing P-FRM landscape, although not all academics are convinced of the manner and degree by which citizens are becoming involved. Academic A has observed an attempt by municipalities to transfer responsibilities to citizens, however they *“are hesitant to actually give them that responsibility because they ultimately feel responsible, for upholding the law, in terms of accountability.”* Academic D indicates civil society organizations and citizens as having the potential to make a *“huge contribution by helping out in their garden and removing tiles,”* however they observe that the municipalities *“are still struggling about how to involve them.”* Academics cite problem awareness as one of the main barriers to taking responsibility. Academic C sums this up, stating, *“Dutch citizens grow up with the knowledge of flood risk, generally, but the actual understanding of the*

impact of dangerous flooding is limited. That is also because the governmental organizations tend to communicate that we will be fine."

Academics' perception on the influence of formal and informal criteria on the division of responsibilities

Academic interviewees largely assume their responsibilities via intrinsic moral motivation, which, as Academic D regards, *"the fact that I know about climate change... is something that gives me more responsibility to do something."* They cite knowledge, skills and resources as determining factors in assuming responsibility on moral grounds. Academics have also stated their motivation by ethical responsibilities in their research, albeit to a somewhat lesser extent than moral responsibilities. Interestingly, although moral responsibility is cited as a potential motivating factor in civil society, and is observed in front runner activity, academics find that the actual assumption of responsibility on moral grounds is rare. On this note, Academic C suggests that incentivizing action in civil society under the guise of moral or ethical responsibilities is not correct, and that *"it should be more focused on what citizens can actually do, what the effectiveness of the measures are, why they should do this, which is much more valuable."*

Academics agree that legal responsibilities are the direct motivation of municipal state to take action, citing the Dutch constitution as well as municipal law in support of this. Responsibility influenced by ethical consideration is also cited as a motivating factor of local state, however Academic A states *"I am not sure whether they fear the pressure of society, or whether they fear the implications of being liable and accountable when the situation is bad."* Academics also highlight the existence of legal precedence for civilians on private property, but cite civilians as less motivated by such legal requirements. This view of legal precedence is supported by previous research, stating that civilians have some recourse for action with regard to land that they own and when the effects are not grave (a Forrest et al., 2020). Academic D, however, provides reasoning for this supposed lack of assumption of responsibilities by civilians, noting, *"There may be a difference in extent of awareness of different stakeholder groups' legal responsibilities. Certainly, everyone will have his or her own implicit assumptions with regard to moral responsibility."* Ethical responsibilities are also observed to be assumed by the municipal state, who act as the elected governing body of their respective constituencies.

Market

Market perception on changes in P-FRM landscape

All market interviewees perceive the field of P-FRM as evolving. A variation in terminology used to describe this trend, such as shift and transition, indicates

vagueness in the degree of evolution that market interviewees perceive to be taking place, however. State and civil society are observed as the main drivers in this trend, with both perceived as placing greater emphasis on P-FRM in the past five years. Market C and D stress the importance of the Delta Program in promoting change, specifically focusing on the creation of the DPRA and addition of urban planning. In their acknowledgement of state as the driver, Market C sees the DPRA as *“one of the most accepted ways of viewing climate adaptation strategy”* and that it serves as a foundational platform with which to view short and long-term iterations in adaptation regarding P-FRM. Moreover, the DPRA is cited as the main promoter of stress tests and risk dialogues within municipalities, with six short-term six-year iteration loops guiding municipalities until 2050.

Technology is also cited as a prominent factor in enhancing this evolution. Market A and C concurrently stress that current innovation would have previously been impossible due to *“the absence of 2D modelling software”* in mapping water flows and gathering points. In terms of obstacles, market B regards the division of space, in public and private domains, as a challenge in that municipalities alone cannot afford to cover the comparative lag in private spaces. As they put it, *“Our inhabitants should act themselves, on their own private property. That is a huge difference because, as a government, you have to acknowledge that you cannot solve this problem, you throw in the towel. We are proud of being masters of the water, but there will be a moment when we realize that we cannot continue the same way in the future, because the climate is changing too much. We cannot continue physically, and it is too expensive to solve the problem in the public space. This is an enormous change”* (Market B). Lastly, Market B mentions both market and state as understanding the importance of private-land integration, pointing to a perceived overlap in approaching the issue.

Market perception on the distribution of roles and responsibilities in P-FRM

All four market interviewees work in advising and consulting roles, mainly assisting municipalities. Therefore, most of their work focuses on market-state interactions. In this vein, market A specifies that they *“advise the municipality and it is then the responsibility of the municipality to include their civilians in the plan. That is where our job stops. We advise the municipality about questions they have in designing their system, and are not involved in later stages.”* The direct comment regarding municipal responsibility to involve civilians suggests market stakeholders view civil society as able contributors. In a more specific manner, however, Market B recognizes the state as struggling to involving citizens.

“First, the citizens have to know, then they have to want to work on the problem, then they work on the problem. Many citizens do not know about the problems within pluvial flooding, and if they do know, they still don’t know what exactly they can do about it right now. This is a difficult part, to give citizens a perspective to act. What

should they do, and what does it help and cost for them to engage." Market C further contends that few citizens are involved in adaptive measures, which, they say, is problematic due to the amount of land in the private domain. This is appropriately summed up by Market D, who refers to the question of "how do you transfer your responsibilities from the state to individuals?" as the main challenge currently being dealt with.

Market C cites private contractors, who have direct and sustained contact with citizens, as being responsible for explaining the benefits of adaptation to citizens, the side effects, and how they should act. They also state that private institutions will only take responsibility if it is beneficial in the short term, and that larger institutions, such as banks, will not pay for climate adaptation. Regarding state responsibility, Market B and D cite all four regions of the state, including national, provincial, water boards and municipalities, as judicially responsible, but state that action must be taken on the local municipal level.

Market perception on the distribution of responsibilities based on formal and informal motivations

Market A, B, C and D cite legal, moral and ethical motivations as reasons for their assuming adaptive responsibilities in P-FRM. As Market D puts it, *"It depends on the situation. If you hire us as a company then of course we have a legal obligation to fulfil the project."* In addressing their moral responsibility, Market C cites their education and research, including the consequences of climate change, as promoting an intrinsic motivation. Market A recalls statements from their company, which allow workers the right to conscious objection to projects, which they deem unfitting with personal and or company values, in a sense freedom of intrinsic expression.

Market C states that, with a growing focus on adaptation from civil society and state and societal expectation, ethical motivation has increased both in them personally and in their company as a whole. They stress, however, that, *"the company sees it as a gold mine in terms of marketing,"* providing support to previous statements regarding short-term benefits and, concurrently creating uncertainty regarding the true intentions of the market in this situation. It also presents a possible gap between thoughts and motivations of practicing consultants, compared to those of executives.

In speaking with stakeholders, Market B suggests finding the facts and the law, *"these are the first two starting points in a dialogue and conversation with stakeholders. Then, you find out what they are willing to sacrifice."* However, they continue, *"if they say no, then that is their choice. This is a moral choice from the stakeholders and an ethical choice for you."* Clear boundaries are drawn here between the giver and receiver, suggesting a nuanced understanding of each motivation. There is also a differentiation made by Market D who states, *"ethical responsibilities have to be translated into legal responsibilities. It is not ethically acceptable to rob people, but*

we need this written in law in order to have a functioning society. Otherwise, we cannot hold people accountable.”

State

State perception of changes in P-FRM landscape

From the extensive knowledge and experience operating in the state domain in the MRA (metropolitan region Amsterdam), State A and C perceive the P-FRM landscape to be changing. In acknowledging that state alone cannot solve the problem, State A believes the government has communicated effectively to involve citizens. In the span of 10 years, Amsterdam Waterproof, and Waternet more generally, have evolved from the assumption of government control to currently engaging citizens in P-FRM, *“that is changing, in a good way”* (State A).

State C specifies that, with growing pluvial flood risk and threat of overflow in either the municipally managed drainage systems or the nationally managed Rijn canal, *“there arises the discussion of how do we, as a national water manager, advise the municipality and water board because this water system is up to its limits. There is a challenge of how to connect urban growth with water management. That is new for us, for the municipality and local water boards as well, and we really have to figure out how to do this”* (State C). Furthermore, although State B cites the public area as having undergone many changes in their 10-15 years of experience, they contend that, *“You really have to see it, to be a part of the change I believe,”* which may be telling for areas that are not as quick to innovate and become active.

Perception of State on the distribution of roles and responsibilities in P-FRM

The state, including national and local departments, is perceived as holding primary responsibility for UCA. State A, B and C perceive a similar distribution of responsibilities, with citizens responsible for their homes and gardens, Regional water authorities managing discharge systems and municipalities financing projects in the public space. Regarding the focus on the local state in this distribution, State A stresses that, *“if you remain at the local level, then you will only stay at incremental adaptation of the environment. You have to zoom out, look at the future and have your knowledge base in place. That is the responsibility, I see, of the state. Therefore, this transformative adaptation can only take place on a national level.”* They go on to state that, while the technical and communicative rationales are viewed as separate entities, you cannot separate them and *“you need a way of systems thinking to connect the dots and zoom in on a local or measurement based level up until how is the entire system functioning and how this system is connected to other systems.”*

Across stakeholder groups, State B makes note of an ongoing discussion between municipalities and insurance companies concerning the rising cost of

homeowners insurance and at what point does the municipality become responsible. Similarly, State A notes that some municipalities mandate stipulations in which project developers must incorporate green space and account for extra surface water in their plans. The advancement of stress testing and risk dialogues are hailed as a new and innovative step, which provides *“a plan... where problems are sorted into an order of severity”* and can give all stakeholders a forum with which to better express their stances (State B). Beyond this, however, lies a deeply rooted problem of strictness in the distribution of responsibilities which State A describes as *“pretty divided and that is what makes it difficult to tell everyone to act in a way that is future proof. We are trying, but every kind of aspect is paid for by another party.”*

State perception on division of responsibilities based on formal and informal criteria

State A, B and C view themselves as motivated by legal, moral and ethical responsibilities, with an intertwining and sometimes clashing perspective of legal and moral motivations in their work. State A explains how, under the guise of moral motivation, they and their colleagues transformed the Regional Water Authority legislation. *“You could allow project developers to make changes... but the total difference between in and out flow should not exceed 40 cm. That also means that if we at the Water Authority take measures to make a lower difference, then the project developer can use that space again for making the system worse.”* Now, they say if, in an area, *“the difference is 2 km per 1 cm, then we need to make the water system better and project developers cannot do anything to make the situation worse”* (State A). Effectively, the legal basis and approach has transformed from viewing the system as a whole, to a granular focus on the appropriate balance in small, combined areas that compose the system.

The approach to communicating with other stakeholder groups is also cited, with conflicting views of legal and moral responsibility. When private homes flood, state B notes, *“Legally, I have to say that we are not responsible. Morally, however, I think we could have done better but if I say that then I make a precedent and it is very risky. You have to separate your feelings from your work, and walk on a thin line. It is very difficult because municipalities are not based on morality, at all.”* They then spell out a softer approach to inter-stakeholder communication; *“you don’t start with a legal form. If you do, you will be kicked out of the house.”* On a similar note, State C recalls that, *“we do see a passion in the market individuals we work with to create a better world.”* These conflicting views of traditional stakeholder perceptions and legal-moral challenges may be telling of what changes are to come, specifically regarding greater understanding across stakeholder groups, and breaking down conventional barriers such as misconceptions and preconceived notions of each other, which hinder communication.

Mixed-Profession

Mixed-Profession perception of changes in P-FRM landscape

Mixed-profession A, B and C perceive the separation of sewage and drainage systems as the primary change in the P-FRM landscape. This is cited as a local change, promoted by municipalities, however, Mixed-profession A also notes that, on a scale of 20 years, it has become commonplace to *“use more green infrastructure and permeable pavement, which is completely different.”* Curiously, all mixed-profession interviewees cite state organizations, Rijkswaterstaat, provinces, regional water authorities and municipalities, as the arbiters of this changing landscape. To this extent, Mixed-profession B finds that, *“the general public is expecting that the government will take care of pluvial FRM. That is the way it is traditionally done. Many areas, especially urbanized ones, are privately owned by market parties and private landowners, and they also have some responsibility for their private land”* (Mixed-profession B).

Mixed-Profession perception on the distribution of responsibilities in P-FRM

The state is perceived as the leader of responsibility in P-FRM (Mixed-profession A and B). In addressing civil responsibilities, Mixed-profession A remarks, *“the state gives the rules and dictates what we should do, in contrast to the residents who... expect the government organizations to take responsibility.”* Concurrently, Mixed-profession B observes the Netherlands as having a *“very firm legal system, but the society doesn’t always know about the legal context. They are expecting that the Water Authorities are responsible for all water issues, when in practice that is not the case.”*

Both Mixed-profession A and C perceive climate adaptation as requiring input and action from multiple stakeholders, but that *“the hierarchy and legal responsibility is engrained in the Water Act and other similar acts and laws in policy”* (Mixed-profession B). Broaching the subject of innovative redesign, however, Mixed-profession B also notes that *“there was a tradition in having a desired standard for pluvial FRM, but... we are seeing that each city and area have their own managers who oversee strategies targeting specific climate impacts. This is a general trend of national overarching strategy to local and more tailored approaches.”*

Perception of division of responsibilities based on formal and informal criteria

Mixed-profession stakeholders are influenced to take responsibility in climate adaptation based on moral and ethical considerations. Referencing civic legal obligations, Mixed-profession A states *“there is no law telling people what to do.”* They continue by addressing municipal risk dialogues as fostering an integrative mindset *“to look for solutions where there is more participation in the civil society.”* (Mixed-profession A). In addressing civic moral motivations, Mixed-profession C remarks that *“many people think the same way and have the potential to act but don’t because they lack the platform or space or are influenced by external factors. One of the ways I got*

involved was simply by leaving a note in my neighbor's front doors, and I received so many replies saying that people had the same ideas and concerns." One can observe a separation, between civilians simply not wanting to engage versus civilians not having the knowledge or resources to engage.

4.3 Observed trends and challenges

The following section reviews interviewee's responses to questions concerning what actions they would take, should they find themselves in the position to change one thing about the system, disregarding the costs, as well as their thoughts on the impact of COVID-19.

4.3.1 Perceived challenges

Academic perceptions of challenges in P-FRM

Building on existing momentum is cited by Academic C as the main challenge, which they see as *"the actual implementation of adaptation measures."* They see a gap in monetary and temporal investment that, if allowed to exacerbate, puts the future of UCA in the Netherlands at risk (Academic C). Concurrently, Academic D regards competing land-use claims as the biggest challenge, which can be seen in their response: *"The same land that could be used for climate adaptation could be used for parking places. Sometimes uses can be combined and sometimes they are in competition with one another."* Furthermore, Academic A notes COVID-19 as exacerbating existing social and economic inequalities, which necessitate intensive short-term action to the detriment of long-term UCA. Academic B, on the other hand, sees citizen's neighborhood ownership increasing to the point where this situation *"may help with people taking more climate adaptation measures against pluvial flooding."*

Market perceptions of challenges in P-FRM

Market B and D cite the biggest challenge as ensuring support from stakeholders, such as citizens and real-estate developers. Legal obligation, Market D states, is crucial in holding stakeholders accountable and must replace the current practice of goodwill. Market C recognizes the failure of statistical models and calculations, caused by increasing uncertainty and precariousness of rainfall predictability, as their biggest concern. They go on to say, however, that the rising uncertainty may in fact help citizens change their thinking about pluvial flooding. To that effect, COVID-19 is viewed by all market interviewees as having little impact on their work, and moreover is cited positively in that, *"when we are home, we think it is more important to live in a good environment."*

State perceptions of challenges in P-FRM

State A believes that the implementation of UCA in both new and existing infrastructure is the primary challenge. Moreover, they stress, *“the market has the biggest innovative capacity”* when referring to the holistic implementation of P-FRM with drought and heat stress. Referring to the need to replace 10-15% of paved private areas, State B notes *“municipalities do not really provide an example to citizens of how they should act,”* suggesting a communicative gap between stakeholders. They go on to say, *“stakeholders compete in that they only think about their own benefits and profits.”*

State interviewees are divided on the impact COVID-19 is having on UCA. State A, for example, sees the “National Teufelwippen,” a regionally promoted stone-removal competition between Rotterdam and Amsterdam, as a positive impact. State B, meanwhile, observes the ministerial deadline extension of risk-dialogues as a direct result of COVID-19. They also cite a more pronounced gap between municipal front-runners and lagers as caused by COVID-19. State C, however, holds that a short collective memory is barring society from long-term lessons of COVID-19. Moreover, in comparing the two-billion euro Paris Agreement with the three-billion euro KLM bailout, they stress a fundamental lack of awareness worsened by COVID-19.

Mixed-Profession perceptions of challenges in P-FRM

Mixed-profession C regards both non-fact information and the science-policy gap as their biggest concerns. Climate change, they say, is an easy target and *“when you take one non-fact sentence from a politician, that is the truth for many people.”* The science-policy gap, they continue, is *“hampered by regulations”* and that, even with the active involvement of stakeholders, *“the system is not transforming with these changes.”* Likewise, Mixed-profession A perceives difficulty in raising awareness because, despite resources spent on UCA, *“a lot of people do not have the knowledge and do not care on why they should change their own views.”*

COVID-19, meanwhile, is viewed less problematically. Mixed-profession A and B believe large-scale UCA projects are experiencing a decrease in momentum caused by COVID-19, however there is also noted a reignited discussion of blue and green spaces, that which is exemplified by Rotterdam’s allocation of €230 million towards its new garden city initiative. Arnhem’s announcement of a 10% reconfiguration of paved areas to vegetated areas is furthermore cited as positively influenced by COVID-19. Moreover, Mixed-profession C regards COVID-19 as transforming Dutch traditions, which may *“count towards changing the Delta plans in the future.”*

4.3.2 Changes and next steps

In this section, results pertaining to interviewees suggested changes to the P-FRM system, as well as suggested next steps, will be presented.

Academic recommendations of changes to responsibility

State A, C, and D cite open and explicit discussion regarding responsibility distribution as their top priority in expanding UCA. State A notes that citizen initiatives *“need different facilitation from municipalities at different stages in their life cycles,”* and that *“clear doesn’t mean fixed and set in stone, but rather transparent and that everyone knows about it.”* Concurrently, State A and B cite the need for a large-scale systemization of best practices, facilitated by top-down intervention, to guide nationwide UCA implementation on the neighborhood level. State B notes a missing community factor among neighborhoods impacted by P-FRM, and that both active financial change as well as learning from the UK are two paths to foster this. In a similar vein, State D regards neighborhood apps, and technology more generally, as a method municipalities can use to engage citizens.

Market recommendations of changes to responsibility

Scaling-up UCA, with dual emphasis on market and municipalities, and nature-based solutions are two priorities of market interviewees. Market A and C see miscommunication as the culprit behind market and municipal division in UCA. *“We attended a lecture in Amsterdam with investment bankers, pension fund managers and insurance people. All of them said that municipalities should be in the leading role.”* State responsibility is noted as a remedy and that, *“with such transcending and overarching uncertainty, we are wasting time in not creating conditions to incentivize market participation.”* However, they also cite an integrative and ideological gap in municipalities, where UCA professionals are separated from their counterparts working on projects that also have implications for UCA. Connectivity between fields, they say, will foster UCA mainstreaming and perhaps influence other stakeholders.

Meanwhile, Market B and D believe tough decisions should be made concerning *“building higher, living with more people and less space,”* in order to prepare for a future with more crowded and less available public space. Nature-based solutions, they continue, have fallen out of practice and yet are crucial for appropriately combining multiple urban planning issues, as well as fundamentally addressing *“how we will deal with our public space.”*

State recommendations of changes to responsibility

State interviewees cite productive communication, multi-use interventions and scaling up as the following steps to take in UCA. In addressing the municipal-citizen gap, State A and B stress that *“Taeful taxes”* (pavement taxes) will further division among stakeholders and, especially for lower-income citizens, *“those are not the*

people you want to hit in their pockets.” They go on to cite the Taefulwhippen competition as an example of how inhabitants and project developers can collectively work to make greener and livable spaces (State A). To that effect, State C emphasized the need for alliances that appropriately address context-specific combinations of stress factors, primary among which is pluvial flooding. They cite the “pilot paradox” that, in order to secure transformative change, must be overcome by uncertainty reduction and evaluation. This, they continue, is a big step and *“there already needs an agenda for working at the end of this year, but that is impossible because we do not know enough”* (State C).

Mixed-Profession recommendations of changes to responsibility

Integrating all stakeholders, research in policy and nature-based solutions are the top priorities of those interviewed in the mixed-profession category. Mixed-profession A cites Belgium and Germany’s compulsory storage and drainage of water on private property and says lessons should be learned about stakeholder participation from abroad. Mixed-profession B sees aboveground development of water infrastructure as potentially receiving a boost from nature-based solutions and that the combination *“raises the awareness to society, in that it is more visual to the general public.”* In this regard, Mixed-profession C believes that connecting urban planning with technical engineering will lead to *“a more livable environment, instead of simply mitigating flood risk.”* Moreover, they cite the stark gap between engineering, landscape architecture, governance and finance, and they stress that *“we need to move to a new normal of a different way of working and exchanging expertise.”* Lastly, Mixed-profession D states that the key to transformative change between policy and science is making sure that policy information *“is proven and stamped by scientists”* prior to implementation.

5. Discussion and Conclusion

The following section reviews findings made from the results of the current research, including practice-based secondary research questions. The main research question is: Does UCA impact Dutch-PFM, and, if so, in what ways; particularly through perceived responsibilities on the part of stakeholders? The aim of the research is to understand the possible influence of UCA in P-FRM, by analyzing stakeholder perceptions of responsibility, categorized as either legal, moral or ethical responsibility.

Mixed-profession interviewees appear more adaptive in that they talk about moving away from specific technical physical barriers. They imply a need to move towards more diverse adaptive methods and being less restrictive in directing water away, as well as working with water and accommodating green initiatives. Market interviewees expressed their suggested measures in terms of future-oriented planning. This was evident in their acceptance of flooding and increases in its frequency. Furthermore, in their proclamation that there are numerous variables present and that the system is messy, implying the necessity of a long-term solution. Market interviewees have a broader holistic perspective including other climate stress factors, as opposed to just pluvial flooding, which also implies a context-specific understanding. This perspective differs slightly from academia, but is not necessarily opposed.

Academic interviewees are focused more on levels of accountability, in addressing the division of responsibility. Market interviewees project into the future, with some built in level of acceptance of flooding, and talk of creating system approaches that address accountability. Academic interviewees seem to be interested in policy as a means of achieving P-FRM, while market interviewees less so. This policy perspective, while important for P-FRM on a larger level, does not reflect a ground level, bottom up mindset espoused by UCA.

There is a direct link of UCA to P-FRM in market interviewee's responses. Their perception of UCA as having a definite impact on P-FRM reinforces earlier findings that market interviewees have the greatest UCA buy-in. While academics, on the other hand, may be on the cutting edge of reporting best practices, they are not on the cutting edge of generating best practices. Essentially, there seems to be a gap between researching best practices and bringing this to the attention of stakeholder groups beyond academic institutions, as other stakeholder interviewees rarely mentioned academia.

There is also a gap between the market perception of what they should do and of what they believe the state should do. Market interviewees note that because of rapid climate change, the state alone cannot solve the problem as they have done historically with coastal and fluvial FRM. They also say it is too expensive to solve the

problem only in the public space, where the state has the highest authority. In this vein, market interviewees see the value and necessity of citizens becoming involved in P-FRM. Furthermore, municipalities are viewed by market interviewees as struggling to uphold their responsibilities in P-FRM, which furthermore are perceived to be changing. With this information, stakeholder perceptions of state, market, academia and civil society can be observed. Importantly, reported connections and lines of communication between stakeholder groups are non-linear and vary in strength. The Conceptual Model Figure 1 has not accurately captured this dynamic, and will need reconfiguration in future research.

In this regard, an overlap is cited between state and market, in the shared desire, and in some cases attempt, to involve citizens. This reveals a stronger focus on civil society inclusion than Mees et al. (2012 pg. 19) found, stating “shared public–private responsibilities are absent; none of the roles is fulfilled via a truly joint public–private effort.” To facilitate this overlap and expedite the involvement of citizens, the establishment of stronger lines of communication is crucial. In order to achieve citizen buy-in at the grass roots level, moreover, Market B suggests citizen education and the allotment of specific tools from several stakeholders to facilitate this outcome.

Overall, it is clear that, for the most part, interviewees in different stakeholder groups are not opposed to each other; rather the main problem appears to be a matter of miscommunication. Thus, the above text answers the secondary research question: what are the core stakeholder perceptions of UCA, Dutch P-FRM and the responsibilities that are attributed to them? In addition, this research adds to the dialogue concerning the extent to which UCA is implemented in the Netherlands. a Forrest et al. (2020) suggest that, while UCA may be blossoming in certain areas, it is still in its infancy. Factors such as a lagging wide scale integration and involvement of civil society in P-FRM, bottom up, context specific approaches supported by municipalities, and uncertainty surrounding citizens willingness, and ability, to contribute to local P-FRM regularly (Dai et al., 2017)

Although interviewees are generally supportive of civil society involvement, the findings support these authors. Interviewees perceive UCA as a viable option, yet limited in the scope and scale in which it has been implemented in policy and practice. Although interviewees generally report positively on UCA, they are also hesitant to commit fully in the face of miscommunication and continued uncertainty. The politicization of adaptation, which was added to the code list during data analysis, was cited by both academic and mixed-profession stakeholders expressing concern regarding the perceived entanglement of politics and adaptation in urban areas with competing land use claims. Coupled with the perception of regulation as a barrier to adaptation, the state and academic-mixed-profession relationship appears to be strained by state-advanced policies.

Interestingly, mixed-profession interviewees have a greater propensity for practice-based work and are not as theoretically grounded as academic stakeholders even though two of the three mixed-profession interviewees are employed in university teaching. If the same trend were repeated in a larger population study, it could imply a stronger individualization of the mixed-profession stakeholder group. Currently, however, literature concerning mixed-profession stakeholders in P-FRM is lacking, which creates uncertainty around their role in facilitating integration of citizens into the P-FRM system, as well as a general stakeholder profile that may be useful in studying dynamic stakeholder relationships. Nonetheless, they are moving towards UCA, and furthermore it seems as though mixed-profession tends to straddle between ideas and perspectives from both state, market, academia, and civil society.

It appears all state interviewees accept that rainfall is heavier, in terms of frequency and intensity, which supports earlier findings made by KNMI (Klein Tank et al., 2014). Most of them, still seem to still be thinking and working around incremental adaptation and preparing the public physical space, as opposed to preparing general public thinking and engaging stakeholders face to face. They specify only certain items of the physical environment in an urban setting deemed worthy of adaptation. This is indicative of the historical technical paradigm of belowground infrastructure. A significant factor limiting this perception is the physical space they are working with, which acts as a barrier to innovative thinking. It can be at least partially explained by their perceived responsibility only for the public space, which is supported by the historically strong civil society rights on private land.

Nevertheless, there are hints that suggest state interviewees are becoming aware of an increasing presence of UCA discourse in P-FRM. They are still entrenched in their historical role as the main provider of FRM, necessarily because of the uncertainty surrounding the involvement and reliability of civil society stakeholders that UCA touts as indispensable. This constraint in the perspective of state interviewees may limit the degree of influence UCA may be afforded in P-FRM in the future. State C, however, includes multiple comparisons of incremental to transformational adaptation, suggesting a nuanced understanding of measures to achieve both and thus, the ability to differentiate in choosing between measures. Increasing dialogue between academia and the state could see the science-policy gap shrink, effectively bringing state stakeholders up to date on best practices and offering academics with fresh insight to utilize in their research.

The use of sewage and drainage systems is not necessarily the most transformative example, but happens to be the focus of academic interviewees. In this regard, academics tend to focus on macro-level initiatives, which is not reflective of a dilution of UCA principles. There has been cited a need for UCA to grow to a larger scale, however the perspective of bottom-up growth is lacking, thus limiting the degree by which localities may achieve innovation. Moreover, academic interviewees

tend to have a broader scope perspective in their formulation for change, which takes a top-down approach versus educating citizens in a bottom-up approach.

The citation by market and state interviewees of a legal motivation for assuming responsibility reveals an interesting contrast to academic and mixed-profession stakeholders, who largely do not hold legal motivation within their reasoning for assuming responsibility. This could explain the perceived expansive role of state, and market to a lesser extent, in P-FRM as opposed to academic and mixed-profession. Legal responsibility is still largely viewed with greater clarity and accountability than moral or ethical responsibility, due in part to an opaque understanding of the mechanisms under which moral and ethical responsibility operate in P-FRM.

This research therefore cites a possible gap in the accountability of certain academic and mixed-profession stakeholders in P-FRM policy and practice. This falls in line with the historic division of responsibility favoring the state and, if supported by future research, may harm the credibility of academic and mixed-profession stakeholders within P-FRM from an institutional perspective. The key item within this thread is accountability and the lasting emphasis placed on legal responsibility. The historical institutional framework of FRM supports this fixation on legal responsibility, where state stakeholders hold primary power in P-FRM via legal obligations. Interestingly, although interviewees largely cite the state as holding primary responsibility in P-FRM, state interviewees espouse support for the inclusion of civil society stakeholders.

In this way, it seems as though as a communicative gap persists between the state and civil society, as well as market and academia. van Popering-Verkerk and van Buuren, (2017, pg. 231) states, “the importance of distance from the formal hierarchy is that it allows participants to cross the boundaries that are dominant in their organization and to become motivated about collaboration.” Incentives and ‘soft power’ have been used by the national state to inspire bottom-up participation, however it is possible that face-to-face meetings with local civil society representatives, to engage more directly and ensure their goals are communicated without error, would be preferable in this situation.

A shift in this framework may lend support to academics, who could see greater accountability and certainty in undertaking morally and ethically motivated responsibilities in P-FRM. Crucially, in-depth research on moral and ethical responsibility in P-FRM would contribute to increasing understanding of the multifaceted mechanisms of responsibility in P-FRM, perhaps promoting UCA by offering several legitimate and accountable pathways to undertaking responsibility in P-FRM. With regard to holistic P-FRM, as supported by UCA, this research suggests the inclusion of academic stakeholders to a greater degree in legal precedence, in order to

bridge the gap between P-FRM theory and practice, science and policy, with the goal of increasing representation of academia in policy.

All interviewees cite moral motivations however state, market and mixed-profession interviewees cite a combined moral and ethical motivation supporting their assuming responsibility in P-FRM, suggesting a more holistic interpretation and understanding of P-FRM and UCA than with academic interviewees who only cite moral responsibility. In this regard, state, market and mixed-profession can be seen as paying attention and responding to societal desire for P-FRM. Moreover, in citing legal, moral and ethical motivations, market and state interviewees appear to have the most developed sense of awareness of their responsibilities in P-FRM. This adds to the debate concerning the extent to which instrumental and normative responsibilities are present within P-FRM, and how they contribute to stakeholder perceptions of responsibility in P-FRM.

It seems that, due to the relatively short existence of UCA in the public conscience thus far, certain academic interviewees are working from a platform debating the level of carbon influence to temperature rise and the required mitigation. State interviewees are observed as connecting to the broader UCA perspective and influence, while still straddling the line between more traditional thought processes, which remain entrenched in P-FRM. While state interviewees recognize the need to incorporate UCA into P-FRM, it is unclear to what extent a coordinated effort exists to achieve this. State B alludes to their desire for people to act future proof, yet they also cite the atmosphere as very divided, thus appropriate conditions for collaboration in P-FRM from a state perspective are in doubt.

Interestingly, although state and market interviewees both identify with moral and ethical motivations, and also believe in the importance of civil society integration, divisions slowing a collective transformation of P-FRM still exist. The general train of thought across interviewees seems to be driven by forward thinking, motivated by the pace of change and exponentially increasing intensity of pluvial flooding. They are in fact saying that the system must be made future proof, but the factor of who pays for what, across stakeholder groups, is sowing division. It speaks to an opposition of largely state interviewees who feel that they must guard against people taking advantage.

Those most frequently cited in this regard are land developers, with whom several state interviewees have had poor interactions. It appears reflective of a more divisive atmosphere, and reveals a degree of distrust of certain elements of the market by state interviewees. An important factor is whom each stakeholder group answers to. State stakeholders, for their part, are beholden to the constituency that elected them; while market stakeholders report to a larger business chain of command. Moreover, state interviewees seem genuinely willing to help citizens improve their implementation and practice of UCA. They are unsure, however, how to go about this

or they simply have not been successful in previous attempts. The ethical motivations cited by state and market; however, support the theory of social groups, be they interpersonal or societal in nature, as a motivating factor. Especially for state and market, this indicates that two stakeholders with different foundations, one being their constituency and the other being their business, are motivated by external influences.

Market interviewees also cited that they themselves need to do a better job regarding integration of civil society. This is understood as speaking directly to citizens, working past a legal responsibility that may not always be present and approaching them with the idea of moral responsibility. To ensure a thorough understanding of the different motivations and methods of holding accountability, a discussion and resolution of the differences and expectations of legal and moral responsibility should occur between stakeholders. This would go a step further to decrease uncertainty surrounding moral responsibility, as a shared understanding may result in effective accountability. Furthermore, citizens may experience a fundamentally different view of moral responsibility than market stakeholders, and therefore this would create a barrier to understanding and achieving an effective division of responsibility in P-FRM. This answers the secondary research question: what ways are the stakeholder perceived responsibilities of UCA reflected in their duties of P-FRM?

Throughout this research, it has become clear that the state, market, academia and civil society are intertwined in a non-linear fashion, complete with stronger and weaker ties. The conceptual model shows reciprocal lines of communication, traveling both directions between stakeholder groups, while the non-linearity aspect will be revisited in future research. According to the data gathered from interviewees, market and state experience strong communication. These two stakeholders experience weaker communication with civil society, while academia and mixed-profession share strong communication with civil society.

For their part, state interviewees appear willing to engage citizens with greater frequency, however lack coherence and organization in their ability to speak directly to and incentivize individuals or groups of citizens creates barriers. This adds to research concerning the degree of involvement of civil society in P-FRM. The details concerning strength and weakness between stakeholder groups has become somewhat more coherent with this research, and will provide a platform with which in-depth studies may base themselves off of.

One motivating factor for the continued lack of communication between market interviewees and civil society could be the absence of formal legal responsibility on the behalf of the market, even though they observe moral and ethical motivations in their profession. As legal responsibility remains the overriding incentive for action, its absence in the development of communication between market and civil society has led to a communication gap. In order to achieve a holistic UCA approach,

the market needs to expand their supportive role in tandem with the state, and engage with citizens in an organized fashion. The possibility of acting as an intermediary presents a nice opportunity for market stakeholders.

As of now, all interviewed stakeholder groups perceive the state as having the greatest responsibility in P-FRM currently, regarding UCA implementation. This paints an incremental picture for the status of P-FRM. Moreover, this finding of perceived state control is supported by legal, moral and ethical motivations. This understanding of the state as in charge is supported by historic institutionalization of Dutch FRM, which largely reflects Dutch culture norms, supporting Kokx and Spit. (2012 pg. 183), who state, the “consensus among stakeholders about climate adaptation is not self-evident, owing to diverse values, beliefs, understandings, norms, policy cultures and so on.” Kaufmann et al. (2018, pg. 258), meanwhile, find a combination of forces creating stability as a main reason for the state continuing to hold power. “Institutional change at the national level,” they posture, “does not necessarily lead to practical effects at the regional or local implementation level, in particular, if the legal instrument is flexible.” With respect to local adaptation, they say, “it takes time for local implementing actors to change their formal and informal working procedures, which have been stabilized over decades.”

That being said, several interviewees across stakeholder groups believe the next steps for the state to take are educating citizens, incentivizing action and providing citizens with the proper tools to be self-sufficient during a pluvial flood event, as interviewees perceive current incentives and payoffs for engaging in P-FRM as not worthwhile for citizens. In this regard, there is an overlap between state and market interviewees in the concurrence of their beliefs. That is, communicating with civil society is imperative, but the state alone cannot solve this dilemma. The starting point provided by this research, is the understanding both that lines of communication between all stakeholder groups are a necessity, as well as the general agreement among interviewees that miscommunication is a source of the uncertainty surrounding responsibility in P-FRM and must be overcome by strengthening lines of communication. Due to the non-linear and opaque nature of stakeholder relations, future research may be conducted to understand the mechanisms with which stakeholders can use to strengthen lines of communication.

One comparison to be made is with extrinsic circumstances. If someone’s house is flooded, for example, it may not necessarily be his or her fault, but rather the cause of external factors outside of their control. Variables such as income, physical capacity, and available time all contribute to a person’s ability to adapt and engage in P-FRM. On this note, community engagement is an opportunity for the state to educate citizens and give them the proper tools, while also bridging gaps of understanding between stakeholder groups and fundamentally reframe the perception of the state.

In incentivizing citizens to remove stones, it helps the environment, the community, creates more greenspace, and, in this regard, removing the tax liability would be positive. There needs to be a conscious method of governing for each level of state, as well as collaboration and coordination among stakeholder groups in driving this engagement down to the citizen level. Creating a forum where citizen representatives may ask their questions in open dialogue with other stakeholder groups is one method of achieving collaboration. This would also allow citizens an opportunity, especially those who want to be engaged at the grass roots level but do not know how to become involved.

Overall, the moral and ethical motivations cited by stakeholders reveals a significant degree of informal responsibilities being assumed, albeit often in conjunction with legal responsibilities. The findings show that stakeholders' decision-making process is much more complex than simply following legal obligations, and that stakeholders from different groups are actively thinking about these issues and listening to the people around them

6. Reflection

Upon reflection, it has become clear that the analysis of stakeholders' perception of responsibility is crucial in obtaining a holistic view of P-FRM. The procedure this study took, however, using semi-structured interviews, is but one way to go about analyzing responsibilities. Runhaar et al., (2016 pg. 1398), for example, used an ex-ante assessment, focusing on formal responsibilities in the preparedness of climate change. Throughout this research, the use of a small sample size has guided the methodology and results, with benefits and drawbacks.

Critically, drawbacks include the inability to draw definitive conclusions regarding the adaptive nature of P-FRM, whether it be incremental or transformational. Future research conducted with a larger population size should be undertaken in order to make a concrete determination regarding the adaptive status of P-FRM. This should also include civil society stakeholders. It was difficult not to have access to civil society interviewees, as willingness to adapt is such an integral part of a holistic implementation of aboveground approaches.

Several indicators were discovered through data analysis. It is possible that they represent understudied variables within the fields of P-FRM and UCA. On the other hand, it may also be that the literature review was not extensive enough to uncover these variables. The politicization of adaptation, multi-use interventions and active financial change all have significant implications for P-FRM and UCA, and it remains important to keep track of variables that do not appear frequently in literature but which are important to the subject. Due some academic and government sources

being available only in Dutch, it is quite possible that these variables are mentioned more frequently than English language literature reveals.

Overall, the theories and results of this research appear to be convincing. A shift of responsibilities from central to decentral mechanisms, especially concerning historically absent stakeholders with which a system of integration is currently being developed, takes quite a long time. The addition of market, academic and mixed-profession stakeholders only increases complexity. Therefore, the incremental nature of the literature review and findings supports an ongoing, yet slow, shift in responsibilities. Again, the comparatively smaller precedent surrounding P-FRM, compared to coastal or fluvial FRM, presents an opportunity to mold it to fit a cast of UCA characteristics. Other issues, such as heat stress, present an opportunity for localities to flex their innovative muscles and develop multi-use solutions. The issue at stake, here, is funding. Since findings support market stakeholders as having the greatest buy-in, the market may offer their assistance and resources in engaging citizens directly. In a larger market view, banks could contribute to active financial change with the national state stepping away financially from localities.

Common ground between stakeholders may also come in the form of an intermediary, with the market or academia acting as a courier for citizens and the municipality. Researchers targeting localized adaptation are well suited for this role, as they may already have connections with civil society. The individual connections between stakeholder groups is cited as a topic for future research. Other suggestions for future research include:

- What specifically state and academia can do to bridge the science-policy gap.
- Obtaining a more nuanced understanding of civil organization in P-FRM.
- Conducting local case studies to research the relationship between flood risk and heat stress, and identify compatible solutions.
- Identify possible connections between legal, moral and ethical motivations of responsibility.
- Teasing apart moral and ethical motivations from legal motivations.
- Study stakeholder age as a possible barrier to integration of UCA.

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Appendix

Information Sheet

Thank you very much for taking the time to consider getting involved in this research project.

Description of the project

Planning experts play several roles in the research, planning and implementation of urban climate adaptation (UCA) in pluvial flood risk management (P-FRM). Stakeholders, who work in universities, state agencies and private companies, have job descriptions and subsequent motivations that define their work and how they rationalize the implementation of their day-to-day activities. These responsibilities are descriptive of their role in P-FRM. Within the past few years, climate adaptation has rose to prominence within Dutch FRM in combination with traditional engineering approaches and innovative spatial approaches. P-FRM is of specific interest, as it is increasingly problematic in Dutch urban areas and has received less attention than other forms of FRM.

This combination of engineering and spatial planning approaches has resulted in a changing FRM landscape, including a push for bottom-up initiatives at local levels. The inclusion and integration of historically absent stakeholders in P-FRM is associated with this, as a characteristic of UCA. The extent to which these approaches have influenced P-FRM, however, is not clear at this time. This lack of clarity and divisiveness raises problems for the effectiveness and efficiency of climate adaptive approaches in policy and practice. By studying stakeholders' perceptions of the division of responsibilities in P-FRM, I hope to contribute to the creation of a transparent status report of P-FRM as it stands currently.

I am interested in planning experts' perception of their responsibilities, and how they should be divided. One focus is the perception of responsibility in P-FRM through the assessment of instrumental and normative responsibility and their division, and the second focus is how these perceptions reflect either an incremental or a transformative adaptive influence by UCA principles in Dutch FRM. I use interviews with Dutch P-FRM stakeholders within universities, state agencies and private companies. From these individual perceptions of responsibility, I can analyze the extent to which UCA has had an influence on FRM in the Netherlands. I aim to answer the following research question:

Does UCA impact Dutch-PFM, and, if so, in what ways; particularly through perceived responsibilities on the part of stakeholders?

The research is a part of my Master Thesis, which I will submit at the end of November 2020. The goal of this research is to provide an understanding of responsibilities, as perceived by Dutch planning experts, and inform the decision-making on UCA. I hope

to create awareness on responsibility and perception and to be able to give advice on potential avenues for partnership in the implementation of urban pluvial FRM in the Dutch context.

Confidentiality and participant rights

- The interviews will be audio-recorded and notes will be taken during the interview.
- You have the right to ask to have the recording turned off whenever you decide and you may also end the interview at any time.
- If you wish so you will be sent a copy of the interview notes, and you will have the opportunity to make corrections or request the erasure of any materials you do not wish to be used.
- The information you provide will be kept confidentially in a locked facility or in a password protected file up to five years upon completion of this research.
- The data may be used for articles, book chapters, published and unpublished work and presentations.
- Unless you have given explicit permission to do so, your name or any other information which would identify you as the respondent will not be included in this research or in any future publication or reports resulting from this project.

As a participant you have the right to:

- decline to participate;
- decline to answer any particular question;
- ask for the audio-recorder to be turned off at any time;
- end the interview at any time
- withdraw from the study up until three weeks after participating in the research;
- ask any questions about the study at any time during participation; and
- ask for the erasure of any materials you do not wish to be used in any reports of this study.

Once again, I thank you for taking the time to find out more about my research. I am at your disposal for any questions you might have. You can reach me at M.John.3@student.rug.nl.

[Consent Form](#)

Urban Climate Adaptation in Pluvial FRM in The Netherlands

This is a research where interview data will be recorded and where we will look at **Dutch P-FRM stakeholders' perceptions of responsibility.**

The researcher has explained the goal and setup of the research to me. I have had the time to think about it and ask questions about my participation in the study.

I understand that my participation in this research is entirely voluntary and that I can retract my permission at any time.

I know that interview data about me, that are relevant to this research, are used for scientific goals and could be published. I agree to this on the condition that my privacy is safeguarded.

Hereby I give my permission/I do not give my permission (if applicable) to use the data from the current research, conducted by the University of Groningen, to use for future related studies.

Hereby I give my permission/I do not give my permission to be approached for a potential follow-up research related to this research.

Hereby I give permission, out of free will, to participate in this research.

Name participant:

Signature: Date:

I, the undersigned, confirm that this study has been explained to the above-noted participant verbally and in writing.

I, the undersigned, warrant the privacy of the above-noted participant and shall anonymize the interview data.

Name researcher:

Signature: Date:

Interview Questions

1. What is your current title and job position?
2. How is your job connected to Urban Climate Adaptation and/or Dutch Pluvial FRM?
3. Please give examples of some of your core research focuses related to Urban Climate Adaptation and/or Pluvial FRM.
4. What do you think Urban Climate Adaptation means in Dutch Pluvial FRM?
5. Do you think the way Pluvial FRM is “done” in the Netherlands is changing? Is it changing to begin with?
 - 5.1 How are the responsibilities between state-market-civil society divided in the context of Dutch Pluvial FRM? (i.e. who is in charge, who contributes, who does not contribute, who pays for necessary changes to infrastructure or damage to properties etc.)
 - 5.2 Have the distribution of responsibilities been influenced by legal aspects, moral aspects, ethical aspects? – Can you identify certain stakeholder groups as being influenced by one or more of these aspects, legal, moral and ethical?
6. What kind of an impact from the Urban Climate Adaptation discourse/policies/programs, if any, do you see in Pluvial FRM in the NL?
 - 6.1 How (if at all) has the Dutch Pluvial FRM discourse changed over the past ~ 5 years?

- 6.2 What kinds of new concepts and ideas do you see entering the Dutch Pluvial FRM 'landscape' and (in what ways) are these ideas related to the increasing interest in climate adaptation?
7. In an ideal world, how would you change these responsibilities to be (better) divided among state, market and civil society actors in Pluvial FRM in Dutch urban areas to become resilient to flooding?
 - 7.1 If there would be one thing you could recommend to do differently in Urban Climate Adaptation in the Netherlands to reduce Pluvial flood risk (disregarding the costs), what would it be?
8. What do you see, based on your research or professional practice, as the main challenges in Urban Climate Adaptation in Dutch cities, related to Pluvial FRM?
9. What do you think are the next steps, in the prescription and division of responsibilities, for Urban Climate Adaptation to reduce Pluvial Flood Risk in NL? What needs to be done next?
10. How has the COVID-19 situation influenced Urban Climate Adaptation as it applies to Pluvial FRM?
11. Can you recommend or refer any other professionals in this line of work that I can interview?
12. Do you have any final thoughts, questions, anecdotes that you would like to share?

Categories	Indicators	Criteria	Sub-Criteria
Urban Climate Adaptation			
	Timeframe of change		
	Pace of change		
	Climate Adaptation Services		
	DPRA		
	Framing of issue		
Reoccurring Themes			
	Greening areas		
	Collective vs. Individual		
	Proactive vs. Reactive		
	Drainage and sewage systems		
	Willingness to adapt		
	Innovative capacity		
	Context-specific differences		
	Very local scale		
	Wateroverlast		
	Relationship factors		
	Attention surrounding UCA and P-FRM		
Issues			
	Barriers to responsibility		
	Planning in Fundamental Uncertainty		
	Short-term thinking		
	Perception of safety		
	Pavement		
	Politicization of Adaptation		
	Missing community factor for citizens		
Solutions			
	Forward thinking		
	Open discussion of responsibilities		
	Mutually beneficial agreement		
	Facilitating citizen involvement		
	State and Academia working together		
	Making use of space		
	Technological innovation		
	Long-term thinking		
	Active financial change		
	Multi-use interventions		
Responsibilities			
	Normative		
		Moral	
			Awareness of Problem
			Area of work
		Ethical	
			Traditions and norms
			Social acceptability
	Instrumental	Legal	
			Governance Arrangements
			Clarity

Table 2. Code tree with categories, indicators, criteria and sub-criteria. Red lettering indicates an indicator that was not included prior to coding, but was added during the process.