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The role of policy entrepreneurs in integrated flood risk management approaches

'Building resilience' in the North Sea Region

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Abstract:

Long-term sea level rise and other climate change related events like storm surges and intense precipitation pose and amplify great future flood risks. In the field of flood risk management, there is a noticeable consensus that relying on traditional technical flood control to face these threats is insufficient - leading to a paradigm shift in water management towards more comprehensive flood risk management approaches in the European Union. In this context, the concept of 'resilience' gained considerable attention; a 'fuzzy' concept due to its broad spectrum of application despite its lack of a proper definition. This research (i) investigates the actions of professionals in water management whose task is to 'do' resilience and (ii) aims at contributing to the understanding of what practices they can successfully adopt to realize more integrated approaches in flood risk management. This study refers to such experts as 'policy entrepreneurs', who in this case are the pilot managers and other professionals working in the discipline within the EU-Interreg North Sea Region FRAMES (Flood Resilient Areas by Multi-layEr Safety) project. The FRAMES project is carried out at 15 pilot sites in the United Kingdom, the Netherlands, Belgium, Germany, and Denmark. The project´s intention is to enhance flood resilience in these areas by developing holistic strategies. By analyzing interviews and surveys from these pilot sites, the aim of this thesis is to create generic findings about the best practices that pilot managers and other experts in the field of flood risk management can adopt to foster flood resilience approaches in their pilot areas. Their tasks are challenging: they work and intervene in diverse relevant fields and disciplines, and they mainly act as mediators while addressing complex challenges, as these often involve a multitude of stakeholders. Thereby, communication-related practices hold the greatest priority when dealing with management deficits within projects. To approach such challenges holistically, paying attention to normative aspects, raising awareness, planning emergency responses and including communities, citizens and other important individuals are emphasized as their crucial tasks. This thesis develops ten statements about practices that make the policy entrepreneurs´ work in integrated flood risk management approaches successful.

Keywords:

Climate Change Adaptation Strategies, Paradigm Shift, Flood Resilience, Multi-Layered Safety, Integrated Flood Risk Management, Policy Entrepreneurs, Collaboration

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1. Introduction

Climate change, cities in coastal regions, increased vulnerability

Worldwide, more than 600 million people live concentrated along coastal zones less than 10 m above sea level and this number is expected to exceed a billion by 2050 (Merkens et al., 2016). More than 50 % of the global population is expected to live within 100 km of the coastline by 2030, which will cause major impacts and alterations on coastal ecosystems (Adger et al., 2005). The projections of Kopp et al. (2014) show a mean global sea level rise that ranges from 0.5 m to 1.8 m by 2100 (under RCP scenario 8.5), which implies that coastal regions are becoming increasingly vulnerable towards flooding and costs for adaptational measures may increase drastically (Adger et al., 2005). Furthermore, not only long-term sea level rise but also other climate change related events like storm surges and long and intense precipitation periods pose and amplify future flood risk (Barnard et al., 2019; Zevenbergen et al., 2008). Damaging flood events have globally increased in frequency throughout the last century (White, 2010). In the European Union, flood events have caused economic losses of estimated US-$ 140 billion between 1972 and 2006 (Barredo, 2009) and 4.700 fatalities in European Environment Agency member states (EEA, 2017).

These examples illustrate the risk floods can pose to settlements situated at the water, their inhabitants, and economic values. While floods “have always been around” (Garrelts and Lange, 2011, p. 200), absolute protection is impossible due to its cost-inefficiency and uncertainty in weather conditions (Schanze, 2006). Moreover, flood events in the EU have become more frequent (Barredo, 2009) and especially severe flood events are expected to become more frequent due to climate change (Alfieri et al., 2015; EEA, 2017). This also complicates flood defense, as the value of previous experiences in flood protection is reduced due to prognostic uncertainty (Lange and Garrelts, 2007).

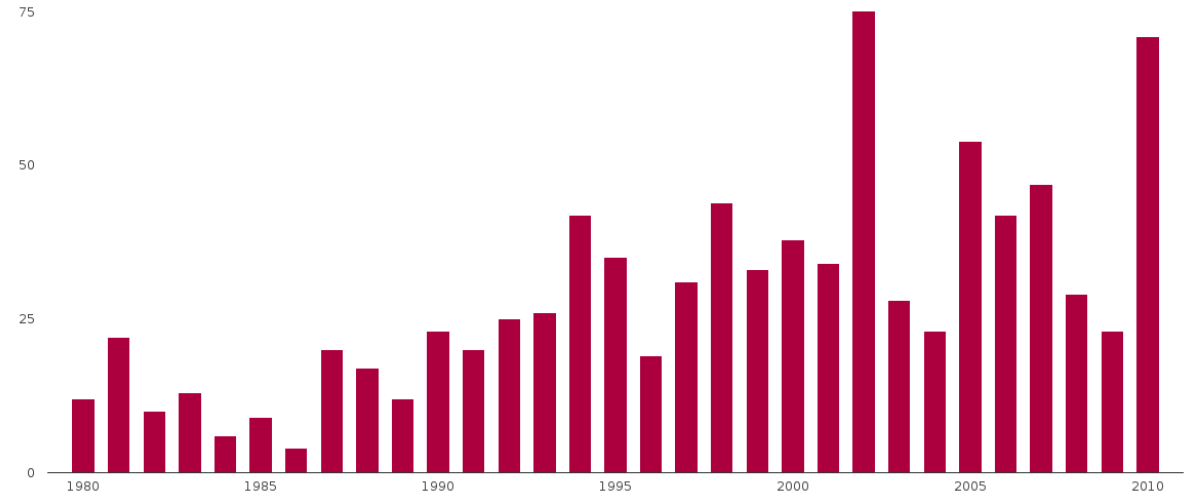

Figure 1: Number of severe floods in Europe (EEA, 2016)

Technical measures are insufficient

Through different adaptation measures, the potential damage can be lowered significantly (Mokrech et al., 2015); here lays the importance of flood risk management. Floods and flood risk management have been receiving increased public and political attention (Krieger, 2012;

Fielding, 2018), leading to a paradigm shift towards a more comprehensive flood risk management in the European Union through the introduction of the Floods Directive (Council Directive 2007/60/EC) (Klijn et al., 2008; Heintz et al., 2012; Krieger, 2012). This includes integrated approaches instead of solely sectoral thinking. Hence, the field of water management is complemented by other disciplines like spatial planning to reduce the risk of flood hazards in vulnerable flood-prone areas (Godschalk, 2003; Woltjer and Al, 2007).

The concept of resilience comes into play

Within this multidisciplinary crossing, the concept of resilience gains considerable attention and is often referred to as a promising framework to involve uncertainty and risk management in planning (Davoudi, 2012; Scott, 2013; White, 2010). Resilience has become a widespread term in various fields including economics, psychology, planning and disaster management (Gunderson and Holling, 2002; Davoudi, 2012). Davoudi et al. (2013) and Shaw (2012) mention its broad spectrum of application as a reason why resilience has not been properly defined and can still be regarded a fuzzy concept. Nevertheless, "it appears that resilience is replacing sustainability in everyday discourses in much the same way as the environment has been subsumed in the hegemonic imperatives of climate change" (Davoudi, 2012, p. 299). The question arises whether the term is appearing as yet another buzzword indicating simply something desirable or whether it actually is a promising framework for planning theory and practice (Davoudi, 2012; Rose, 2007).

The Floods Directive as incentive for multi-layered safety and the Flood Resilience Rose

The concept of multi-layered safety has its origins in the Floods Directive (Council Directive 2007/60/EC). It promotes risk-based flood management approaches which go beyond traditional flood protection measures (Moel et al., 2013; van Herk et al., 2014). This concept focuses on "prevention, protection and preparedness" (2007/60/EC) as well as reviews and resilient recovery. Furthermore, the Flood Resilience Rose, developed by Karrasch et al. (2020) aims at shifting from technocratic measures towards risk-based approaches. It incorporates the concept of multi-layered safety and represents a strategic framework tool for operationalization and systematization for decision-makers in flood risk management. The Flood Resilience Rose aims at the enhancement of understanding how the different layers and levels in flood risk management are complexly interwoven and which parts need increased attention. It takes the multi-layered safety approach into account, the respective institutional context as well as the wider context, and poses a modern and advanced interpretation of the resilience concept in flood risk management. It presents flood risk management in a more systematized way which appears to be more applicable in practice and is supposed to be initially implemented in the EU-Interreg North Sea Region FRAMES project.

The EU-Interreg North Sea Region FRAMES project as empirical basis for this research

The North Sea region FRAMES (Flood Resilient Areas by Multi-layEr Safety) project was launched in 2014 to face shared threats like sea level rise and extreme precipitation in the North Sea area. The project is carried out at (currently) 15 pilot sites in the United Kingdom, The Netherlands, Belgium, Germany and Denmark (Interreg North Sea Region FRAMES, 2019). The aim is to develop and implement adequate flood resilience strategies which can only be performed in collaborative approaches due to their inherent complexity and the variety of

stakeholders and actors involved (Buijs et al., 2018). The countries involved have a long history of flood issues and thus have developed strategies along context related governance settings that vary in their way of dealing with complexity and uncertainty (Huitema et al., 2011; van Herk et al., 2014). The focus of the FRAMES project is thus on regional flood risk management investigations as well as related social challenges to gather insights and improve knowledge for enhanced decision making in multi-layered strategies (Buijs et al., 2018).

This thesis does not cover detailed descriptions of the individual pilot sites but rather focuses on generic findings regarding which roles pilot managers and other experts working closely in the field play and what strategies they use to successfully implement integrated approaches for flood risk management. Hence, the guiding research question focuses on water managers whose task is to 'do' resilience.

Decision makers in flood risk management as policy entrepreneurs

Water managers have to consider the complex interdependencies of the social and the ecological spheres to make appropriate decisions on a multitude of risk management options (Pahl-Wostl et al., 2007; Tempels, 2016). Long-term policy ambitions and strategic development become even more crucial as these options are often subject to severe complexity and uncertainty (Boelens and de Roo, 2016; Bormann et al., 2015). Following Huitema and Meijerink (2009), Huitema and Meijerink (2010) and Huitema et al. (2011), this thesis refers to pilot managers and other decision makers in water management issues as 'policy entrepreneurs' who "instigate, implement and sometimes block transitions" (Huitema et al., 2011, p. 718).

The point of departure for this thesis is the ongoing shift in water management which poses a considerable challenge to society and water managers in particular. Resilience is conceptualized in a more practical way in the form of the multi-layered safety approach for flood risk management and the Flood Resilience Rose, inspired by the Council Directive 2007/60/EC. Shaping change in water management towards more holistic, integrated approaches is accompanied by great complexity and uncertainty which is why pilot managers face enormous challenges.

The research topic of this thesis was agreed on with partners of the FRAMES project and it concerns what practices pilot managers have successfully and effectively used to realize integrated approaches for flood resilience within the FRAMES project. Another goal of this thesis is to locate the actions taken by pilot managers in the Flood Resilience Rose to pinpoint in which fields they primarily act and are influential to change the current flood risk management approaches towards more integrated and holistic concepts. The focus is on all pilot areas of the FRAMES project, not country-specific. The aim is to create generic findings about the role of policy entrepreneurs in integrated flood risk management approaches.

1.1. Scientific and societal relevance

The societal relevance of this thesis lies in its guidelines for action on how to make the fuzzy concept of resilience in the context of flood risk management better applicable in practice. Focus is on holistic approaches in which a multitude of disciplines and stakeholders play crucial roles. This study sheds light on how complexly interwoven certain challenges in

comprehensive management approaches can be and at the same time emphasizes the importance of communication- and collaboration related actions in order to work towards common goals.

From a scientific point of view, this research is relevant as it presents state of the art flood resilience approaches by merging the resilience concept with the multi-layered safety concept. It moreover introduces the comprehensive Flood Resilience Rose. On these grounds, it assesses the best practices that policy entrepreneurs can employ as they must deal with complex and interdisciplinary challenges and foster flood resilience measures. This research does not only offer insights into the complex challenges that they encounter but also presents lines of action they can follow to overcome these challenges and encapsulates their successful work into ten statements.

1.2. Research structure

Following the developments in water management and considering the complexity policy entrepreneurs must face, the main research question of this thesis is the following:

> What role do individual policy entrepreneurs (pilot managers and professionals working in their teams) play in the development and acceptance of integrated approaches for flood resilience?

Further related research questions are dealt with in order to contribute to finding adequate answers to the main research question:

> Question 1: What is the practical added value of the resilience concept in flood related issues and how can it be conceptualized?
>
> Question 2: To what extent are multi-layered safety approaches adopted in different governance levels in the countries in which the FRAMES project is carried out?
>
> Question 3: Which practices used by pilot managers and professionals in their teams have been applied for the implementation of more integrated multi-layered safety approaches in flood risk management?
>
> Question 4: In which fields of the Flood Resilience Rose can the actions taken by pilot managers be located?

This chapter presents an introduction and the research questions. Figure 2 depicts the structure of this research. Chapter two is devoted to the broader theoretical framework. It deals with the paradigm shift from traditional flood risk management to comprehensive and integrated approaches. Furthermore, it includes a literature review about the role of policy entrepreneurs in shaping change and eventually leads to the conceptual model of this chapter. Chapter three specifies the applied methodology in this research. Results are presented in chapter four while chapter five contains the following discussion. Chapter six draws on the previous chapters to offer novel findings about the work of policy entrepreneurs, thus broadening current knowledge on their roles towards increasing flood resilience. The final conclusions are presented in chapter seven which closes with a brief section on propositions for future research and critical reflections about the research process.

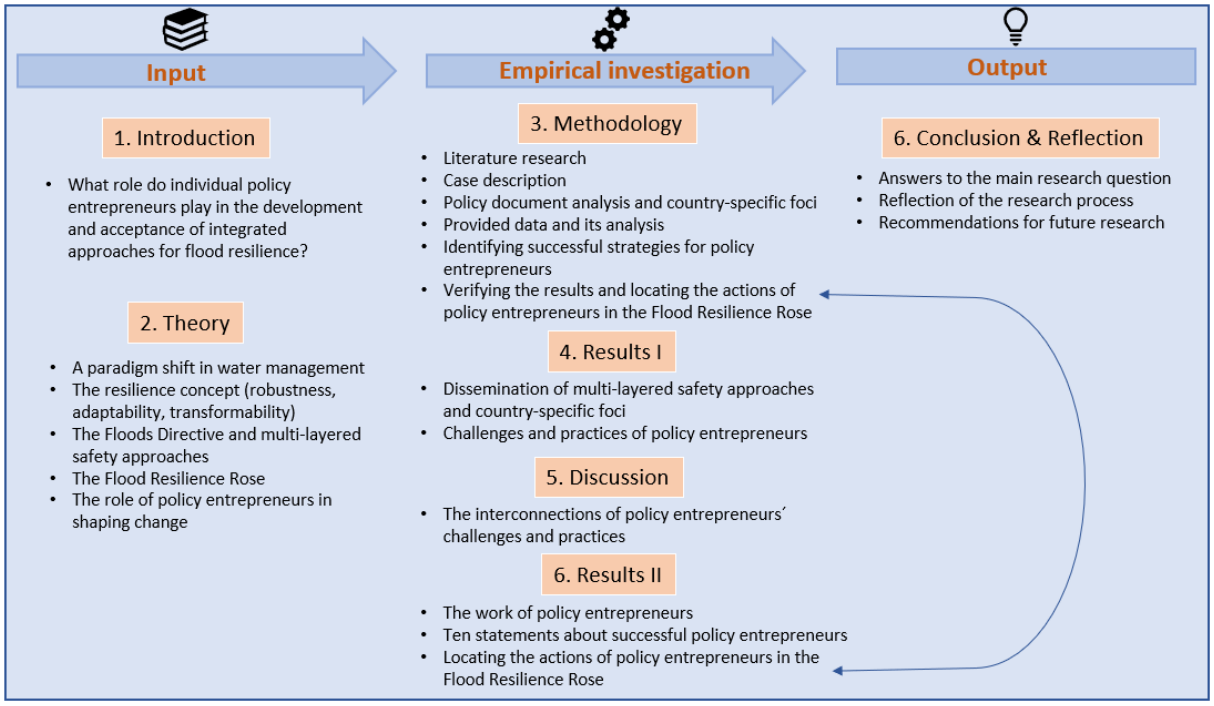

Figure 2: Research design of this thesis (own figure)

2. Theory

This chapter deals with the progresses made in the discipline of water management in Europe to date and sets up the theoretical foundation for this thesis. The central guiding theme is the paradigm shift in the field of water management in terms of flood risk management. Consequently, the related conversion from floods being fought with engineering measures (Klijn et al., 2008; Wagner, 2008) towards accepting flood events as unavoidable natural phenomena (van Alphen et al., 2006) represents a main focus of this study. Traditional approaches become increasingly outdated as water related issues reveal increasing signs of complexity, which has fostered the rise of a new paradigm in water management (chapter 2.1). The concept of resilience (chapter 2.2) and its required characteristics robustness, adaptability, and transformability (chapter 2.3) play a key role in this regard. Considering these developments, the Council Directive 2007/60/EC represents the overarching framework for the further developed multi-layered safety approach (chapter 2.4). Subsequently, the concept of the Flood Resilience Rose (chapter 2.5) was developed and takes all previous developments into account. It constitutes a comprehensive management, communication- and capacity building tool which pays attention to complex interlinkages among diverse levels and layers and can be applied by decision makers in water management. This thesis investigates the role of such decision makers in shaping change and executing flood resilience measures as well as which strategies they effectively and successfully apply. The present state of research in this regard is outlined in chapter 2.6. The pilot areas of the North Sea Region FRAMES project (chapter 3.2) serve as a basis for this empirical investigation. The conceptual model of this research is illustrated in chapter 2.7.

2.1. The upturn of a new water management paradigm

Natural water systems have always played a vital role for humans for transportation, trade, resources and settlements. Access to water has been crucial for prosperity throughout human history, including nowadays. However, the immediate proximity to water does not only hold opportunities but also bears great risks like flooding from rivers and the sea (Hughes, 2005; White, 2010). Floods per se are a natural phenomenon often defined as a temporary covering of usually dry land by water (Schanze, 2006; 2007/60/EC; Vojinovic, 2015). Depending on their source, the respective mechanism of flooding and other possible characteristics, different types of floods can be categorized, including riverine or fluvial floods, storm surges and pluvial floods (EEA, 2017). While often portrayed as a danger, floods are not inherently negative events. Some authors point out that they are "critical for maintaining and restoring many of the important services provided to humans by riparian ecosystems" (Wisner et al., 2004, p. 203) as they are beneficial for the ecosystem and its biodiversity and carry nutrients and sediments necessary to replenish agriculturally used areas (Coleman, 2009; Wisner et al., 2004). Flood disasters have occurred again and again throughout human history, including historic floods such as the St. Mary Magdalene´s flood in 1342 or the St. Marcellus´s flood in 1362 which affected large parts of Northern and Central Europe, but also more recent ones such as the flooding of New Orleans due to Hurricane Katrina in 2005 or the central European floods in 2002 and 2013, highlighting the extreme hazards floods can pose.

Traditionally, flood hazards were attempted to be controlled through defense measures to keep rivers within their normal confines and prevent water from flooding surrounding floodplains (Patt and Jüpner, 2013; Merz et al., 2010; Klijn et al., 2008). This can be regarded as a control or security approach (Wagner, 2008) in which floods represent an adversary that is to be fought with engineered flood control. In his widely influential thesis (Macdonald et al., 2011), White (1945) describes this perspective as follows:

> "It has become common in scientific as well as popular literature to consider floods as great natural adversaries which man seeks persistently to over-power. According to this view, floods always are watery marauders which do no good, and against which society wages a bitter battle. The price of victory is the cost of engineering works necessary to confine the flood crest; the price of defeat is a continuing chain of flood disasters" (White, 1945, p. 1).

This fight was led by the "water technocracy" (Roth and Warner, 2007, p. 519) with engineering approaches, including river training, the construction of reservoirs, and embankments such as levees, dykes, and dams (White and Howe, 2002; Merz et al., 2010). Technical perfection of these constructions was the paramount target of flood control (Patt and Jüpner, 2013). However, no matter the expenses, total protection from floods is impossible and "floods remain unavoidable natural hazards" (van Alphen et al., 2006, p. 375), even in the most economically powerful countries worldwide (van Alphen et al., 2006). Some of the most severe floods, especially in terms of economic damage, took place in wealthy countries that deemed themselves protected (Wisner et al., 2004). The perceived security caused by dykes and other technical measures actually increases flood risk, as it becomes more attractive for businesses and households to settle and invest in floodplains, increasing the number of assets at risk (Hartmann, 2011; Tempels and Hartmann, 2014). This effect termed "dyke paradox" (Hartmann and Spit, 2016, p. 363) creates a "cycle of vulnerability" (White and Howe, 2002, p. 738), leading to risk transference towards rarer, more extreme

events (Etkin, 1999). Additionally, the risk of flooding increases due to an extension of construction land and with it a reduction of room for the natural unfolding of the water system (van Slobbe et al., 2013). Therefore, anthropogenic pressure and societal developments are the real drivers of ever-increasing flood damages (Smith, 2004; Barredo, 2009; Merz et al., 2010). As White put it already in 1945: floods may be "acts of God, but flood losses are largely acts of man" (White, 1945, p. 2).

The enormous flood damages throughout the 1990s in both developed and developing countries, notwithstanding the United Nation´s International Decade for Natural Disaster Reduction starting in 1990 (Macdonald et al., 2011), can be regarded as leading to a "collapse of confidence in engineered flood prevention" (Wisner et al., 2004, p. 176) and the beginning of a paradigm shift. The dominant paradigm started to shift from flood defense or flood control, thus a safety approach, towards a more comprehensive flood risk management approach (DKKV, 2003; Garrelts and Lange, 2011; Heintz et al., 2012), a trend Hartmann and Driessen (2017) and Klijn et al. (2008) situate within the last 20 years.

From a risk management perspective, floods represent a hazard, thus a "potentially damaging […] phenomenon" (UNISDR, 2004, p. 16), but only susceptibility to this hazard, i.e. vulnerability and exposure, creates risk (Smith, 2004; Klijn et al., 2008). As Klijn et al. (2008) state: "without people or property there is no risk" (Klijn et al., 2008, p. 309). Thus, the term risk in flood risk management represents the probabilistic combination of hazard and its consequences. Besides the aforementioned floodplain invasion, risk is further increased through human interventions, including flood protection measures that increase hazard downstream (Strobl and Zunic, 2006), urbanization (Smith, 2004; UNISDR, 2004) and cascading hazards such as water contamination through pollutants and chemical substances (Wisner et al., 2004; Nones and Pescaroli, 2016). Modern flood risk management tries to capture these and many more factors, taking a holistic approach to manage flood risk. It requires its stakeholders to assess associated risks, to implement appropriate flood management measures and to maintain these measures (Klijn et al., 2008; Schanze, 2006), and it covers all measures defined in the disaster management cycle (Moel et al., 2015).

While many authors agree on a continuous or repetitive dimension of flood risk management describing it either as 'continuous' (Schanze, 2006), 'without end' (Plate, 2002) or a 'cycle' (Klijn et al., 2008; Thieken et al., 2016), the definitions of its target differ. Flood risk management can be aimed at reducing the flood risk (Schanze, 2006), "making space for water/rivers" (Krieger, 2012, p. 238), achieving an "acceptable residual risk" (Klijn et al., 2008, p. 309), "minimizing both the probability and the consequences of flood events" (Raadgever et al., 2018, p. 93) or creating a more flood resilient society (Thieken et al., 2016). As Klijn et al. (2008) and Schanze (2006) point out, flood risk management does not even necessarily imply reducing the level of risk, as the benefits of using floodplains and other threatened areas may outweigh the risk. Decisions within the management system thus depend on the risk assessment and the underlying priorities and values (Plate, 2002; Schanze, 2006). This indicates the substantial complexity of human and nature interdependent systems, their related uncertainties and how traditional approaches are no longer adequate for handling them (Pahl-Wostl, 2015). Water-related issues can be regarded as a model example of such complex subjects as they concern a large variety of heterogeneous stakeholders with different

perspectives and capacities to act (van der Brugge et al., 2005). Some sources of water-related issues may lie outside the actual water management discipline, i.e. agriculture and land ownership which adds a multitude of actors involved, even if only indirectly and thus increases the level of complexity even further.

In a widely influential publication, Rittel and Webber (1973) denoted complex problematics in social policy as 'wicked problems' that cannot be solved with traditional scientific approaches as they "cannot be definitely described" (Rittel and Webber, 1973, p. 155). Loorbach (2010) and van der Brugge et al. (2005) speak of ´persistent problems´ which they describe as even more complex as they develop in interplay with several domains and can only be approached on the long term. The diverse interpretations for flood risk management thus have governance implications; the discipline requires inclusive approaches and merges centralized and decentralized efforts (Meijerink and Dicke, 2008). The discipline of spatial planning is regarded to be important in future possibilities to deal with flood risk due to its strategic, regulatory, and communicative abilities. It is supposed to play a mediating role among different policy and scientific fields as well as between the variety of stakeholders involved in water issues. (Burby et al., 2000; White, 2010). The integration of traditional flood risk management measures (rooted in natural sciences) and spatial planning (rooted in social sciences) is a difficult task (Woltjer and Al, 2007). The previously depicted paradigm shift 'from fighting the water' by means of engineering measures to 'living with the water' with more holistic approaches caused a considerable increase of popularity for the concept of resilience (Petrosillo et al., 2015; Davoudi, 2012), which will be examined in the following section.

2.2. Defining Resilience

The resilience concept is not new even though it recently became more popular and used more frequently in planning discussions (Davoudi, 2012). In the common sense the term stands for something positive, something that is worthwhile but "its use is comparable to the use of the concept of sustainability, in the sense that everybody agrees that it is desirable, without agreeing on what is precisely meant by it" (Vis et al., 2003, p. 34). The concept has experienced different stages of development from a clear physical meaning ('engineering resilience') to the field of ecology ('ecological resilience') up to 'evolutionary resilience' (Davoudi, 2012; Gunderson and Holling, 2002). The first two will only be mentioned shortly; focus is on evolutionary resilience as this concept is highly relevant for the following chapters of this thesis.

Originally a Latin word, *resilire* means "to spring back". Consequently, the term resilience is frequently connected to bounce back and/ or bounce forth abilities of systems (Davoudi et al., 2013). The origins of equilibrium-based resilience lie in a Newtonian or mechanistic conception of a world full of facts and certainty in which everything can be predicted and explained (Davoudi, 2011). Engineering resilience has originally been used by physical scientists to specify the level of material-resistance to external influences (Holling, 1961; Hashimoto et al., 1982). Holling (1973) proposed that "stability […] is the ability of a system to return to an equilibrium state after a temporary disturbance" (Holling, 1973, p. 17). Hence, engineering resilience can be characterized as a system´s capability to restore a previous state

or equilibrium after external impacts or disturbances (Holling, 1973; Holling, 1986). The focus is on bounce-back time, stability, foreseeability and efficiency (Pimm, 1991; Holling, 1996; Gunderson, 2000).

Contrary to the definition of engineering resilience, 'ecological resilience' does not only aim at resistance and bounce-back capacities but also at adaptability (Adger, 2003; Gunderson, 1999). Holling (1996) defined ecological resilience as "the magnitude of the disturbance that can be absorbed before the system changes its structure" (Holling, 1996, p. 33). Consequently, the main difference between the two categories is that engineering resilience only focuses on a single, permanent equilibrium (Adger, 2003; Gunderson, 1999), while ecological resilience rejects this approach and instead supports the concept of various equilibria in which it is possible that systems bounce forth into other stable domains (Davoudi, 2012; Gunderson, 2000).

Beyond Equilibrium - Evolutionary Resilience

In contrast to equilibrium-based resilience perceptions, modern interpretations of the concept show various similarities with the socio-ecological systems approach (Carpenter et al., 2005). Berkes and Folke (1998) introduced socio-ecological systems which combine aspects of multiple disciplines like technology, politics, economy, ecology, and also takes into account cultural aspects, "emphasizing the integrated concept of the 'humans-in-nature' perspective" (Petrosillo et al., 2015, p. 419). The notion of socio-ecological systems is based on complex systems theory due to their complex and unpredictable attributes (Binder et al., 2013; Cumming et al., 2017). Levin (1999) and Holland (1995) describe complex systems as unpredictable, non-linear, organic, process-dependent and with a tendency towards self-organization. Complex systems cannot be understood by observing single elements but must be approached as an entity (Berkes and Folke, 1998). The difference between a complex system and a complex adaptive system is that the latter "consists of heterogeneous collections of individual agents that interact locally, and evolve in their genetics, behaviors, or spatial distributions based on the outcome of those interactions" (Folke, 2006, p. 257). Socio-ecological systems can be regarded as complex as well as adaptive (Petrosillo et al., 2015). The integration of humans and the environment is the most conspicuous characteristic of socio-ecological systems as it includes aspects which other disciplines often neglect to cover (Davoudi, 2012).

On these grounds, current interpretations of the resilience concept are defined as 'socio-ecological resilience' (Folke et al., 2010). Other authors employ the term evolutionary resilience (Simmie and Martin, 2010; Davoudi et al., 2013; Davoudi, 2012), which will also be used in this thesis. Evolutionary resilience thinking rejects the idea of equilibrium-based interpretations and promotes the understanding that systems´ behaviors can be seen as constant dynamic fluxes, with or without external shocks and in spite of apparent stable periods (Walker et al., 2004; Scheffer, 2009).

This interpretation of the resilience concept gained momentum when equilibrium-based approaches were called into doubt due to the acknowledgement of systems´ thresholds. These include for example unpredictable and possibly irreversible behavior like tipping points of climate change (Adger et al., 2005; Porter and Davoudi, 2012). Hence, modernist and

positivist beliefs in the resilience concept which represent certainty and predictability get levered out by the rise of evolutionary resilience (Porter and Davoudi, 2012). This understanding of evolutionary resilience discards the assumption of bouncing back or forth to a stable state, but focuses on the capability to undergo changes, adaptations and (more crucially) transformations in response to disturbances (Carpenter et al., 2005). Berkes and Folke (1998) highlighted complexity, non-linearity and self-organization as well as unpredictability and discontinuity as characteristics of systems. This interpretation of the resilience concept can be considered a paradigm shift in scientists´ worldviews (Davoudi, 2012). Humans and nature are seen as interdependent systems (Steffen et al., 2007).

Acknowledging that everything around us, the natural as well as the societal world, even if it may appear static and stable, can suddenly change and shift into something fundamentally new and different when exposed to disturbances, is central to evolutionary resilience (Kinzig et al., 2006; Pendall et al., 2010). Evolutionary resilience implies that transformational changes and dynamic behavior are prevailing conditions and ought to be considered the new normality (Porter and Davoudi, 2012; Carpenter et al., 2005). It is about "the importance of assuming change and explaining stability, instead of assuming stability and explaining change" (Folke et al., 2003, p. 352) as well as "about the opportunities that disturbance opens up in terms of recombination of evolved structures and processes, renewal of the system and emergence of new trajectories" (Folke, 2006, p. 259). Resilience can create adaptive capacity (Smit and Wandel, 2006). Hence, systems barely bounce back to their initial state after experiencing shocks. As can be noticed in the ecological resilience concept, this awareness is per se not a thoroughly new observation.

The central novelty is that the disturbances and shocks do not necessarily have to be originated outside of the system to cause regime shifts; they can as well be of internal kind whereby cause-effect relationships are not necessarily definite and predictable. In this regard, small modifications within systems can develop, become self-reinforcing, and eventually cause major system changes. Extensive disturbances on the other hand may as well cause little reactions (Davoudi, 2012). Consequently, former system responses to disturbances and shocks based on past experiences do not provide a solid indication for future reactions of the system, even though the circumstances are comparable (Duit et al., 2010). Hence, resilience in the evolutionary perspective is "understood not as a fixed asset, but as continually changing process; not as a being but as a becoming" (Davoudi, 2012, p. 304).

Decision-making and data processing based on past experiences belong to traditional working practices of planners to predict systems´ behavior and create certainty. Hence, this conception of resilience challenges the efficacy of such approaches and raises the question whether they are still up to date (Davoudi, 2012; Duit et al., 2010). Several authors of literature about modern interpretations of the concept agree that resilience thinking aims at integrating three facets comprised by socio-ecological systems, namely robustness, adaptability and transformability (Davoudi, 2012; Davoudi et al., 2013; Folke et al., 2010; Tempels and Hartmann, 2014). Following this interpretation, this thesis understands resilience under these three considerations.

	Equilibrist resilience	Evolutionary resilience
Aim	equilibrist	adaptive
	existing normality	new normality
	preserve	transform
	stability	flexibility
Focus	endogenous	exogenous
	short term	medium to long term
	reactive	proactive
	atomised	abstract
Planning approaches	technorational	sociocultural
	vertical integration	horizontal integration
	building focus	societal focus
	homogeneity	heterogeneity

Table 1: Different planning processes in evolutionary and equilibrist resilience (White and O'Hare, 2014)

2.3. (Flood) resilience requires robustness, adaptability and transformability

There is a widespread assumption that resistance approaches aim at preventing flood events while resilience measures focus on decreasing the effects flood events can cause. Resistance strategies are characterized by engineered and constantly maintained flood control measures to keep water bodies in their confines (Klijn et al., 2008; Wagner, 2008); resilience strategies accept floods as unpreventable events and put emphasis rather on risk management (Vis et al., 2003). Publications about flood risk management repeatedly draw a sharp line between resistance and resilience (Hooijer et al., 2004; Klijn et al., 2008; Patt and Jüpner, 2013; van Slobbe et al., 2013; Woltjer and Al, 2007). However, other authors mention 'persistence' (Holling, 1973; Folke et al., 2010) or conterminously 'robustness' (Davoudi, 2012; Tempels and Hartmann, 2014) as being part of resilience, meaning that they do not necessarily have to be regarded as antagonists and both should be incorporated and balanced (Needham and Hartmann, 2012; Tempels and Hartmann, 2014). Robustness can therefore be regarded as an essential part of resilience. However, adaptability and transformability are named as other crucial attributes of resilience by numerous authors. In order to achieve flood resilience, combinations and interlinkages of all three elements are required (Davoudi, 2012; Folke et al., 2010; Restemeyer et al., 2015; Scott, 2013).

Robustness basically equals resistance strategies: a city or an area is prepared for a possible flood event by means of engineered structures like embankments, dykes, levees or dams to absorb and persist damages (White and Howe, 2002). It represents a control or security approach in which floods are to be fought with technical flood control (Wagner, 2008; Vis et al., 2003). Consequently, clear parallels can be drawn to the concept of engineering resilience and the related bounce-back ability. In practice, robustness measures are currently the most common strategies to approach flood-related issues (Folke, 2006). However, absolute flood protection can never be guaranteed as major shocks can possibly exceed the limits of technical constructions (van Alphen et al., 2006; Wisner et al., 2004), which indicates that a flood resilient city or area requires further actions than just robustness. This is where adaptability comes into play.

Adaptability can be referred to as the capacity of actors to incorporate experiences, thereby diminishing vulnerabilities, turning opportunities to good account and conforming to altering environments and internal stresses (Berkes et al., 2003; Walker et al., 2004; Folke et al., 2010). In socio-ecological systems with a predominant human influence adaptability arises mainly from the social sphere (Folke, 2006; Gunderson et al., 2006). Adaptability in the context of flood risk management therefore implies that the areas behind the first robustness layer are designed in a way that if major flood events occur, damages can only occur to a limited extent (Klijn et al., 2008; Smith, 2004). Measurements to decrease vulnerability need to incorporate adaptations in the social domain as well as in the environmental configuration of the hinterland. The flood-prone areas can be prepared by a variety of measures depending on their geographical and communal context. These may include the designation of areas for controlled flooding, the preparation of buildings to become flood-proof or ´steering´ the water towards less vulnerable places first in order to decrease the chance that crucial areas of great importance like main infrastructure get flooded (Patt and Jüpner, 2013). Numerous adaptational measures inevitably add social components to modern flood risk management (Restemeyer et al., 2015). Awareness raising and willingness to adapt are crucial keywords in this respect (Folke et al., 2010). People living in flood-prone areas need to be actively included in the process of accomplishing a comprehensive flood risk management approach to gain knowledge and the ability to take actions when lives and assets are at risk (Fünfgeld and McEvoy, 2012). Hence, this modern kind of flood risk management becomes increasingly more a societal and collective mission which is only feasible by merging several disciplines like spatial planning, risk management and general water management related expertise.
However, robustness and adaptability can be regarded as essentially striving to preserve the characteristics of a system (cf. engineering resilience and ecological resilience), respectively to bounce back or to bounce forth. When a state is attained in which “ecological, economic or social conditions make the existing system untenable” (Walker et al., 2004, p. 7) and the mind-set of people shifted towards being sensitive for the issue and the necessary steps to be taken (Restemeyer et al., 2015), it can be regarded a possibility for transformation.

Transformability can be regarded as the capacity to generate essentially new systems (Walker et al., 2004) and distinguishes evolutionary resilience from the equilibrium-based resilience concepts (Davoudi et al., 2013). Transformability also covers the understanding of how to turn extreme events and disasters into opportunities to profoundly redesign system compositions. In the discipline of water management, transformability is currently understood as the capacity to execute the steps required for the paradigm shift from “water technocracy” (Roth and Warner, 2007, p. 519) and the related flood defense and flood control measures (DKKV, 2003; Garrelts and Lange, 2011; Heintz et al., 2012) towards “making space for water/rivers” (Krieger, 2012, p. 238) where resilience strategies “rely on risk management instead of on hazard control” (Vis et al., 2003, p. 33). It is an ongoing learning process which involves the inclusion of new observations to create the capacity for finding pertinent options on how to deal with the risk of flooding (Restemeyer et al., 2015), and consequently shifts in arrangements among stakeholders involved and political as well as institutional patterns (Folke et al., 2010). Folke et al. (2010) mention transformability as a central element of resilience thinking. These attributes of (flood) resilience can be closely linked to the

components of multi-layered safety approaches which are derived from the Council Direction 2007/60/EC (Floods Directive). This connection is drawn in the next chapters.

2.4. The Floods Directive and multi-layered safety in water management

Introduced in 2007, the Council Directive 2007/60/EC on the assessment and management of floods (Floods Directive) calls for a new culture of dealing with flood risks (Heintz et al., 2012). Even though it recognizes floods as a potential hazard that can lead to fatalities, displacement of people as well as economic and environmental damages, the Floods Directive emphasizes that anthropogenic pressure and climate change are the paramount drivers for increasing flood damages (2007/60/EC). 2007/60/EC thus does not aim at avoiding or fighting floods (Heintz et al., 2012), but it seeks to reduce the risk of negative flood consequences, "especially for human health and life, the environment, cultural heritage, economic activity and infrastructure associated with floods" through river basin wide flood risk management (2007/60/EC).

The Floods Directive moreover requires flood risk management to systematically take extreme events into account (Heintz et al., 2012), to improve local stakeholder participation (Begg et al., 2018) and to focus on giving rivers more 'space' through non-structural measures (2007/60/EC). The Floods Directive also addresses land-use and water-use changes as a potential factor and introduces a future assessment of their impact on flood risks (Nones and Pescaroli, 2016). All considered, it thus represents the previously introduced paradigm shift from flood protection towards a more holistic and integrative flood risk management (Heintz et al., 2012; Hartmann and Driessen, 2017).

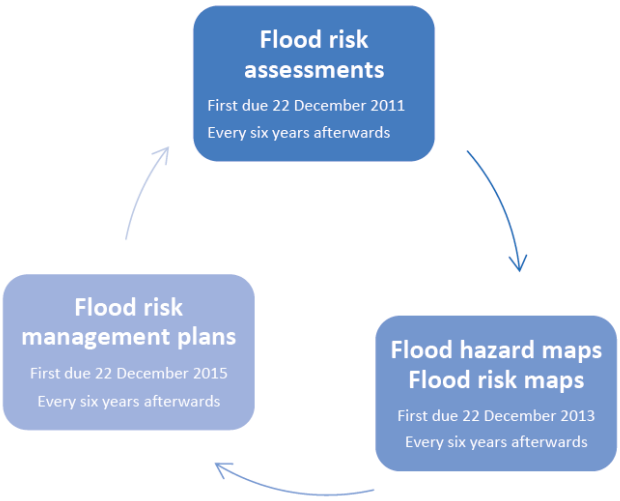

Figure 3: Flood risk management cycle as required by 2007/60/EC (own figure)

Concretely, the Floods Directive sets three main targets that EU member states are obliged to fulfil within specific timeframes. It places EU member states under the obligation to (1) conduct a preliminary flood risk assessment by 22 December 2011, (2) to create flood hazard and flood risk maps by 22 December 2013, and (3) to introduce flood risk management plans based on the river basin districts by 22 December 2015 (2007/60/EC). All these measures are designed to be applied every six years, creating a continuous cycle of flood risk management.

The Floods Directive however does not provide specific technical guidance, as its purpose is by definition to offer rather generic advice on the transportation into national law (Reinhardt, 2008). Each member state of the EU transposed the directive into their respective national legislations, with different outcomes – partly because of the difference in institutional layouts, and because of pre-existing instruments (Hartmann and Spit, 2016). Flood risk management

plans according to the Floods Directive "[…] shall address all aspects of flood risk management focusing on prevention, protection, preparedness …" (2007/60/EC, p. 31), forming the basis for the derived multi-layered safety approach.

The concept of multi-layered safety has been laid out in the Dutch National Water Plan in 2009 to foster a risk-based flood management approach which goes beyond traditional flood protection measures (Moel et al., 2013; van Herk et al., 2014). Nevertheless, protection is still of major importance and constitutes the first of three layers. It includes predominantly strategies focusing on engineering approaches including river training, the construction of reservoirs, embankments such as strong levees, dikes, dams, barriers as well as artificial drainage systems to keep floods away from vulnerable areas (White and Howe, 2002; Merz et al., 2010). This can be regarded as a control or security approach (Wagner, 2008). Furthermore, this can include the application of natural processes like eco-engineering and the restoration of natural systems to make use of ecosystem services (Mitsch, 2012). The focus of layer two is on prevention e.g. damage reduction by means of proactive and flood-proof spatial planning (Stive et al., 2011; Leskens et al., 2013). This includes adjusted land-use like "making space for water/rivers" (Krieger, 2012, p. 238), achieving an "acceptable residual risk" (Klijn et al., 2008, p. 309) by identifying appropriate locations for urban development, "minimizing both the probability and the consequences of flood events" (Raadgever et al., 2018, p. 93). Preparedness constitutes layer three in the form of disaster management and enhanced emergency responses (Stive et al., 2011; Leskens et al., 2013). The aim is to reduce the vulnerability of communities by raising risk-awareness and fostering adequate behavior in case of a flood event. Active communication, warning and forecasting systems and emergency plans are of crucial importance (Hegger et al., 2014). Flood risk management based on the multi-layered safety approach aims at developing integrated strategies to face present and future flood-related challenges. The approach is supposed to be applied to combine and operationalize measures derived from the three layers that collectively decrease the overall flood risk and respective damages (Moel et al., 2013; van Herk et al., 2014). In a Dutch case study, it was found that the multi-layered safety approach "implicitly broadened the objective – from flood probability to flood risk including reducing potential consequences of flood events – and explicitly spanned the design freedom to develop alternative solutions with more integrative elements" (van Herk et al., 2014, p. 113). The concept of multi-layered safety is inspired by the Council Directive 2007/60/EC on the assessment and management of floods (Floods Directive, see chapter 3.3.1) which incorporates the paradigm shift from flood protection towards a more holistic and integrative flood risk management (Heintz et al., 2012;

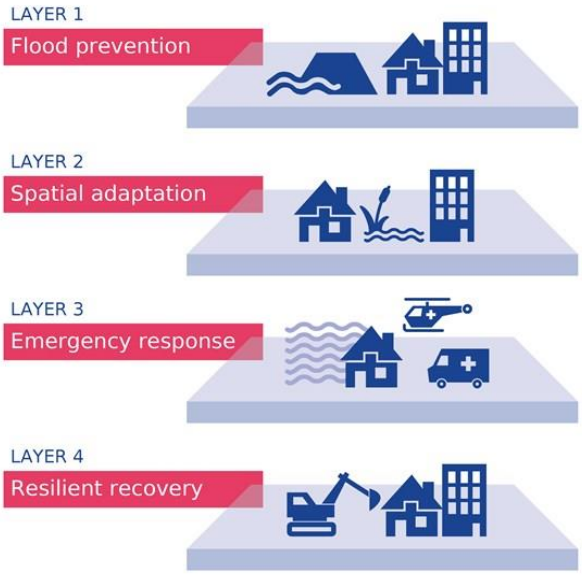

Figure 4: The Multi-Layer Safety Concept (Interreg North Sea Region FRAMES, n.d.)

Hartmann and Driessen, 2017). The focus is as described above on “prevention, protection and preparedness” (2007/60/EC, p. 28) and furthermore, “the flood risk management plan(s) shall be reviewed, and if necessary updated” (2007/60/EC, p. 33) - which constitutes a cyclical approach. Reviewing and updating can be regarded as a fourth layer focusing on review and recovery. This can include reconstruction measures and making use of lessons learned to create less vulnerable conditions in the future. Additionally, insurances and compensation schemes are of major importance for the recovery of communities and individuals. These can include clean-up activities, restoration measures as well as health support services (Hegger et al., 2014). The multi-layered safety components protection, prevention, preparedness, and recovery are central elements in the concept of the Flood Resilience Rose which was developed by Karrasch et al. (2020). This concept is outlined in more detail in the next chapter.

2.5. The Flood Resilience Rose

The ‘Flood Resilience Rose’ developed by Karrasch et al. (2020) in the course of the FRAMES project (see chapter 3.2) is based on the EU Floods Directive as well as on the multi-layered safety approach with four layers. Additionally, it merges the previously described resilience components robustness, adaptability, and transformability.

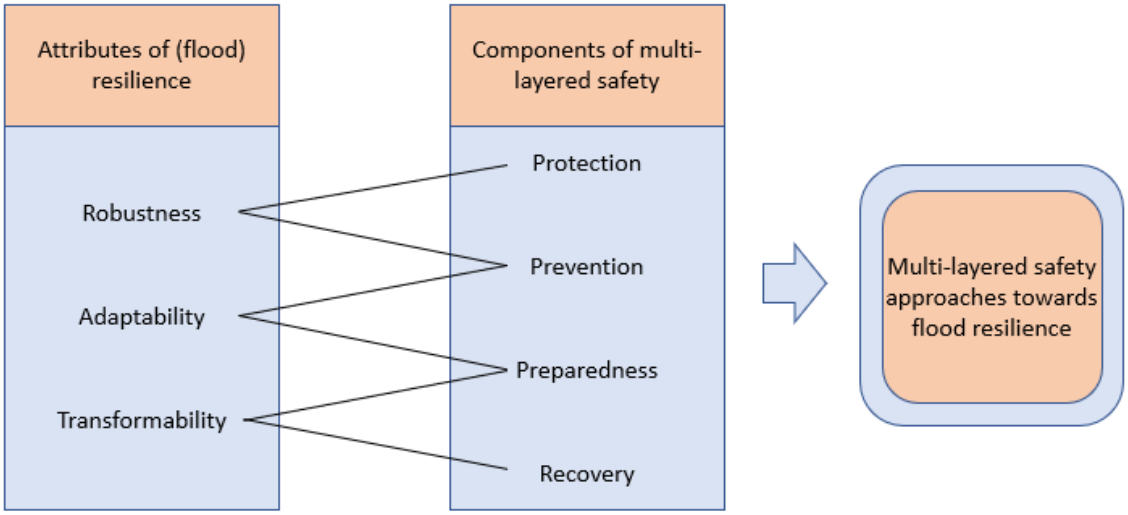

Figure 5: Merging components of flood resilience and Multi-Layer Safety (own figure)

The Flood Resilience Rose aims at shifting from control and security measures towards risk-based approaches. Operationalizing flood risk management and increasing flood resilience are thereby central elements. It is a tool to improve awareness, understanding, and support communication. It can help to show how the different layers and levels in flood risk management are complexly interwoven and which parts need more thorough scrutiny, for scientists, policy – and decision-makers alike. It constitutes a management, communication, and capacity building tool. Particular attention is hereby drawn on the complex interlinkages among the diverse levels and layers, and on the enhancement of holistic perspectives. As shown in Figure 6, the concept of the Flood Resilience Rose comprises of three levels.

Level one: Application of multi-layered safety measures

The first level includes the previously described multi-layered safety approach with its four different layers: protection, prevention, preparedness, and recovery, shown in the core of Figure 6.

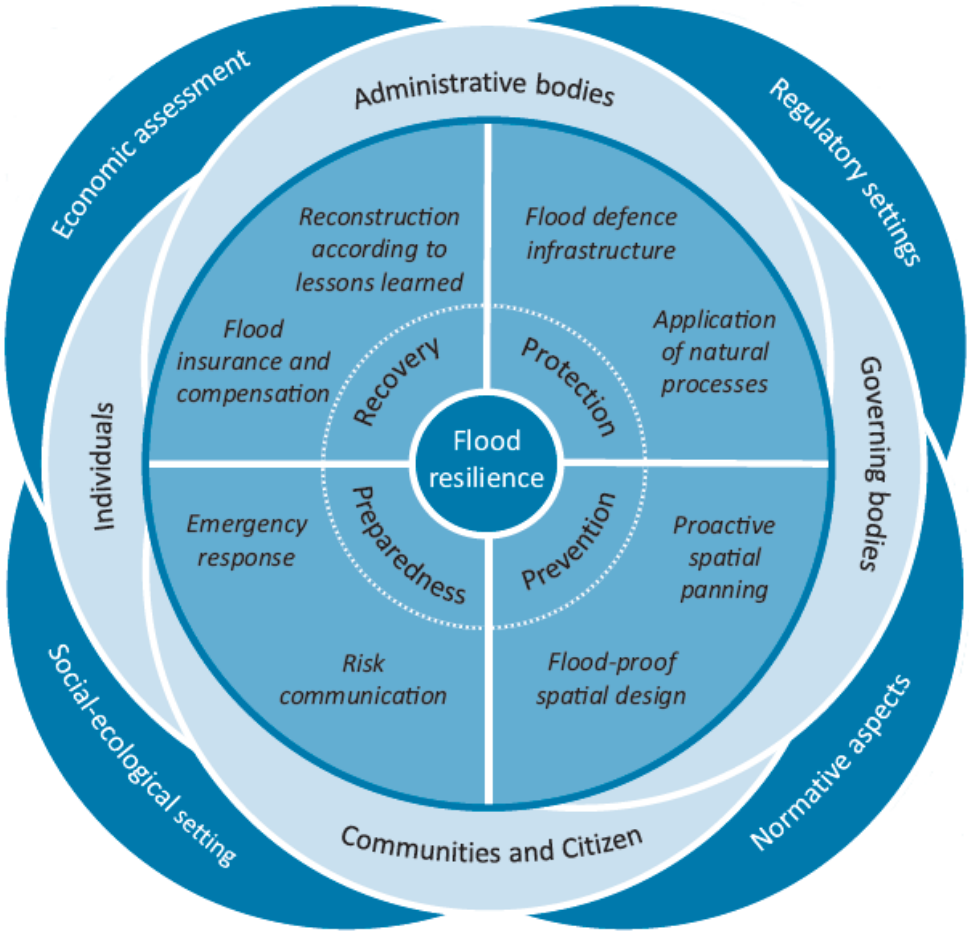

Figure 6: The Flood Resilience Rose (Karrasch et al., 2020)

Level two: The institutional context

These layers are embedded in level two, the institutional context which consists of administrative bodies, governing bodies, communities, and citizens, as well as individuals which are all interlinked and to be considered holistically. As stated in the Floods Directive, the institutional context plays a major role in its implementation into national laws as well as in the application of the multi-layered safety approach (Reinhardt, 2008).

'Administrative bodies' are the overarching authorities and institutions which operate on high decision-making levels responsible for flood management. EU member states are under the obligation to transpose the Floods Directive into national laws by conducting flood risk assessments, creating flood hazard and flood risk maps and introducing flood risk management plans adapted to the context (2007/60/EC).

Diverse actors and interest groups regarding flood risk management are summarized in 'Governing bodies'. These include operators in industries, agriculture, tourism, nature

conservation, construction, water management, researchers as well as citizens. Governing bodies should be part of holistic settings which especially include practitioners and experts in the field as well as decision-makers from different governance levels.

In its cyclical approach, the Floods Directive repeatedly emphasizes that "concerted and coordinated action at Community level would bring considerable added value and improve the overall level of flood protection." (2007/60/EC, p. 27). This refers to collective actions like local groups developing and sharing effective measures, instituting volunteer practices as well as citizen groups contributing to flood risk management plans (Adger, 2003; Patt and Jüpner, 2013) and represents the section 'Communities and citizen' in the Flood Resilience Rose.

'Individuals' are households and private actors who find means to reduce their vulnerability to flood events for their own individual properties. Sandbags, elevations, and reinforcement of flood prone structures belong to the most common measures taken. The financial management, for instance flood insurances and contracts, poses a great challenge in this regard (Karrasch et al., 2020). The interlinkages in stakeholder networks can be very complex as well as their relationships which can significantly vary (Pahl-Wostl et al., 2007). Therefore, participatory approaches are a central element for the concept of the Flood Resilience Rose which aims at including diverse interests of those holding a stake in flood risk management (Karrasch et al., 2020). Capacity building and social learning processes play a role in enhanced decision-making.

Level three: The wider context

Level one and two are then again affected by the socio-ecological setting, regulatory settings, normative aspects, and economic assessments, which together constitute layer three, the wider context. Flood resilience requires the inclusion of contextual factors. These can be geographical circumstances and the regional influence of climate change as well as the interaction of people and ecosystems, indicated as ´Social-ecological setting´ in the Flood Resilience Rose. Flood events due to climate change and related events like storm surges and long, intense precipitation periods illustrate the vulnerabilities in flood prone areas (EEA, 2017). Strategies like ecosystem-based management aim at restoring or creating self-sustaining ecosystems and at making better use of the services they provide (Mitsch, 2012). Ecosystem services contributing to flood protection like reduction of wave impact, creation of coastal wetlands and avoidance of erosion are gaining increasing attention (Cheong et al., 2013).

Legislative obligations determine the 'Regulatory Settings' in the Flood Resilience Rose. Each member state of the EU is under the obligation to implement the Floods Directive into their respective laws. This leads to different outcomes as generic advice is given rather than technical guidance (2007/60/EC). Possible approaches to reduce climate change related impacts are laid out in the national climate change adaptation strategies. However, until now, their focus was mostly on sectoral control and security measures which rather relate to protection and prevention approaches.

'Normative aspects' refer to the cultural embeddedness of planning approaches, norms, and values (Karrasch et al., 2020). Sources of information which go beyond those usually and technically associated with the work field are vital. This calls for showing a great degree of

receptiveness and attention to historical developments and regional identities, “because effective action depends on the mature understanding of the underlying premises on which action is based” (Booth, 2011, p. 27). Traditionally, flood protection is carried out by means of control or security approaches (Wagner, 2008) which can influence decision-making processes. Activities that raise awareness about alternatives in flood risk management can contribute to establish new conceptualizations and structures.

Flood risk assessments are crucial for further developments and improvements regarding flood resilience. They are required by the Floods Directive and involve gathering socio-economic data, for instance to create flood risk maps (2007/60/EC). Additionally, possible costs after flood events need to be considered. This is indicated as ´Economic assessment´ in the Flood Resilience Rose.

Following this review on the evolution of flood risk management, the next section will consider the role of professionals (‘policy entrepreneurs’) whose task is to ‘do’ resilience according to current literature.

2.6. The role of policy entrepreneurs in shaping change

In Europe, recent decades have shown a tendency to shift from centralized government-driven decision-making patterns towards more decentralized and liberal systems. Policymaking structures spread across multiple levels of government in a decreased top-down manner, often referred to with the term ´governance´ (Hooghe and Marks, 2001) and new policies are increasingly developed together with diverse societal actors (Loorbach, 2010). The development and implementation of new policies can lead to a structural change in the way societal systems operate and thus to a transition (van der Brugge et al., 2005; Font and Subirats, 2010). The previously described rise of a new water management paradigm can be regarded as a transition since “a transition in water policy should become visible in a reorientation of the policy substance or the governance paradigm” (Werners et al., 2010, p. 4).

Decision makers in flood risk management have an extraordinarily challenging task (Folke et al., 2005; Huitema et al., 2009). They have to take the complex interdependencies of the social and the ecological sphere into account to make appropriate decisions on a variety of risk management options (Pahl-Wostl et al., 2007; Tempels, 2016; Folke et al., 2005). Thereby, they have to employ “deliberate planning interventions (related to an ongoing desire for control and the striving to come to power)” (Buijs et al., 2018, p. 3) and at the same time take self-organized processes into account (Boelens, 2010; Teisman and Edelenbos, 2011). Long-term policy ambitions and strategic development however become even more difficult as they are often subject to extensive complexity and uncertainty due to climate change and unforeseeable severe events (Boelens and de Roo, 2016; Bormann et al., 2015). Thus, a comprehensive and profound understanding of useful and accessible flood management options is essential for decision makers in this field to anticipate long-term effects of climate change (Buijs et al., 2018; Meijerink and Stiller, 2013). Nevertheless, water managers cannot thoroughly know and understand the complex social-ecological systems they are intervening in (Easterling et al., 2000); and yet must address the above mentioned challenges.

Literature reveals that relevant strategies in dealing with these challenges can be closely linked to the previously identified attributes (robustness, adaptability, transformability) for flood resilience. All three attributes are crucial, and it is important to acknowledge that resilience approaches require an extension and refinement of responsibilities. Hence, establishing flood resilient places is a highly complex challenge (Huitema and Meijerink, 2010; Restemeyer et al., 2015; Young et al., 2006). People working in this field and fostering transitions can be referred to as 'change agents' (Huitema and Meijerink, 2010), whereas other terms like 'policy advocates' (Sherraden et al., 2002) or 'boundary spanners' (van Meerkerk and Edelenbos, 2018) can be found in literature as well. Following Huitema and Meijerink (2009), Huitema and Meijerink (2010) and Huitema et al. (2011), this thesis does not focus on the possible subtle differences between these designations but refers to these actors as 'policy entrepreneurs' who "instigate, implement and sometimes block transitions" (Huitema et al., 2011, p. 718). The influence of individuals and groups of individuals in water policy change is often much stronger than commonly assumed (Huitema et al., 2011). Focusing events like floods or other disasters are often the most effective triggers for changes in policy but reactions to these events rarely appear in a logical, linear relationship to their causes (Huitema and Meijerink, 2010). The understanding and meaning of such focusing events varies and can be framed in different ways with more than one explanation and method of resolution (Boin et al., 2009), which can have significant effects on the way the possibly following transition develops. However, Huitema et al. (2011) argue that agency-driven policy change also arises regardless of disastrous events, for example through policy entrepreneurs who were defined as:

> "people willing to invest their resources in return for future policies they favor. They are motivated by combinations of several things: their straightforward concern about certain problems, their pursuit of such self-serving benefits as protecting or expanding their bureaucracy´s budget or claiming credit for accomplishment, their promotion of their policy values, and their simple pleasure in participating" (Kingdon, 1984, p. 214).

Font and Subirats (2010) conclude that policy entrepreneurs play a crucial role in developing alternative water policy approaches, creating networks and merging parties; moreover, they can influence the credibility and feasibility of such alternatives. Werners et al. (2010) come to a similar conclusion and argue that individuals should initiate new approaches to challenge traditional water management agendas. Further along these lines, Huitema and Meijerink (2009) have dealt in their extensive and widely influential publication with the topic of which role policy entrepreneurs can play in adapting water policy and which strategies individuals have used to successfully and effectively shape change. Their transnational research includes several case studies around the world and has shown that policy entrepreneurs played a crucial role in realizing transitions in all cases and countries. Based on these findings, in following publications Huitema and Meijerink (2010) and Huitema et al. (2011) have identified five generic, frequently used strategies that policy entrepreneurs have resorted to:

1. Developing new ideas
2. Building coalitions and selling ideas
3. Recognizing and exploiting windows of opportunity
4. Orchestrating and managing networks

5. Recognizing, exploiting, creating, and/ or manipulating multiple venues in modern societies.

These strategies can be seen as generic guidelines that are practically applied in diverse ways and combinations, in that circumstances depend on the setting and individual policy entrepreneurs differ in their way of taking action, their capacity to intervene and their perceptiveness (Huitema and Meijerink, 2010; Huitema et al., 2011). Different countries offer different opportunities for policy entrepreneurs to intervene, introduce their problematics at hand and look for support (Meijerink and Stiller, 2013). It is particularly important that strategies of policy entrepreneurs are adapted to the national context and the corresponding institutional setting. However, the five strategies mentioned above constitute patterns that were repetitively observed in the transnational case studies (Huitema et al., 2011). Kingdon (1995) stated that individual policy entrepreneurs can potentially exist anywhere, for example in political parties, expert- and local communities and farmers´ associations, which was verified by Huitema et al. (2011). They "are often found among politicians, bureaucrats, experts, and interest group representatives" (Meijerink and Stiller, 2013, p. 243).

This thesis seeks to investigate what practices policy entrepreneurs (here: pilot managers and their teams working closely together in this field) have successfully and effectively adopted to realize more integrated approaches for flood resilience within the EU-Interreg North Sea region FRAMES project (see chapter 3.2). Another goal of this thesis is to locate their actions in the Flood Resilience Rose to pinpoint in which fields pilot managers primarily act and thus can influence current flood risk management approaches towards more integrated and holistic strategies.

2.7. Conceptual model of this research

Figure 7 illustrates the conceptual model of this research. It frames the key findings and concepts of the literature review as well as the direction of the following empirical investigation aimed at answering the main research question (Baxter and Jack, 2008). The model spans the spectrum along the previously described paradigm shift in water management from traditional engineering flood protection measures towards integrated flood risk management approaches. This paradigm shift has been described extensively on a theoretical level and many concepts have been developed in literature. However, the paradigm shift is also ongoing on a practical level. Significantly less research has been conducted on how to actually implement flood resilience measures in practice. Thus, this thesis focuses on implementing this theoretical paradigm shift. The evolutionary resilience concept and the attributes robustness, adaptability and transformability have been identified as crucial for flood resilience. They are taken into account in the Council Directive 2007/60/EC (Floods Directive) which additionally introduces and fosters multi-layered safety approaches in flood risk management. The Flood Resilience Rose goes one step further by merging all previously mentioned concepts and aims at operationalizing flood risk management while emphasizing holistic approaches. Furthermore, it takes the institutional and wider context into account. The Flood Resilience Rose is in this thesis regarded as the link between the holistic theoretical concepts and their practical implementation, in that it represents a tool for those whose task is to 'do' resilience. The conceptual model also introduces policy entrepreneurs as

their actions are the focus of the empirical investigation of this thesis. The main focus is precisely on the practices of those that execute flood resilience measures in practice, and particularly on what role they play in the development and acceptance of integrated approaches for flood resilience. Such professionals (here: pilot managers and their teams) were identified as policy entrepreneurs in this research.

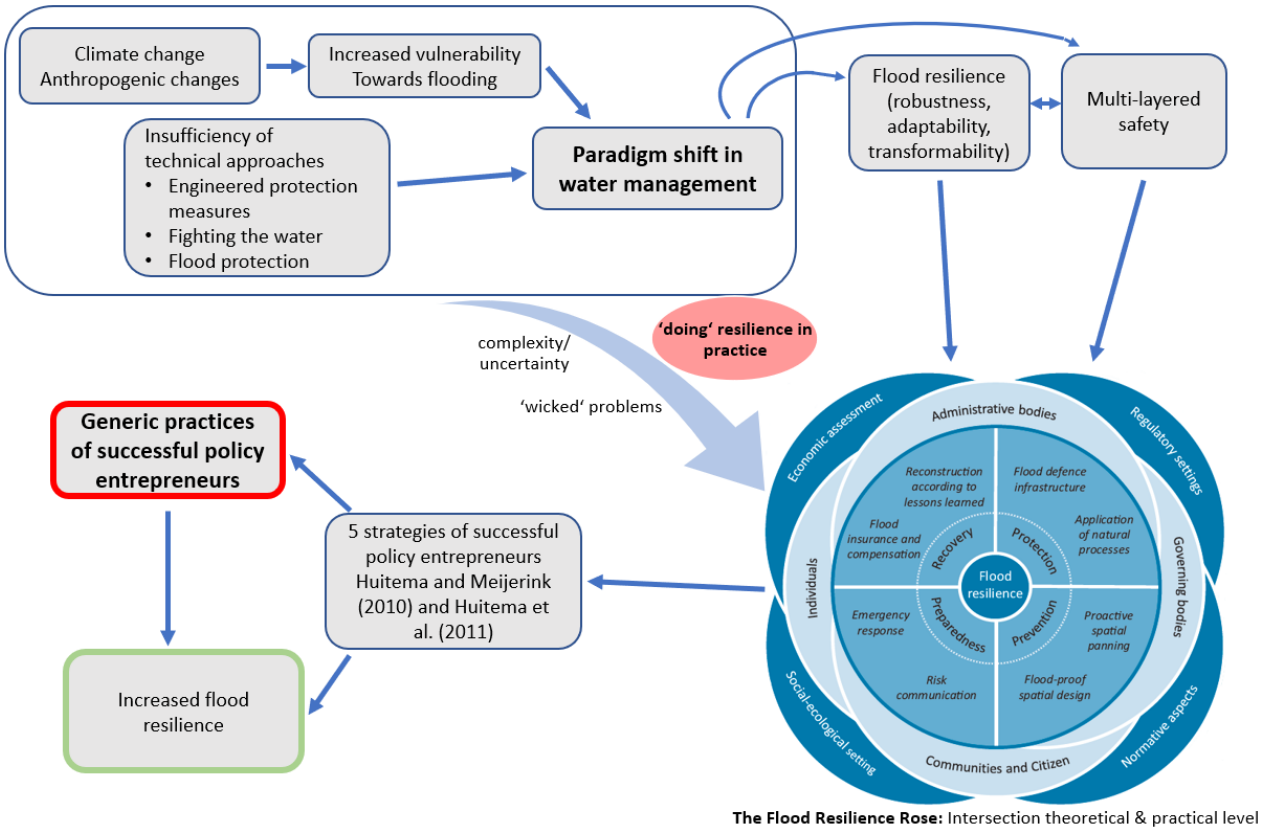

Figure 7: Conceptual model of this research (own figure)

3. Methodology

This chapter (i) introduces the EU-Interreg North Sea Region FRAMES project that serves as a case for this study, (ii) presents the applied methodologies and methods, and (iii) describes the analysis and evaluation of provided and collected data.

The first step in this research on the role of policy entrepreneurs is a literature review about state-of-the-art flood resilience approaches as well as on policy entrepreneurs whose task is to ´do´ flood resilience. This step is described in chapter 3.1. This thesis was executed in coordination with researchers of the University of Oldenburg which is involved in the FRAMES project as a partner. Hence, in order to explain the next steps, an introduction of the EU-Interreg North Sea region FRAMES project (3.2) is necessary as it constitutes the empirical foundation of this research. The focus of this research is on generic findings about the practices which policy entrepreneurs can adopt to improve flood resilience in their respective pilot areas. The findings are supposed to be generic and suitable throughout all pilot project areas of the project. Nevertheless, this project is executed in five different countries. Therefore, a policy document analysis was conducted to see if and how multi-layered safety

approaches were implemented in all governance levels in all the countries (3.3). In this step, also country-specific foci of multi-layered safety approaches in each country are briefly outlined as the historical and societal context play important roles in their development. With focus on the main research question, the next step concerns challenges and best practices of policy entrepreneurs which were encountered in the pilot sites of the project (3.4). For this purpose, data which was collected by researchers of the University of Oldenburg was made available for this research. This data was analyzed in the course of this thesis. Through this analysis, it was possible to identify new generic findings about challenges and practices of policy entrepreneurs throughout all pilot areas. These findings were presented at a project meeting in England to part of the pilot managers of the FRAMES project. Hence, they were reviewed by part of the target audience. Afterwards, the revised findings were used to formulate a new survey for verification and further insights in the course of this thesis (3.5). As a last step, it could be estimated in which fields of the Flood Resilience Rose the work of policy entrepreneurs can be located.

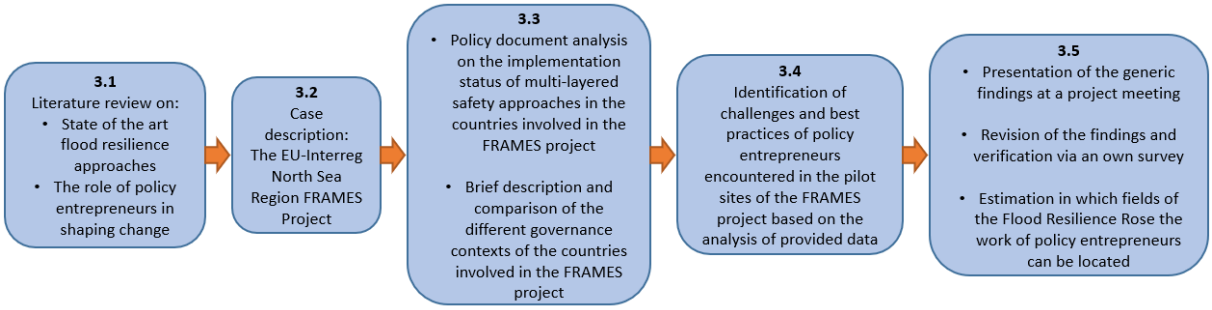

Figure 8: Methodology overview scheme

3.1. Literature review

The first sub-question of this thesis aims at identifying the aspirations and principles behind state-of-the-art flood resilience approaches, investigating their practical value and how to conceptualize them in a holistic framework. In a framework, "a variety of links must be brought to bear in the current view of theory" (Pickett et al., 2007, p. 90), in order to portray complex circumstances. To collect relevant and significant data, existing literature on the generic resilience concept was examined, as well as on further adaptations made suitable for integrated flood risk management. This includes the multi-layered safety approach and the comprehensive concept of the Flood Resilience Rose.

In this manner, research on relevant scientific literature was conducted as illustrated in chapter 2, the theoretical background of this thesis. Literature research is not a mere summary of related concepts but a discussion of relevant scientific information available in the literature to this day. Therefore, the most pertinent references for the conducted research need to be identified (Healey and Healey, 2016). Initially, a coarse framework scheme was established and subsequently a more precise examination was undertaken. Multiple portals and sources such as SmartCat, Google Scholar, relevant books, and various articles found in the process were used to find applicable materials. Some sources offered meaningful inputs, which in turn led to other useful sources making this an evolutionary form of research. Literature about areas and cities which suffer under increased vulnerabilities due to climate change, the insufficiency of traditional flood protection measures, paradigm shifts in water management

and the resilience concept as well as its emergence and development was analyzed to form the basis of this research as well as to highlight the importance and societal relevance of the overall topic. Literature about the Floods Directive, the derived multi-layered safety approach and the overarching Flood Resilience Rose was analyzed to identify possible measures to face the previously identified challenges. Eventually, information regarding actors responsible for executing these measures, referred to as 'policy entrepreneurs', was gathered with the purpose of identifying strategies that can make their work successful. The results of this literature review are illustrated in chapter 2 of this thesis.

3.2. Case description: EU-Interreg North Sea Region FRAMES project

To explain the following steps of this research, a case description of the EU-Interreg North Sea Region FRAMES project is required as the project´s pilot sites form the empirical basis for the following investigations. The FRAMES (Flood Resilient Areas by Multi-layEr Safety) project was prompted through territorial challenges and threats like rising sea levels and extreme precipitation events. Absolute flood protection everywhere and for everybody is considered unfeasible but a resourceful aggregation of resilience instruments might reduce the consequences of severe events. Countries that have a long history of flooding have developed strategies on how to deal with these issues over a long time. These strategies have evolved along country- and context-related governance settings and thus differ in their progressiveness and the way complexity and uncertainty are included in decision-making (Huitema et al., 2011; van Herk et al., 2014). Hence, in the pilot areas of the FRAMES project regional investigations take place with a special emphasis on flood risk management. The generation and implementation of flood resilience measures however can – due to their inherent complexity and the multitude of stakeholders and actors - only be realized by means of collaborative actions (Buijs et al., 2018). The FRAMES project has been carried out at 15 pilot sites in the United Kingdom, the Netherlands, Belgium, Germany, and Denmark from 2016 until 2020 (Figure 9).

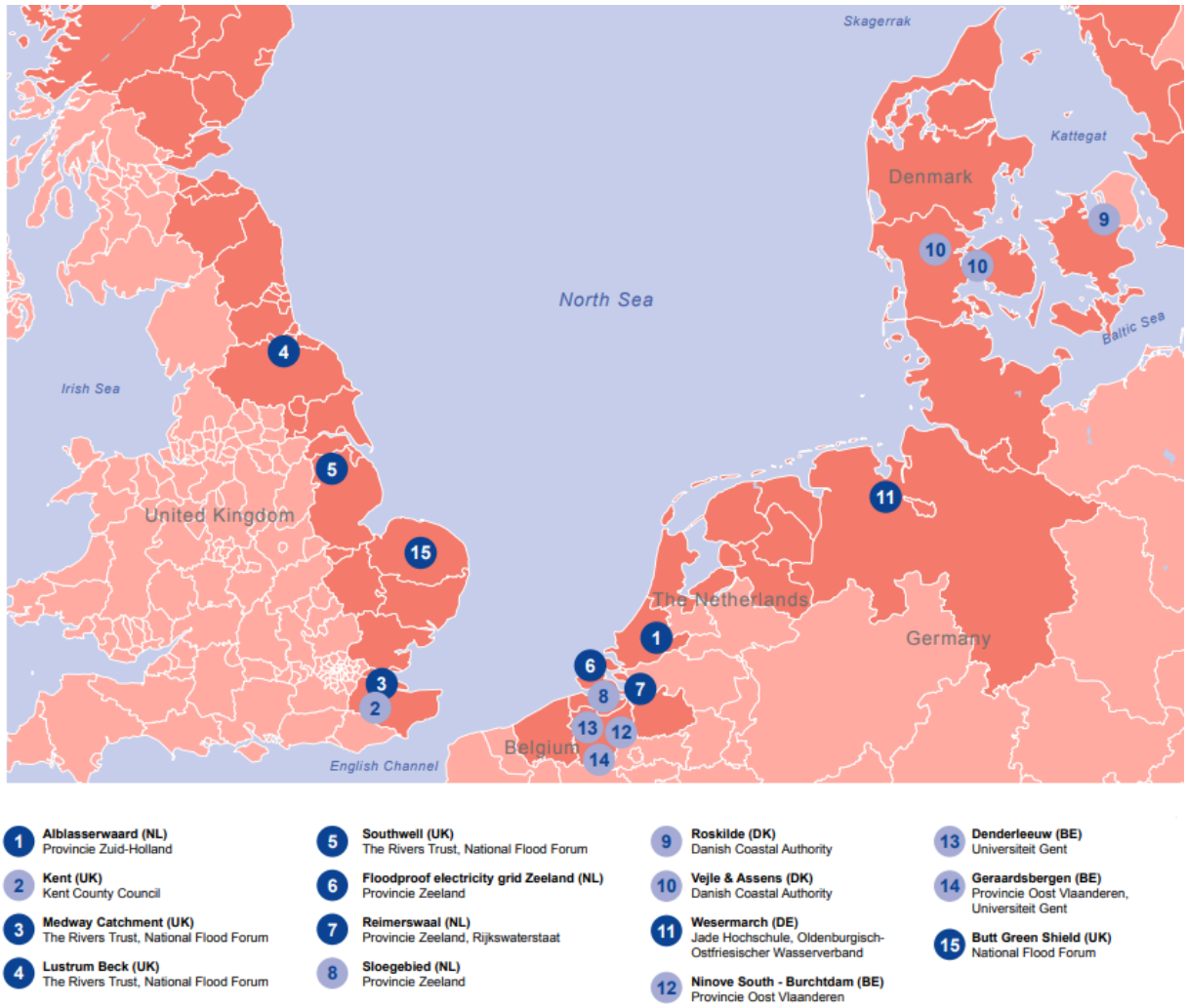

Figure 9: Pilot project sites of the EU-Interreg North Sea Region FRAMES project (Interreg North Sea Region FRAMES, 2019). Project duration: October 2016 – July 2020

The purpose is to enhance flood resilience in these areas by developing holistic strategies which take several disciplines into account. A variety of actors work together in the project areas to investigate and implement steps to mitigate the adverse impacts flood events can pose, and to improve the options for multi-layered safety approaches (Buijs et al., 2018).

Additionally, the FRAMES project devotes particular attention to the related social challenges in order to gain insights and knowledge on the decision-making process of multi-layered safety approaches (Buijs et al., 2018). All 15 pilot areas in the five different countries have explored multi-layered safety approaches in order to increase their overall resilience.

3.3. Policy document analysis and country-specific foci

The aim of the policy document analysis is to observe whether multi-layered safety components are detectable, and whether the multi-layered safety approaches proposed by the Floods Directive have been considered in the actual climate change adaptation plans and in documents from all governance levels.

The Floods Directive binds EU member states to develop risk management plans under consideration of protection, prevention, preparedness as well as review and recovery

measures (2007/60/EC). This forms the multi-layered safety approach and at the same time represents level one of the Flood Resilience Rose (see chapter 2.5).

The policy document analysis was conducted as a first step to see if and how these multi-layered safety approaches are implemented in the countries in which the pilot sites of the FRAMES project are located: Belgium, Germany, England, The Netherlands and Denmark. 18 policy documents (Table 2) were scanned for the multi-layered safety components protection, prevention, preparedness as well as review and recovery.

Documents Belgium
1. Belgian National Climate Change Adaptation Strategy (National Climate Commission 2010) (Hoyaux et al., 2010)
2. The Flemish Climate Policy Plan 2013-2020, a summary (Flemish Government, 2013)
3. Stroomgebietbeheerplan voor de Schelde 2016-2017 (Coördinatiecommissie Integraal Waterbeleid, 2016)
4. Overstromingsrisicobeheerplan Dender (Maat-ontwerpers and Labo S, 2018)
Documents Germany
5. Deutsche Anpassungsstrategie an den Klimawandel (Umweltbundesamt, 2008)
6. Empfehlungen zur Aufstellung von Hochwasserrisiko-managementplänen (LAWA, 2010)
7. Hochwasserrisikomanagementplan 2015 bis 2021 für die Flussgebietseinheit Weser (FGG Weser, 2015)
Documents England
8. The National Adaptation Programme and the Third Strategy for Climate Adaptation and Reporting (DEFRA, 2018)
9. Understanding the risks, empowering communities, building resilience. The national flood and coastal erosion risk management strategy for England (EA and DEFRA, 2011)
10. Flood risk management plan. South East river basin district summary (EA, 2016b)
11. Flood risk management plan. Northumbria river basin district summary (EA, 2016a)
Documents Netherlands
12. National Climate Adaptation Strategy 2016 (NAS) (Ministry of Infrastructure and the Environment, 2016)
13. Flood Risk and Water Management in the Netherlands. A 2012 Update (Rijkswaterstaat and Ministry of Infrastructure and the Environment, 2012)
14. Overstromingsrisicobeheerplan stroomgebied Rijn 2016-2021 (Ministerie van Infrastructuur en Milieu, 2015b)
15. Overstromingsrisicobeheerplan stroomgebied Maas 2016-2021 (Ministerie van Infrastructuur en Milieu, 2015a)
Documents Denmark
16. Danish strategy for adaptation to a changing climate (Danish Energy Agency, 2008)
17. Denmark´s seventh national communication and third biennial report under the United Nations Framework Convention on Climate Change (Rasmussen, 2018)
18. Risikostyringsplan for oversvømmelse Vejle Midtby (Klimakontoret Teknik & Miljø, 2015)

Table 2: List of official documents considered for this analysis

First, for each country the respective national climate change adaptation strategy was examined to cover a broad spectrum of different governance levels. Then more localized documents were scanned (see Table 2).

Furthermore, this analysis aims at discovering how multi-layered safety approaches were roughly interpreted in their respective context and whether they already offer precise advice for professionals on how to act, where to gather information and how to translate it into practice. Depending on the national context, multi-layered safety could be subject to different interpretations and have therefore been contextualized. The results are outlined in chapter 4.1.1.

As stated before, this thesis focuses on generic findings which are prominent at all pilots of the FRAMES project. Common challenges and best practices to overcome these challenges despite acknowledged country-specific differences are the main interest in this investigation. Therefore, the main focus is on the pilot sites, not on detailed country-specific context investigations. However, the FRAMES pilot sites are located in five different countries which differ in their approaches towards flood resilience. The historical and societal background influences the characteristics of the pilot´s specific objectives, involved stakeholders and approaches for the implementation of flood risk management measures. Therefore, this step

involves brief descriptions and comparisons of the different governance contexts of the countries involved in the FRAMES project. For this purpose, findings about flood risk governance and flood risk management strategies from the EU FP7 project STAR-FLOOD Matczak et al. (2016) and further additions by Buijs et al. (2018) are outlined to provide a brief overview about the country-specific flood risk management foci. This is described in chapter 4.1.2.

3.4. Challenges and best practices encountered in the FRAMES project based on provided data

The next step of this research is directly connected to the main research question. Data provided by the University of Oldenburg was investigated to identify which challenges and best practices in the implementation of integrated flood risk management measures were encountered in the FRAMES project. These frame the practices of policy entrepreneurs and therefore their role in these approaches. This data (Table 3) was not collected by the author of this thesis. It was collected in the pilot sites of the FRAMES project by researchers (Dr. Britta Restemeyer and Dr. Leena Karrasch) who at the time were affiliated with the University of Oldenburg. The data set was fully made available for this thesis. Hence, this thesis took all case studies for which data was made available into account to develop generic findings about the role of policy entrepreneurs in the implementation of flood resilience measures.

Since the main research question of this thesis is on generic findings, it does not focus in detail on country-specific contexts but on developing generic statements about practices which prevail at all pilot areas. This was agreed on with researchers from the University of Oldenburg as this generic focus was of interest for the project.

The focus is on similarities of encountered challenges and best practices to overcome them and the findings will be formulated in a way that they are suitable for all investigated contexts. Analyzing multiple case studies generally grants more reliable outcomes than a study on an isolated case (Baxter and Jack, 2008). Therefore, all FRAMES pilot projects for which data was made available were taken into account for this research. This approach appears suitable for addressing the question on generic strategies that can be applied in all cases. Table 3 lists all types of data that was provided. It consists of surveys, interviews, interview notes and short videos. They will be explained in more detail in the next section.

Country	Diagnostic Survey	Interview	Other
Belgium	**Belgian pilots** (Diagnostic Survey 1, 2018) Contributors: 4: Pilot manager (Belgian pilots) and three other professionals	**Belgian pilots** (Interview 5, 2019) Duration: 120 min. Location: Ghent Interviewees: 2: Pilot manager (Belgian pilots) and one other professional	**Belgian pilots** (Interview notes 1, 2019) **Belgian pilots** (Video key points 1, 2019) Duration: 2 min.
Germany	**Wesermarsch** (Diagnostic Survey 2, 2018) Contributors: 3: Two Pilot managers (German pilot) and one other professional	**Wesermarsch** (Interview 6, 2019) Duration: 120 min. Location: Oldenburg Interviewees: 2: Pilot managers (German pilot)	**Wesermarsch** (Interview notes 2, 2019) **Wesermarsch** (Video key points 2, 2019) Duration: 4 min.
England	**Southwell** (Diagnostic Survey 3, 2018) Contributors: 3: Two pilot managers (Southwell), and one pilot manager (Butt Green Shield) **Medway Catchment** (Diagnostic Survey 4, 2018) Contributors: 4: Pilot manager (Medway catchment) and three other professionals **Lustrum Beck** (Diagnostic Survey 5, 2018) Contributors: 2: Pilot manager (Lustrum Beck) and one other professional **Kent** (Diagnostic Survey 6, 2018) Contributors: 5: Two pilot managers (Kent) and three other professionals **Great Yarmouth** (Diagnostic Survey 7, 2018) Contributors: 6: Two pilot managers (Butt Green Shield) and four other professionals	**Kent** (Interview 1, 2019) Duration: 78 min. Location: Kent Interviewees: 3: Two pilot managers (Kent) and one other professional **Lustrum Beck** (Interview 2, 2018) Duration: 84 min. Location: Stockton-on-Tees Interviewees: 1: Pilot manager (Lustrum Beck) **Medway Catchment** (Interview 3, 2018) Duration: 24 min. Location: via Skype Interviewees: 1: Pilot manager (Medway catchment) **Southwell** (Interview 4, 2018) Duration: 201 min. Location: Southwell Interviewees: 3: Two Pilot managers (Butt Green Shield) and one other professional	-
The Netherlands	**Reimerswaal & Sloegebied** (Diagnostic Survey 8) Contributors: 1: Pilot manager (Reimerswaal & Sloegebied) **Electricity Grid** (Diagnostic Survey 9, 2018) Contributor: 1: One other professional **Alblasserwaard & Vijfheerenlanden** (Diagnostic Survey 10, 2018) Contributors: 2: Pilot manager (Alblasserwaard & Vijfheerenlanden) and one other professional	-	-
Denmark	**Danish pilots** (Diagnostic Survey 11, 2018) Contributors: 3: Pilot manager (Assens & Vejle) and two other professionals	**Danish pilots** (Interview 7, 2018) Duration: 35 min Location: via Skype Interviewees: 1: Pilot manager (Assens & Vejle)	-

Table 3: Data made available for this research

Surveys and semi-structured interviews

Projects which are executed in practice cannot sufficiently be represented by official descriptive reports (Bowen, 2009). For this reason, in-depth surveys as wells as semi-

structured interviews were conducted by the aforementioned researchers Dr. Britta Restemeyer and Dr. Leena Karrasch to gather information that would otherwise not be available. These qualitative surveys and interviews were thus not conducted in the process of this thesis but beforehand, and they were made available for this research.

All pilot areas of the FRAMES project have one or several pilot managers. In some cases, one pilot manager is responsible for more than one pilot site. Furthermore, there are other professionals working closely together with them. Pilot managers and professionals working closely together in the field are the people this thesis refers to as policy entrepreneurs. They are the subjects of the survey and interviews in Table 3. The table shows the type of collected data, where it was collected and who contributed. It was the researchers who conducted the surveys and interviews that selected the respondents and the interviewees, not the author of this thesis.

The surveys were supposed to offer relevant input regarding flood resilience and the implementation of the multi-layered safety concept in the project sites of the FRAMES project. They were designed to provide management and policy support for professionals working on flood risk management. The questionnaires are structured along three main aspects:

1. Context: Flood risk in the pilot area and future developments
2. Multi-layered safety: Goals, measures, and instruments
3. Multi-layered safety: 'Ingredients' for managing change

The questionnaire is attached to this thesis in Appendix B.

The actual aim of these surveys was not to answer the research questions of this thesis, nevertheless they partly provided useful insights when the textboxes were filled in. Content about context-related aspects did not prove useful to this research. Some surveys, however, specified challenges, practices and opportunities in the textboxes. Hence, they offered valuable insights that were useful to the main research question of this thesis along with the interviews. This process is described in the next sub-chapter.

In addition to the surveys, semi-structured interviews were conducted by the same researchers of the University of Oldenburg during the FRAMES project and likewise made available for this thesis (Table 3). Semi-structured interviews combine open-end questions which were prepared beforehand as well as spontaneous questions that are posed during the process. This approach ensures that relevant data is captured during the interview while allowing for flexibility as insightful topics can be explored more extensively (Fylan, 2005).

The aim of these interviews was to identify challenges which appeared during the implementation process of multi-layered safety approaches, and on the practices that the pilot managers and other professionals have applied to tackle these challenges. The interviews were already transcribed and later provided for this thesis for analysis. The focus was on challenges and best practices which frame the role of policy entrepreneurs.

In the process of the interview analysis the focus was on the challenges that appeared during the project, and on the measures and strategies employed to overcome them. Accomplishments and lessons learned were of paramount significance to answer the main research questions of this thesis. Most of the interviews were held face to face at the pilot

sites with the responsible pilot manager and/ or professionals working closely together with them. Some interviews were held via Skype. Table 3 provides an overview about these details and also states the lengths of the interviews to give more detailed insights on the total body of data which was analyzed by the author of this thesis. For two of the interviews, interview notes were provided as well. These were scanned for the same purpose.

Videos

The provided data furthermore included two videos in which one pilot manager shortly presents the ´top ingredients´ which were considered as crucial for the successful implementation of the FRAMES objectives. Table 3 states the length of these videos. The videos were provided as raw data and they were transcribed by the author of this thesis.

3.4.1. Analysis of the provided data

All provided data (Table 3) was coded with the software MAXQDA in order to properly organize the extensive total body of text and the findings. Deductive codes were used, and inductive codes were developed in the process. The deductive codes were the five strategies of policy entrepreneurs by Huitema and Meijerink (2010) and Huitema et al. (2011), namely: (1) developing new ideas, (2) building coalitions and selling ideas, (3) recognizing and exploiting windows of opportunity, (4) orchestrating and managing networks and (5) recognizing, exploiting, creating and/ or manipulating multiple venues in modern societies (see chapter 2.6). Huitema and Meijerink (2010) and Huitema et al. (2011) state that these strategies are generically executed by policy entrepreneurs. This thesis focuses on their actions in the pilot sites of the FRAMES project. Therefore, these strategies were expected to be found in the provided data. Hence, the deductive codes were in a way given.

In addition to the five strategies, many challenges in the implementation process for integrated flood risk management measures could be identified. These challenges need to be overcome and they frame the work of policy entrepreneurs as the latter must address them with their practices and lines of action. Hence, inductive codes were developed by the author of this thesis throughout the coding process. While the deductive codes are strategies, the inductive codes are mostly challenges from which in turn practices to overcome them are derived through the discussion of the findings. To see whether the inductive codes that were developed throughout the process were also applicable in the data that was scanned at first, the initially coded data was scanned once again. The coding thus involved scanning the data back and forth multiple times. The deductive and inductive categories and codes can be seen in Appendix C. The coding allowed for a joint analysis of all provided data in Table 3. This approach was chosen as the software MAXQDA provided a good opportunity to structure the findings which the data revealed and to put them into respective categories.

It is again important to note that up until this research step the author worked with the data which was provided. The interviews, surveys, relevant notes attached and videos were anonymized in Table 3 to ensure the privacy of the participants and to prevent any undesired repercussions (Flick, 2009; O'Leary, 2004).

3.5. Identifying successful strategies for policy entrepreneurs in integrated flood risk management approaches

This research step stems from the data scanning described above. The aim was to find out whether the five generic strategies of policy entrepreneurs by Huitema and Meijerink (2010) and Huitema et al. (2011) could be identified in the provided data (Table 3). Secondly, it was determined whether the five strategies could sufficiently describe all the challenges and practices found in the data. This was not the case: The findings from the data analysis provided insights that allowed for a reformulation of the five strategies that is better suitable to the FRAMES project. More significantly, it was possible to identify and formulate new strategies that are additional to the five by Huitema and Meijerink (2010) and Huitema et al. (2011). This led to the development of statements (see chapter 6.1). Hence, the challenges and best practices revealed in the surveys, interviews, interviews notes and videos allowed to set up novel statements that describe successful practices of policy entrepreneurs in the field of flood risk management, specifically in the context of the FRAMES project. These partly reformulated and partly newly developed statements are still generic as they were set up based on the data from all pilot areas of the FRAMES project.

To verify the validity of the statements, the author of this thesis was given the opportunity by the University of Oldenburg to participate at the Kent FRAMES Days which took place from the 11th – 14th of November 2019 in Tunbridge Wells, England. This was one of several regular meetings where plenary sessions take place and the general status of the project is presented and discussed. This was also an opportunity to meet the object of interest for this thesis: the pilot managers and other professionals working in the project. It was the same target audience of the research from the University of Oldenburg provided for this thesis (chapter 3.4). Furthermore, several presentations and workshops on policy recommendations, deliverable reviews, and findings as well as site visitations took place during the FRAMES Days. During workshops and informal meetings opportunities arose to talk to some policy entrepreneurs, to present the thesis focus and to discuss the current status of the findings from the analysis of the provided data. To do so, the author of this thesis presented a research poster. It can be found in Appendix D.

The tight schedule during the FRAMES Days did not allow for extensive conversations with all policy entrepreneurs. The research poster contained eleven statements which were subsequently summarized to ten statements. Content-wise they did not change as positive feedback was received, and the present policy entrepreneurs could clearly identify their own work in the presented statements. Ten statements are an even number which is better suitable for further surveys and analyses.

After the FRAMES Days, the ten statements were sent to the policy entrepreneurs as part of a new and own survey via e-mail (Appendix D). The participants were chosen based on the attendance list of the FRAMES Days in Kent. The objective was to have these policy entrepreneurs weight the statements to assess which are considered the most important and effective in the work of a pilot coordinator in the framework of the FRAMES project. The participants were asked to rate each statement with points ranging from 0 to 100. Only one statement, the most preferred one, could be given 100 points. The difference of relevance between the statements is indicated with at least 5 points (95, 90, 85, 80 etc.). Different

statements could score the same number of points with the exception of 100 and 0. The results of this survey were analyzed and graphically represented through Microsoft Excel.

The total number of surveys sent was 28. After two weeks, a reminder was sent to those who did not answer. This way, a few answers could still be received. In total, 17 replies were received. How many surveys were sent to each country is indicated in Appendix D. This number varies strongly due to differences in responsibilities, number of people involved in each project site and especially due to the number of pilot sites in each country. As mentioned before, this thesis focuses on pilots, not countries and therefore possibilities for country-specific comparisons are limited. The focus is on generic findings which are applicable throughout the pilot areas of the FRAMES project. This research step can be seen as a verification of the findings from the previous analyses as the target audience directly ranked the statements about their own work.

3.5.1. Locating the actions in the Flood Resilience Rose

The results of all previously conducted research have revealed many challenges but also practices which policy entrepreneurs can apply in their pilot areas to increase flood resilience. These qualitative findings were then taken as a basis for estimating in which fields of the Flood Resilience Rose (see chapter 2.5) pilot managers can influence transitions the most. These estimations were based on (i) the results of the analysis of the provided data and (ii) the results of the own survey. The frequency and the attention dedicated to specific challenges and practices were taken into account, as well as the ranking that resulted from the own survey. A heatmap of the Flood Resilience Rose was created to visualize these estimations synoptically.

4. Results I

The following section presents the findings of the previously described research steps 'policy document analysis and country-specific foci' (4.1) as well as 'challenges and best practices encountered in the FRAMES project based on provided data' (4.2). 4.1 describes the results of the conducted policy document analysis and shows a brief overview of the country-specific foci. 4.2 presents the results of the data which was made available for this thesis by the University of Oldenburg (Table 3). Focus is on the challenges and best practices of pilot managers in integrated flood risk management approaches.

4.1. Policy document analysis and country-specific foci

4.1.1. Policy document analysis

All policy documents (see Table 2) were analyzed in order to identify key concepts related to multi-layered safety approaches. In most cases the terms 'protection', 'prevention', 'preparedness' as well as 'review and recovery' or at least synonyms were traceable in the examined documents. National policy documents were all developed in their respective contexts with dissimilar perspectives. Since the Floods Directive rather gives imprecise advice than detailed provisions, interpretations of protection, prevention, preparedness and review and recovery differ in some cases.

The analysis shows almost no gaps, which indicates that the multi-layered safety keywords appear in all examined countries and on all policy levels; ranging from overarching national climate change adaptation strategies to regional flood risk management strategies down to more local flood risk management plans for river basins. Furthermore, it is noteworthy that in the national climate change adaptation strategies the terms appear more often as synonyms, broad descriptions that are similar to the definitions in the Flood Resilience Rose or they are simply mentioned shortly and not specified in detail. The relevant documents for more regional and local contexts, however, rather offer more detailed advice and more often contain descriptions of the keywords which equal the definitions of the Flood Resilience Rose. The findings of this analysis can be found in Table 5 – Table 9 in Appendix A. In the following paragraph, country-specific foci of multi-layered safety approaches in each country are briefly outlined as the historical and societal context play important roles in their development.

4.1.2. Country-specific context

This section shortly describes and compares the different governance contexts of the countries involved in the FRAMES project based on the findings of the EU FP7 project STAR-FLOOD. The STAR-FLOOD project was conducted as a comparative study which focused on flood risk governance and flood risk management strategies in 18 regions in six European countries: Belgium, The Netherlands, England, France, Sweden and Poland (Matczak et al., 2016). The first three stated countries also hosted pilot sites during the FRAMES project. Buijs et al. (2018) employed and extended the analyses of the STAR-FLOOD project by adding flood risk governance in Germany and Denmark. Hence, they completed the country-setup of the FRAMES project.

To compare the governance context of the FRAMES pilots, Buijs et al. (2018) applied the framework of Hegger et al. (2014) to the respective countries. The framework analyzes flood risk governance arrangements, i.e. "[...] the whole of actors, discourses, rules and resources through which Flood Risk Management Strategies (FRMS) are developed and put into practice" (Buijs et al., 2018, p. 10), according to the following aspects: diversification and dominance of strategies, multi-sector governance, multi-actor governance, and multi-level governance.

Diversification and dominance of strategies and arrangements: This dimension serves to investigate the reasons behind the dominance and the diversification of strategies and arrangements in a specific country. According to Matczak et al. (2016) these can be traced back to a country´s hydro-physical characteristics and to its history with regard to governance developments. English flood risk governance arrangements are highly diversified and relatively balanced. This can firstly be explained by the fact that the country faces diverse flood types, and so fluvial, pluvial and coastal threats have equal importance. Secondly, because the national government does not hold a clear legal responsibility to protect its citizens from flood risks, different sub-parties play a vital role. Belgium and especially The Netherlands show a much lesser degree of diversification. This is because both countries have a notorious history of extreme vulnerability and traumatic flood events. Moreover, because geographical areas protected through dikes historically experienced a subsequent high economic development, as risks increased the demand for the state to provide habitability and safety also increased (Buijs et al., 2018). The government has thus developed a legal responsibility to protect its

citizens from flood events, a responsibility that translates into a strong sub-flood risk governance arrangement which favors traditional flood defense approaches. Germany and Denmark also focus on defense approaches, at the same time showing a great degree of diversification. In Germany the security approach set out in the Federal Water Act (WHG) has been predominant until 2010, when an amendment to the WHG caused a paradigm shift to the risk based approach (Heintz et al., 2012). According to Ahlhorn and Bormann (2015) however it is still unclear how this shift will translate into practice. Denmark has traditionally resorted to strict spatial planning to decrease flood risks. When flood events do occur, soft defenses like beach nourishments are preferred, and in case of uninhabited areas land is given back to the sea.

Multi-sector governance: The focus here is on assessing whether flood risk governance relies either on sector-based water management, or rather on integrated planning or even integrated risk management. According to Matczak et al. (2016), this is mostly due to a country's general preference in terms of levels of governance, for example depending on whether local or national governance is preferred, and also to the strength and level of coordination of spatial planning or risk management. Matczak et al. (2016) state that in all countries analyzed spatial planning and water-management governance bodies co-exist. In England and Germany in particular spatial planning plays a very important role (Heintz et al., 2012). Belgium and the Netherlands rely greatly on institutionalized water management, but in the case of Belgium the use of spatial planning instruments in the context of integrated water management has significantly increased. In the Netherlands to this day this development can be seen only discursively. In Denmark multi-sector involvement is central as national overall strategies must be initiated and applied by municipalities, as well as by landowners – who profits from coastal protection bears the responsibility (Buijs et al., 2018).

Multi-actor governance: This aspect illustrates whether flood risk governance is solely a responsibility of the state or whether other actors play a role. Matczak et al. (2016) show that in each investigated country market actors and civil society are becoming increasingly involved. There are however differences with regard to intensity and the type of co-production that these private actors perform. England shows the highest degree of interrelationship between state and society. Communities in flood-prone areas work closely together with authorities both in the decision-making and the implementation of flood risk measures. Market actors also play an important role because of the privatization of the water sector and the marketization of flood insurance. In the Netherlands and in Belgium governments are attempting to raise public awareness about the sharing of flood risk responsibilities. The Belgian market opened up its doors to private flood insurance in 2006 (Matczak et al., 2016). In Germany the public sector is very much dominant as the security approach requires a strongly hierarchical structure (Heintz et al., 2012). Denmark on the contrary with its privatized water management shows a constellation of local water companies that are in charge of water and water waste infrastructures, but they are also vital in local adaptation processes to climate change (Jensen et al., 2016).

Multi-level governance: This final dimension assesses whether flood risk governance is organized nationally, regionally, or locally, and what types of shifts towards (de)centralization occur. Here the geographical size of a country necessarily plays a role (Matczak et al., 2016),

but there are other factors at play. England shows a general trend towards decentralization in all policy domains, thus including flood risk management, to the extent that competences have reached the municipal or inter-municipal levels. Although in Belgium competences were transferred from the federal to the regional level, the process is practically one of recentralization: rather than further decentralizing to the local level, higher governmental bodies have intensified supervision onto municipal flood risk management. In the Netherlands flood risk management is very balanced in this regard as competences are divided between the centralized Rijkswaterstaat and decentralized bodies. The latter come into play in instances where traditional defense approaches are impractical. In Germany the federal government sets general standards but it is the federal states (Länder) that must implement national legislation and perform risk management in practice (Bubeck et al., 2017). Denmark presents a similar situation as local actors can look at the national climate adaptation strategy for a range of options on how to prepare for climate change, and how to assess risks at a local level (Jensen et al., 2016). There is moreover an ongoing tendency towards further decentralization.

Characteristics of governance	**Belgium**	**United Kingdom**	**The Netherlands**	**Germany**	**Denmark**
Diversification & dominance	Moderately diversified, defense still important	Highly diversified, quite balanced	Low diversification, defense dominant	Highly diversified, defense dominant	Highly diversified, defense dominant
Multi-sector	Water sector and spatial planning gaining equal importance; water sector still important	Multi-sector involvement integrated by spatial planning	Water sector dominant	Multi-sector involvement integrated by spatial planning	Multi-sector involvement (involvement of landowners and farmers)
Multi-actor	Public (state dominant)	Public and private	Public (state dominant)	Public (state and federal states dominant)	Public and private
Multi-level	Decentralized, tendency towards centralization	Central and local level	Both central and regional level (water boards)	Central guidance; Decentralization to federal state and local level	Central guidance; Ongoing decentralization to local level

Table 4: Flood risk governance in countries of pilot studies. Based on Matczak et al. (2016), Wiering et al. (2017) and Buijs et al. (2018)

4.2. Challenges and practices of pilot managers

As outlined before, the provided data about the EU-Interreg North Sea Region FRAMES project sites (Table 3) was examined to determine what challenges and obstacles pilot managers and other professionals in the field had to face when attempting to implement multi-layered flood risk management approaches. Based on the identified challenges this thesis formulates the general tasks of policy entrepreneurs. The findings will thus be transnational as the aim of this research is not to assess which challenges are the most vital for each pilot area. Furthermore, best practices and general lessons learned will be outlined in this chapter. The challenges and

practices presented in this chapter are based on the data which was provided for this research by the University of Oldenburg (see Table 3).

4.2.1. Challenges

The challenges identified in the interviews and surveys can broadly be categorized as communication-, resources-, and power relations-related challenges. Communication issues appear as unclear responsibilities, lack of communication among project-relevant parties, lack of interest and awareness as well as language barriers. Resource-related challenges broadly include time constraints, financial means as well staff numbers. Power-relations can be problematic in terms of powerful stakeholders and organizations exerting their influence, the question of inequalities, and the ambition of powerful actors to achieve and preserve a good reputation. It is important to note that the provided interviews and surveys for this thesis do not allow for weighting and ranking the identified challenges by importance. This chapter qualitatively points out the challenges identified in the areas of observation. The available data does not allow for quantitative analyses.

Communication (and collaboration)

Due to their complexity, multi-layered approaches can pose substantial challenges for the proper organization of measures. Several surveys have revealed that a well-established integration of different (policy) sectors is lacking. Even though there is existing expertise in all layers of the multi-layered safety approach in the respective sectors, this expertise is often employed at a sectoral level instead of holistically. To "[…] get us more to think about how it all works across the spectrum, it´s gonna be so important as an enabling factor, to actually build resilience" (Interview 1, 2019). However, many different parties like agencies, authorities, communities, companies, and councils can have vested interests in participating in resilience approaches. Thereby, cross over in their work is often inevitable and constant communication is required. When large numbers of stakeholders work with different means to similar ends and collaboration is lacking, outcomes towards more holistic resilience strategies can be highly compromised. Even within the same institution, different teams can be responsible for organizing different sectors. This includes among others defense and prevention, biodiversity, community resilience, emergency response and emergency preparedness. In case of severe flood events, all teams get mobilized and they all play important roles. However, communication among these departments appears to be lacking. For example, people working in the field of community resilience have entirely different tasks than the flood risk officers dealing with flood protection. More intensive collaboration and communication among these teams would be desirable to improve the use of available resources. Sometimes it is "[…] about how people do it, not necessarily what they do" (Interview 1, 2019) to avoid slowing down important processes.

In most areas, there are clearly defined responsibilities regarding layer one (protection) of the multi-layered safety approach whereas measures in the context of the other layers call for shared responsibilities. However, they are not necessarily linked to each other in reality. "[…] when we asked for risk planning for water bodies, we were sent to many people who sent us to many other people. Nobody wanted to have the responsibility to do flood risk management" (Interview 6, 2019). The question here is who shall stop doing the individual

work for the benefit of "[…] the middle bit" (Interview 1, 2019); "[…] who sits in the middle of the Flood Resilience Rose to help facilitate the more holistic thing? […] who would sit in the middle of the rose to make those layers work together?" (Interview 1, 2019). Hence, for some departments it is questionable whether staff should focus on their core tasks or whether increased efforts should be put into diversified topics that are potentially the tasks of other departments. Unclear responsibilities can hamper integrated approaches and simply shift problems from one place to another instead of solving them.

Traditionally, flood risk governance was often considered an exclusive state responsibility in the examined pilot areas. Today, projects aim at including citizens and other private actors in flood risk measures. However, considering the novelty of this development, their inclusion is not completely achieved which makes holistic approaches more difficult. There is growing consensus that "[…] you really need local actors like local municipalities, in some cases sewage managers, the water managers and so on all on board to develop this kind of planning" (Interview 5, 2019). This is important to increase public awareness on flood issues and to unveil shortcomings by reviewing disaster management mechanisms. Linking the stakeholders (governmental and non-governmental) is crucial to share challenges and insights in order to interactively develop solving strategies.

The cultural history and background of a country can be of great relevance for how communication matters are coped with. Often, different organizations are responsible for small aspects of flood risk management. If they come together or not depends on the intensity of collaboration in previous projects. Collaborations within these projects are frequent but they do not constitute everyday practice. Additionally, the implementation of the Water Framework Directive has brought about a planning focus based on river basins instead of administrative units. This requires much more intensified cooperation and can therefore be challenging.

Multi-layered safety approaches include all governance levels and require the collaboration of various stakeholders. Therefore, it is often not possible to suggest straightforward solutions to flood resilience challenges. Solutions need to be developed collectively and through the inclusion of many disciplines. This inherent complexity makes it more difficult to 'sell' the project measures to a wider audience. When seeking support without having formulated clear solutions to a problem, the reaction is often fruitless criticism instead of constructive ideas but "[…] what can we actually achieve without the people that are the major players in those different layers of multi-layered safety, or within the major players of the sector […]" (Interview 1, 2019).

The surveys and interviews have revealed different cases of lacking interest and awareness. Citizens still rely on authorities and do not consider themselves in charge to prepare for flood events. There is a low social acceptance for multi-layered safety measures observable. The general support for flood related issues is usually high but the focus of action remains largely on protection. People are unaware of their own flood risk or the topic fades into the background as they "[…] are normally too busy until they flood" (Interview 2, 2018). This is especially true for people living in areas in which flood events did not occur in several years. Consequently, communities tend to forget that they are at risk. Even if people experience an extensive flood, they hope it remains a once in a lifetime event. Risk might have been reduced

through respective measures, but it does not mean that it disappeared. Hence, it can be an issue as areas close to water bodies and the coast are often regarded as attractive places for companies, recreational purposes and living. Some of the interviewees mention housing and business developments in flood plains and in coastal areas without any flood-proof designs. The integration of local knowledge and actors like municipalities, sewage- and water managers is crucial, yet it is challenging to raise awareness and improve respective spatial planning approaches. This also applies to creating understanding about how flood prone areas can be connected. In case stakeholders do not understand what occurs downstream of their area, their actions can result in flood issues simply being transferred elsewhere and potentially even intensified. Without extensive collaboration and communication "everybody is blaming everybody else for something" (Interview 2, 2018). Traditional ways of thinking and managing are often related to the desire to control nature and can therefore become a significant hurdle to holistic approaches. Due to ownership relationships, especially in rural areas, it is a great challenge to execute integrated flood risk management measures. Persuasive efforts to change people´s perception can be a long and difficult process.

In some cases, interest and participation at the start of the project can be low due to skepticism. People tend to have a passive stance and observe what outcomes the measures result in. Making people aware of their flood risk can be a sensitive communication challenge as disaster-related topics can potentially cause panic instead of leading to the development of useful measures. Additionally, maladaptation can be caused by poorly optimized flood warning systems. Some cases have shown that people received numerous messages that were irrelevant for them. Filter improvements would be necessary to send information to the right people and to avoid warnings from being neglected. Interviewees report about a strategic focus missing from the national government and a lack of adequate ways of approaching flood-affected communities to initiate resilience actions. There is a "[…] need to change the narrative, to talk the same language" (Interview 4, 2018) to avoid counterproductive outcomes. Furthermore, intensive communication is required to understand the institutional setting and who is responsible for what. "[…] what is the county doing, how do volunteer organizations come in, how does the military come in and at what point are they allowed to send forces to help" […]. "Our list of interviewees got longer and longer. When we got everyone, it was a good picture of how it´s working" (Interview 6, 2019). Communication is crucial to make the implementation of multi-layered safety measures possible. However, it is particularly difficult to include socially vulnerable people. Many information meetings, community resilience workshops and events are held in the local language and people with migration background for instance and possible language barriers cannot properly participate.

Resources

Insufficient funding is a resource-related challenge that appears in several surveys and interviews. The interconnectedness of different disciplines and sectors requires more elaborated measures which in turn can cause significant costs. Also, the monitoring of measures taken during a project requires long-term funding. This concerns not only data-gathering but also overseeing that specific measures that require constant maintenance are being followed up on. Lack of funding can also hamper communication between relevant parties, which might be bound to the limited time frame of a project as organized meetings

and other instruments for coordinated communication require financing. Also, the adequate continuance of the measures set in place requires financial resources which might not be available anymore after the end of a project. The general "list of things that can be done got so long that within the project time and financial frame we said: we cannot do it […]" (Interview 6, 2019). It is possible that some topics which are of paramount importance can be assured to be executed successfully, but further and more comprehensive measures require support, dedication, and financial resources from all parties.

Additionally, unfeasible workload due to lack of staff is an issue frequently mentioned in the surveys and interviews. Often there are small working-groups in a sector, but significant progresses in the broad flood resilience field "[…] would actually need quite a lot of resources behind it, to push it, to market it […]" (Interview 1, 2019). Hence, "[…] at the end it is the excuse of many people: We don´t have money, we don´t have people, so many duties, we cannot do that" (Interview 6, 2019), "[…] we´d love to do more" (Interview 1, 2019). This can be particularly challenging when there is a small number of people responsible for the project who volunteer in their spare time or even constitute permanent staff "[…] which also means that it is quite difficult to get things done for FRAMES next to their normal job" (Interview 7, 2018). This can lead to fewer possibilities for orchestrating networks seen that requesting broad engagements of possible new parties in the project can only be done carefully and incrementally or else they will be swamped by an excessive workload. Overwhelming local governments and stakeholders' organizations can be counterproductive and lead to more passive stances towards the project. Limited resources often only allow for implementing measures and establishing networks during the project, actions that will need to be further pursued by other parties. This is often not possible with the same intensity. When the activities of the project end, it "[…] all depends if somebody takes the lead or not" (Interview 6, 2019).

One example of limited resources is related to the collection of data during the project and the creation of maps and brochures which will then be provided to the counties and municipalities. This information oftentimes gets integrated in respective databases or planning for emergency situations and is frequently used. However, it rarely gets processed and elaborated further. As a result, lack of information, outdated data and maps appear to be issues in several project areas. Flood maps are designed in a simple manner, lack accuracy and other important information and do not show precisely enough which areas are at risk of flooding. Evacuation plans and vulnerability analyses, however, would be important to understand current and future risks and the applicability of resilient solutions. In some cases, people do not have the right expertise, technical equipment, or resources to create or update adequate risk management maps and plans. Hence, false assumptions and conclusions can hamper management improvements. However, since a great share of this work is done by volunteers, it can be unreasonable to ask people about their work progress.

Since many processes in pilot projects are new to responsible parties, they undergo a learning curve to understand complex relationships and circumstances. Time is mentioned as an important factor which oftentimes becomes an issue in the project. The time frame in which a project takes place can become an immense challenge for executing parties as the project can be regarded an experimental area. Measures need to be developed and realized within

that time frame and there is no guarantee that they will work. However, learning opportunities need to be maximized in that time. Complex partnerships need to be established which takes time and perseverance. It is a lengthy process to get to know numerous stakeholders and gain their trust. “Something that all literature says on community resilience actions is that it takes time and we knew actually from the beginning that three years is not enough” (Interview 5, 2019). Hence, it needs to be estimated beforehand what can be achieved during the project. Implementing measures, improving them, raising awareness and motivating people to act are all time-consuming tasks. It is certain from the start of a project that not everything can be implemented and optimized within the time window.

For instance, it can take up to several years until people get interested in the flood resilience measures initiated by the project. Interest and participation of the public and even state agencies are often low at the beginning. They rather take a more passive stance and observe what outcomes the project measures result in, which slows down the success. This can be related to traditional ways of thinking and managing. Straightened rivers are examples of traditional desires to control nature. This can lower the interest in integrated flood resilience measures and therewith the project´s success. Due to ownership relationships, especially in rural areas, it is a great challenge to execute the desired holistic and integrated flood risk management approaches as persuasive efforts to change people´s perceptions can be a long and difficult process.

Time-constraints can also be related to issues of reputation. In case the wider community has made negative experiences with an agency, it can take a long time to gain back trust and reengage with them. Therefore, the focus must be on developing a good learning base to work with. It is a great challenge to select the right ideas and strategies which fit best the needs of the stakeholders during the limited time of the project. It requires to set the right course in sufficient time to ensure proper long-term effects and the continuance of measures after the project. “We knew we only had three years, so it was impossible to have a fully-grown community in such a short time, but we wanted to plant some seeds” (Interview 5, 2019) in order to make the FRAMES project have a sustainable impact. The project needs to be exploited for incentives that are being followed up on. Learning processes, making use of lessons learnt and their communication are stated as important intermediate stages; the case studies show that inadequate measures can waste some valuable time for the project. Additionally, interpersonal relationships and personal tensions among people can have impacts on the project´s outcomes and spell the difference between success and failure of measures, especially when a lot of communication is required. This can happen within project-executing groups as well as among individual stakeholders. Lastly, local experts who work in the field for a long time often have interpersonal connections that go beyond the field they work in. Personal relationships may turn out extraordinarily valuable to get access to certain networks and to seek for supporters.

Power-relations

“Many of these stakeholder organizations are very small and they don´t have the resources and the power to do that” (Interview 6, 2019). Power relations can cause significant challenges in the execution of flood risk management measures. In some cases, for example, agencies

can have interests to stay in charge of their core business. Sometimes they need to prove that they are capable of executing a great share of measures to ensure their funding. Also, authorities have a strong interest in maintaining a good reputation which is why spreading good news and claiming their own success is common. Even if authorities agree partly with the steps taken in the project, they might emphasize their competences and do not want anyone to interfere. This can cause major differences in the possibilities actors have on national, regional, and local levels as information are less shared and tend to be treated confidentially. Traditional top-down roles in flood risk governance have rather been considered a state responsibility for a long time. Therefore, for small groups of stakeholders, "tiny players relatively new to flood work" (Interview 2, 2018), it might be difficult to talk to powerful stakeholders and to 'be heard'. National unions, for example of farmers can potentially have a strong voice and clear ambitions that are often profit-driven. There might be a strong interest to continue business as usual instead of taking new approaches into account. Additionally, individuals can strongly influence the evolution of a project, especially when they hold powerful positions. The appointment of a new chairman within an agency or union for example can have massive impacts on the support for the project. Powerful actors can enable or halt the projects´ ambitions. Another factor that can hamper a project´s progress is outdated legislation that is unsuited for nowadays´ flood related challenges. This applies for example when individuals are responsible for maintaining flood infrastructure themselves and therefore potentially oppose comprehensive strategies to avoid own liability. On the other hand, people might claim that they flooded because of the measures and even when this is not the case, project-executing parties need to be insured. "So, it is also about personal liability when you work on someone´s ground" (Interview 4, 2018). It is challenging to set up new strategies that are entirely legally transparent. Contracts often sound 'risky' to stakeholders and hence new kinds of agreements need to be established.

4.2.2. Best practices and lessons learned

The previous section presented the identified findings categorized as communication-, resources-, and power relations-related challenges. This chapter points out which practices of pilot managers were identified as vital to face these challenges. The focus continues to be on transnational findings based on all pilot projects rather than on country- or area- specific best practices.

"Yes, indeed it´s a lot of talking" (Interview 1, 2019). All interviews and surveys imply that increased communication and collaboration among organizations are necessary to reveal current management deficits and to improve integrated approaches. It is important to better understand the applicability of resilient solutions. To achieve this, an open attitude towards new ideas and innovations, knowledge sharing and willingness to take experiences of other parties into account are necessary. Measures to strengthen linkages among stakeholders include expert sessions on possibilities for multi-layered safety approaches and meetings to clarify what each party is working on to avoid crossover work. Furthermore, working groups with the stakeholders to discuss and prioritize different activities towards awareness raising, technical solutions and collaborative activities have proved insightful. This joined-up approach to communication includes brokering strategic solutions to the identified problems through partnerships. Ranking priorities and appointing leaders for the different activities is important

to clarify responsibilities. It is also important for reciprocal motivation as it can create positive peer-pressure. Also, active participation in meetings is vital to gain a better grasp of the dynamics of the institutional context, as well as of potential flood risks. This will allow to effectively take advantage of existing expertise and to link the latter to a network of key stakeholders, e.g. building developers and planning authorities. Collaborations with engineering, housing and sewage companies have resulted in design proposals for making a specific neighborhood more flood-proof. Appropriate and illustrative information material is a favorable input for working groups and is therefore crucial.

Furthermore, it is important to engage with the local government as it plays a key role in activating citizens. Constant exchange of information is important to actively include citizens in flood risk management processes. Several interviews and surveys state that moves towards local contributions, participative processes and community resilience activities are important. This contributes to setting up community resilience actions and linking them to other spatial and social challenges in order to increase their chances of implementation. The purpose is to raise awareness of flood action plans among communities. It is essential to analyze who is important to reach and whom to share information and knowledge with, which helps to avoid misunderstandings and to accelerate processes for the future. To improve resilience there is an element of understanding "what is the status, who has risk management plans, what quality are they, have they tested anything" (Interview 1, 2019). It can be extraordinarily valuable to include somebody in the project who is originally from the area or has lived there for a long time and therefore potentially has a lot of experience working in the field. Such people are familiar with the local circumstances and can possibly also have access to many networks and social contacts. "In reality you need both: Someone who has been there forever, with all the knowledge but also people with that wider experience" (Interview 4, 2018).

Many different parties need to be considered for a proper network. "When we got everyone, it was a good picture of how it´s working" (Interview 6, 2019). It is important to find ways to enable stakeholders to share their knowledge on a larger scale and make their materials available to other parties. It is "the biggest accomplishment that people talk to each other about their ideas and that a lot of information comes out of it that the people didn´t have before" (Interview 6, 2019). One of these new ideas is the inclusion of already existing safety networks (i.e. those of the fire brigade and the police) to communicate in case of flooding. With such a network, it could be easier to reach and involve citizens for their assistance in case of extensive flood events. It is important to establish plans for volunteers to instruct them on how they could help and where. Uncoordinated responses in disaster management issues can otherwise become extremely counterproductive and hamper recovery measures. The training of local flood wardens is mentioned as a solution to such issues. Only in areas where flooding happens frequently it is possible to build up a new structure that deals solely with flood risks. In areas where floods occur less frequently, resilience measures should be linked to other teams within existing structures. It has proved beneficial to start from the needs and engagements of local communities, to be open for discussion and to define priorities collectively. This approach has proved more fruitful than including other parties midway through the implementation processes.

Further activities to involve citizens include community resilience workshops to raise awareness and change their attitudes towards personal contributions. The distribution of informative material like brochures and preparedness manuals is considered a further helpful measure. “It is important to make this engagement of the public with the water happen, it keeps it alive […] So we try to get people engaged, for example in schools” (Interview 2, 2018). It is important to educate the public in an attractive way, to “[…] make it fun” (Interview 6, 2019). For example, by holding informative and engaging flood risk awareness days. Other stakeholders will likely pick up with this initiative and carry it on the following year and further. Often, the success of such activities depends on whether the public enjoys them. Many people work on project measures as volunteers in their free time. Hence, it would be helpful to make these meetings as pleasant as possible. For instance, by preferring informal settings to official and formal environments. “It has to be a bit fun” (Interview 5, 2019). It has proved fruitful to hold these meetings in cafés or even bars and engage with the community through games. Furthermore, catchy and interactive word plays can impact on people. ´Water zonder kater´ (= water without hangover) is one example.

“The narrative needs to include everyone, not just those at the highest flood risk. We all have a role to play” (Diagnostic Survey 3, 2018). Adapting language to the context can be useful to seek support for the implementation of project measures, change perspectives, convince people, and gain their trust. “That´s how we start. Knocking on people´s doors, showing a face, shaking a hand, establish a trust relation, and from there sort of looking at the business” (Interview 2, 2018). These door-to-door visits in combination with resilience workshops can provide insight on the neighborhood profile. These activities are time consuming but interviewees report helpful self-reinforcing neighborhood effects like recommendations and increased consent. “It´s really about changing people´s perceptions” (Interview 2, 2018). Showing interest in people´s personal issues and simply listening to them can have positive effects; especially elderly people often have a strong sense of community and trust. That is another lesson learned and it has proved helpful to avoid jargon when approaching them. In the case of people with migration background it is important to find ways to properly include them despite potential language barriers in order to make them acquainted with the topic.

Open communication is important to avoid misunderstandings in the early stages of a project already. Water managers were worried not to be involved in the project and that another party would be charged with a very similar task. It is important to stress that the project is additional, complementary, and integrative to their work and not meant to replace it. Increased communication measures have led to a certain shift in the mindset of the public and organizations. Flood related topics cause less panic; it is rather considered positive to talk about it.

Another lesson learned is that it is important to acknowledge and accept that intensive communication and collaboration processes require a lot of time. It is not possible to change people´s attitude and mind-sets in a short time frame and it takes a long time to set up collaboration networks between organizations and authorities. Furthermore, changing an organization´s potentially negative reputation can be time consuming, and it is important to acknowledge that reputation issues can hamper collaboration measures and approaches. It is advisable to try to make use of windows of opportunities to seek support for the realization

of project measures. One example is the momentum of climate change related topics like recent extensive flood events. Another example is the application to funding schemes. Greater funding opportunities can in turn allow windows of opportunity to be opened as short-term funding leads to start-stop approaches and changes in personnel. This can result in hampered progress of measures and frustration in communities. It is furthermore important to acknowledge that the FRAMES project can be regarded as an experimental area and that experiments can also fail. Therefore, after the implementation of measures, it is useful to critically evaluate the process and send out results in form of a report. Thereby, others can learn from it and apply it to their contexts. Successful strategies might be applied successfully elsewhere, especially in the European context.

5. Discussion

The previous chapter presented the findings of the policy document analysis and offers an overview about the country-specific flood risk governance foci. It also described the findings of the analysis of the data provided by the University of Oldenburg to identify the challenges faced by pilot managers in comprehensive flood risk management approaches. This chapter discusses the key aspects of these findings. It emphasizes the interconnectedness of the pilot managers´ challenges and it serves as a basis for developing generic statements about successful lines of action pilot managers seek to implement in their work.

Building resilience is inevitably a contentious process that involves large numbers of stakeholders with their motives, power-relations and trade-offs across spatial and temporal scales (Carpenter et al., 2001). Therefore, the questions “resilience for whom, what, when, where, and why need to be carefully considered” (Meerow et al., 2016, p. 46). The Flood Resilience Rose which was developed based on the requirements of the Council Directive 2007/60/EC and the multi-layered safety approach attempts to answer these questions. It does so by taking the institutional and wider contexts into account, paying attention to complex interlinkages of diverse levels and layers, and fostering holistic perspectives. According to this study, the Flood Resilience Rose offers the most comprehensive approach to operationalize flood risk management and at the same time attempts to make resilience applicable in practice. Resilience clearly encompasses various complex issues. However, frameworks serve the purpose of simplifying complex phenomena in a reasonable manner that would otherwise exceed a complete grasp (Pickett et al., 2007), and so the focus is on being comprehensive and interdisciplinary instead of very detailed (Cumming et al., 2015). The Flood Resilience Rose therefore bargains being between its workability and the depiction of holistic approaches.

Policy document analysis

The policy document analysis regarding the current implementation status of multi-layered safety approaches has resulted in the finding that most documents at all governance levels employed multi-layered safety approaches and the terms ‘protection’, ‘prevention’, ‘preparedness’ and ‘review and recovery’ were traceable. The documents in which these terms were not used described similar measures or used synonyms (see Appendix A). For instance, in documents at national level the terms are rather used as buzzwords. There is a

trend observable that these documents use the terms without further explanation as they need to remain as generic as possible. On the other hand, when looking at more localized documents like river basin management plans, protection, prevention, preparedness and review and recovery measures are described more in detail according to the context. The more local the documents, the more specific the interpretation of the measures. This finding emphasizes the importance of local knowledge and the fact that pilot managers have to keep the greater picture in mind without losing their regard for the local context and the need to adapt to it when choosing adequate approaches. Hence, policy entrepreneurs can potentially seek for information about country-specific settings and information about localized measures in official policy documents.

The interconnection of identified challenges

The interviews and surveys have revealed various challenges which were broadly categorized as communication-, resources-, and power relations-related challenges. This counts for all provided surveys and interviews despite the different governance contexts (see chapter 4.1.2). The following analysis has revealed that all these challenges in all pilot areas are highly interrelated and interwoven and that it is not possible to draw a sharp line between categories. For example, the integration of different sectors is important as existing expertise is often employed at a sectoral level instead of holistically. Reaching collaboration through communication measures is crucial to improve the allocation of available resources and avoid unclear responsibilities. Multi-layered safety approaches require the collaboration of various stakeholders which can be a long process and they demand a lot of resources. Meetings and events are necessary but they require staff and financial means thus linking communication challenges with resource-related challenges. Therefore, the connection of different disciplines and sectors can cause significant costs. However, lack of staff and financial means is mentioned in multiple interviews and surveys. Furthermore, interviewees agree that the timeframe of the project is insufficient to integrate all potential measures for fruitful resilience but it needs to be used to the fullest possible extent to lay the foundation for future measures. Limited time leads to decreased opportunities in orchestrating networks which links resource- and communication-related challenges. Often after a project ends, another party needs to take responsibility for the continuation of measures which is a challenge that again includes communication- and resource-based challenges. On the other hand, a lack of resources can cause for example the creation of poor information material which is used for communication purposes like awareness raising. Overall, multi-layered safety approaches are new to many parties who need to undergo a learning curve. Complex partnerships need to be developed; this takes time and perseverance as well as a wide range of communication- and collaboration-related actions.

Not only are communication- and resource-related challenges highly interwoven, they are also both closely interlinked with power-relations. Interviews and surveys have revealed that in many cases the main interest of powerful stakeholders is to stay in charge of their business. That is one reason why collaboration and communication with such actors can be difficult as information sharing is compromised. Traditional top-down roles in flood risk management make it difficult for smaller actors with less resources to be heard. It is important to convince people in powerful positions through communication measures, in order to seek their

support. Thus, all challenges are highly interwoven and solutions for some of the mentioned challenges are prerequisites for others. Making people aware of their flood risk for example, a communication-related challenge, can be regarded a prerequisite for following measures. However, frequently stated resource-related challenges like lack of staff and insufficient funding add complexity and make finding proper solutions an extraordinarily challenging task.

Figure 10 illustrates the interconnections of the identified challenges that pilot managers in the FRAMES project are facing. The arrows showing the challenge categories indicate that most challenges cannot be considered individually but are highly interwoven. A great share of challenges is part of the greater picture and solutions require holistic approaches.

Figure 10: Circular figure illustrating the interconnections of the identified challenges pilot managers in the FRAMES project are facing (own figure)

The interviews and surveys have revealed that best practices and lessons learned in the FRAMES project by pilot managers are mostly based on communication-related lines of action. All interviews, surveys and videos imply that increased communication and collaboration among organizations is necessary to reveal potential management deficits. This is true for all pilot areas independently from their location and thus from the different multi-actor, multi-sector, and multi-level governance settings (see Table 4). To achieve improved communication

and collaboration, cooperative activities like expert sessions, meetings and working groups are necessary.

It is the challenging task of pilot managers and their teams to initiate such communicative and cooperative activities, to take complex interdependencies into account and to make appropriate decisions on a variety of risk management options. The identified best practices and lessons learned imply that it is beneficial for pilot managers to gain a comprehensive knowledge of the institutional system they are working in and of how to navigate in it. What matters is not only the existing context, but also that policy entrepreneurs create an own context by means of communicative measures – this allows to define priorities collectively in the process of understanding the applicability of resilient solutions. Hence, it is important to be willing to learn from others. By means of cooperative and collective activities like joint-up approaches, meetings and expert sessions, policy entrepreneurs try to build and manage extensive networks across a large variety of stakeholder groups. Thereby, individuals can play key roles as some have a lot of experience in the field or can enable access to certain networks. Communication, networking skills and narratives that include everyone to frame issues and justify change are crucial to seek support for project measures, convince people and gain their trust.

To execute communication measures collectively is important in order to take power relations and possible inequalities into account as well as to acknowledge that transitions mostly happen via a combination of bottom-up and top-down strategies. Policy entrepreneurs must find a balance between activism and fine politics for their vision to come through. It is about pushing the own agenda and facilitating relationships between different actors at the same time. Mediation seems to be more adequate and promising than hard lobbying. It is about balancing advocacy and brokerage strategies (Meijerink and Huitema, 2009). Therefore, it is important to identify venues or to create them to seek for support and to introduce new inputs and ideas into decision-making processes. It is helpful to anticipate windows of opportunity and make use of them.

The interviews and surveys have also revealed that newly introduced intensive communication and collaboration processes require a lot of time and it is not possible to make transitions happen in a short time. Thus, policy entrepreneurs need perseverance in dealing with complex circumstances. Therefore, it is important to ´plant seeds´ within the timeframe of the project and to make sure other parties in the future will follow up. This is valid for all pilot areas in the FRAMES project. The provided data (Table 3) does not allow for more country-specific insights. The focus of this thesis is on identifying practices policy entrepreneurs can apply in all pilot areas to successfully increase the overall resilience of their respective area.

6. Results II: The work of policy entrepreneurs

6.1. Ten statements about successful policy entrepreneurs

As explained previously, Huitema and Meijerink (2010) and Huitema et al. (2011) have identified five generic strategies of successful policy entrepreneurs, namely: (1) developing

new ideas, (2) building coalitions and selling ideas, (3) recognizing and exploiting windows of opportunity, (4) orchestrating and managing networks and (5) recognizing, exploiting, creating and/ or manipulating multiple venues in modern societies.

Through the analysis of the interviews and surveys concerning the FRAMES project it is evident that these five strategies could all be identified and confirmed. Additionally, the findings from this analysis provided insights that allowed for a reformulation of the five strategies that is better suitable to the FRAMES project. More significantly, it was possible to identify and formulate new strategies that are additional to the five by Huitema and Meijerink (2010) and Huitema et al. (2011). This led to the development of ten statements. Hence, the challenges and best practices revealed in the surveys, interviews, interviews notes and videos allowed to set up novel statements that describe successful practices of policy entrepreneurs in the field of flood risk management, specifically in the context of the FRAMES project. These partly reformulated and partly newly developed statements are still generic as they were set up based on the data from all pilot areas of the FRAMES project.

Successful policy entrepreneurs…

1. Gain a full and comprehensive knowledge of the institutional system they operate in and know how to use it.
2. Think alongside the context they are working in but also have to generate own context and are willing to learn from others.
3. Build and manage extensive networks across a large variety of different stakeholder groups. Successful strategies are often collective strategies in which individuals play complementary, sometimes even key roles.
4. Adopt excellent communication and networking skills, use narratives to frame issues, justify change, attract supporters.
5. Take power relations and possible inequalities into account as well as acknowledge that most transitions happen via a combination of bottom-up and top-down strategies.
6. Balance advocacy and brokerage strategies.
7. Create and shop for venues to introduce newly developed ideas into forthcoming decision-making processes.
8. Anticipate and exploit windows of opportunity.
9. Are aware that things need time to change and have perseverance in dealing with complex circumstances.
10. Consider the future. The duration of a project comes to an end and ´seeds need to be planted´ for the time after a project.

Figure 11 shows an overview on how the ten statements relate to the five strategies.

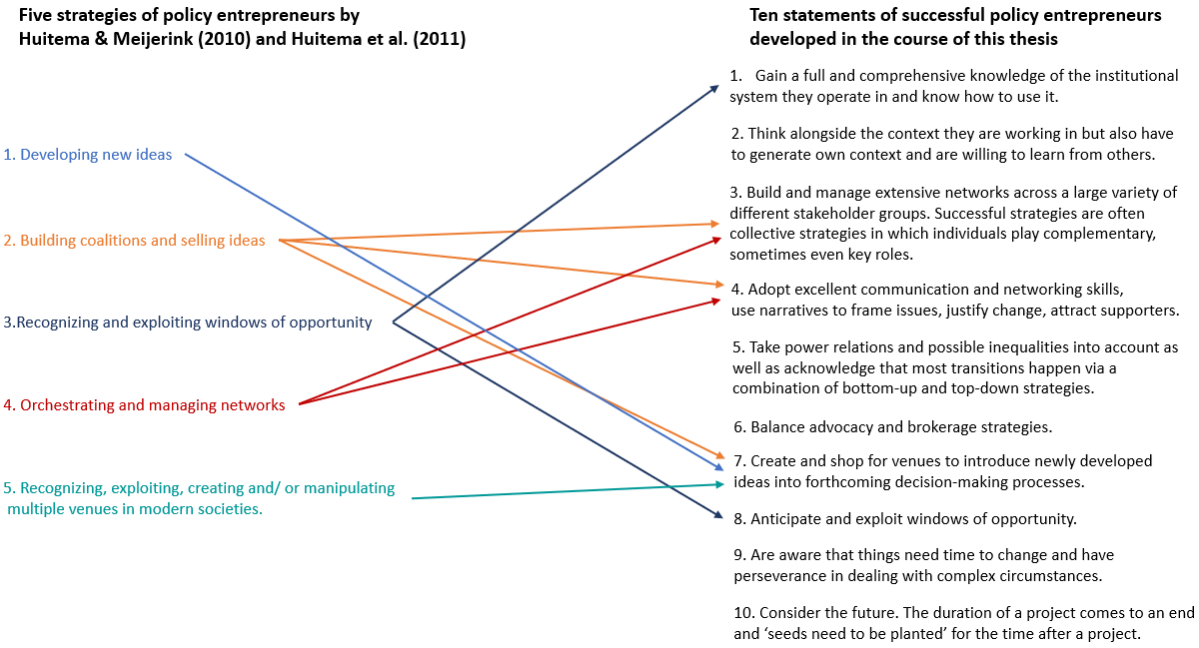

Figure 11: Ten statements based on the strategies by Huitema and Meijerink (2010) and Huitema et al. (2011) and developed through analyses of the data provided by the University of Oldenburg (see Table 3)

These general lines of action were repetitively found in the interviews and surveys provided for this research. The challenges and necessary actions to overcome them described by pilot managers and their teams served as a basis for developing these generic statements.

Figure 11 shows that the five strategies by Huitema and Meijerink (2010) and Huitema et al. (2011) are integrated in the ten statements developed in this thesis. However, not all of the ten statements are directly connected to the five strategies. Statements two, five, six, nine, and ten were only identified and formulated by the author of this thesis through the analysis of the provided data by the University of Oldenburg. They were not found in theory through a literature review. Furthermore, they were found repetitively in pilot areas independent of their country-specific governance characteristics. Therefore, they were formulated in a way that they are generic and applicable transnationally. Every single one of the ten statements is relevant to all pilot areas in the FRAMES project. However, all ten statements can also be interpreted context-dependent: Their exact meaning and significance may vary dependent on the priorities of each pilot and on the country-specific historical development and governance setting (see chapter 4.1.2). These differences are not part of this thesis and require extensive further research.

Despite country-specific differences, the findings revealed practices that are valid transnationally. For instance, in all pilots different parties need to be considered for a comprehensive flood risk management network. New ideas and findings like the inclusion of already existing safety networks to improve communication measures play an important role to overcome management deficits. Furthermore, the research revealed that it is advisable to make use of windows of opportunities to seek support for project measures. This can include to exploit the momentum of climate related topics like recent extensive flood events.

Pilot coordinators can mainly undertake communication tasks to tackle the challenges and aspirations within the project. While the challenges are diverse, the identified actions can mainly be categorized as communication related actions. Therefore, the pilot manager is

rather the organizer and initiator of participatory processes seeking for support, collaboration with multiple stakeholders, and gaining the public´s interest and motivate people to act. It is important for pilot managers to know how and where to receive information and how to process it.

In many cases, it is possible to identify and analyze the causes for challenges and management deficits. Solutions include simply desirable improvements like increased communication and collaboration. Challenges become strategies and in turn, strategies become the challenges. However, transferring seemingly simple theory into practice is highly complex and time consuming as it is still necessary to take the challenges into account holistically. Therefore, measures that increase communication and collaboration can be regarded as the most important. The results suggest that single solutions hardly exist in building resilience and it is rather the accumulation and variety of small solutions that constitute one step in the right direction. Static or linear planning approaches are inadequate to face challenges in a non-linear world (Duit and Galaz, 2008; Byrne, 2003). Therefore, pilot managers cannot focus on one activity but always need to consider the greater picture to avoid neglecting relevant aspects. However, it is important to note that an expansive focus potentially leads to an exponential increase of complexity (Cumming et al., 2015). A methodological pluralism is unavoidable, and its

> "integrating principle must be an understanding of the combination of these tools – quantitative and qualitative – ethnographic and historical – analytic and holistic – as a way of understanding the complex causality of particular local systems – embedded in interrelationships with other systems – at particular points of time" (Byrne, 2003, p. 176).

The EU-Interreg North Sea Region FRAMES project is a unique learning opportunity and it is crucial to make use of lessons learned concerning the approaches that have proved successful and those that have not. Trial and error plays an important role for future capacity building and better planning.

6.2. Verifying the statements and locating the actions of policy entrepreneurs in the Flood Resilience Rose.

After these generic statements of best practices were set up, they were sent to the pilot managers and other professionals working closely together in this field. The objective was to let these policy entrepreneurs weight the statements to find out which ones are considered the most important and effective in the work of a pilot coordinator in the framework of the FRAMES project. The participants were asked to rate each statement with points ranging from 0 to 100. Only one statement, the most preferred one, could be given 100 points. The difference of relevance between the statements was indicated with at least 5 points (95, 90, 85, 80 etc.). Different statements could score the same number of points with the exception of two statements rating 100 and 0 respectively.

The boxplots and bar charts (Figure 14) in Appendix E illustrate the results of this survey; they are the statistical representation of the point distribution based on the preference of 17 pilot managers and professionals working in the field.

The results of this survey validate the previous findings about the challenges and strategies of pilot managers in chapter 4.2 of this thesis. Statement 3 (summarized as ‘collaboration’) scored the highest average points and therefore shows the highest median value. This statement also shows a low interquartile range with only one outlier at 35 points which highlights a generally high importance of this practice-statement in the work of pilot managers.

The same applies to statement 5 (‘power relations’), statement 9 (‘perseverance’) and statement 4 (‘narratives and language’), which likewise manifest high median values and high numbers of average points. Here again, only one extensive outlier and low interquartile ranges indicate great relevance in practice.

Statement 8 (‘windows of opportunity’), statement 2 (‘context and context creation’), statement 1 (‘examination’) and statement 10 (‘future’) show median values between 75 and 80 and the average points range from 64,12 to 72,06. This situates these statements in the middle range of this survey. It is noteworthy that the distribution of points varies more widely. Although median values are relatively high, the interquartile range and number of outliers is considerably higher than in the previously mentioned cases.

Statement 6 (‘advocacy and brokerage’) and statement 7 (‘venue shopping’) occupy the lowest ranks. Median values (45 and 50) as well as number of average points (43,24 and 45,29) are significantly lower than all other statements. The boxplots for these statements furthermore show the highest interquartile ranges indicating that the considered practical value of these statements differs remarkably in the different pilot projects.

The following figure displays the average points and median values of each statement, listing the statements in decreasing order of their rating.

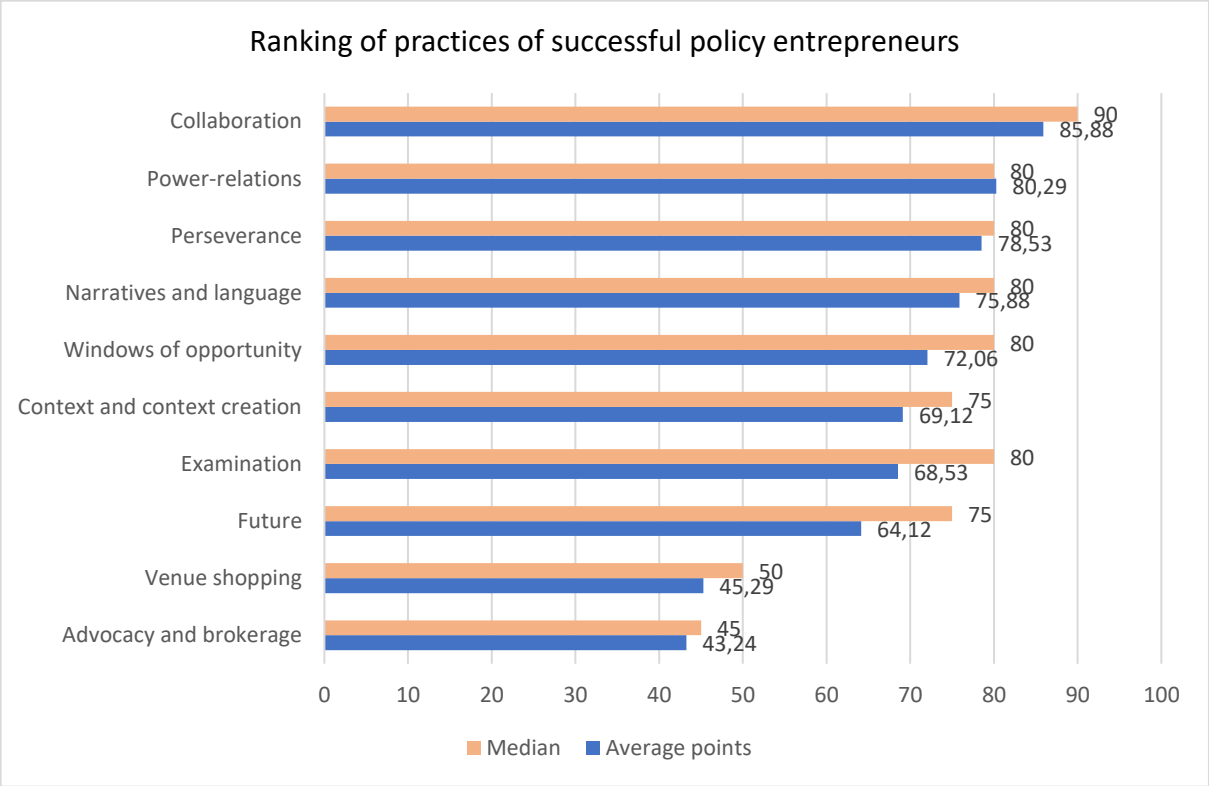

Figure 12: Ranking of successful policy entrepreneurs (average points & median)

All ten statements in the surveys were developed based on the five generic lines of action of policy entrepreneurs by Huitema and Meijerink (2010) and Huitema et al. (2011) and the results of the interviews and surveys conducted during the FRAMES project. Therefore, it was defined beforehand that all ten statements in this survey are of relevance in the work of pilot managers. This was also confirmed by the feedback received from the participants. Several participants added to the survey that it was difficult to rank the statements as many or even all of them are greatly relevant or equally important.

The responses vary, perhaps depending on the current issues that need to be addressed in the respective pilot area. For example, when trying to bring about change in policy, developing extensive networks is of paramount importance, but then recognizing that many things require a lot of time to change suggests that some of these statements may be prerequisites for others and/ or only work in combination. Therefore, the survey is supposed to illustrate a rough estimate.

The same applies to the following Figure 13 which shows estimations according to this study in which fields of the Flood Resilience Rose pilot managers can influence transitions the most. As previously described, pilot managers can mainly employ communication means to face challenges and management deficits within projects. This is illustrated in Figure 13 by the color indications in the respective fields of the Flood Resilience Rose, and on all three levels:

Application of multi-layered safety measures, institutional context and wider context (see chapter 2.5).

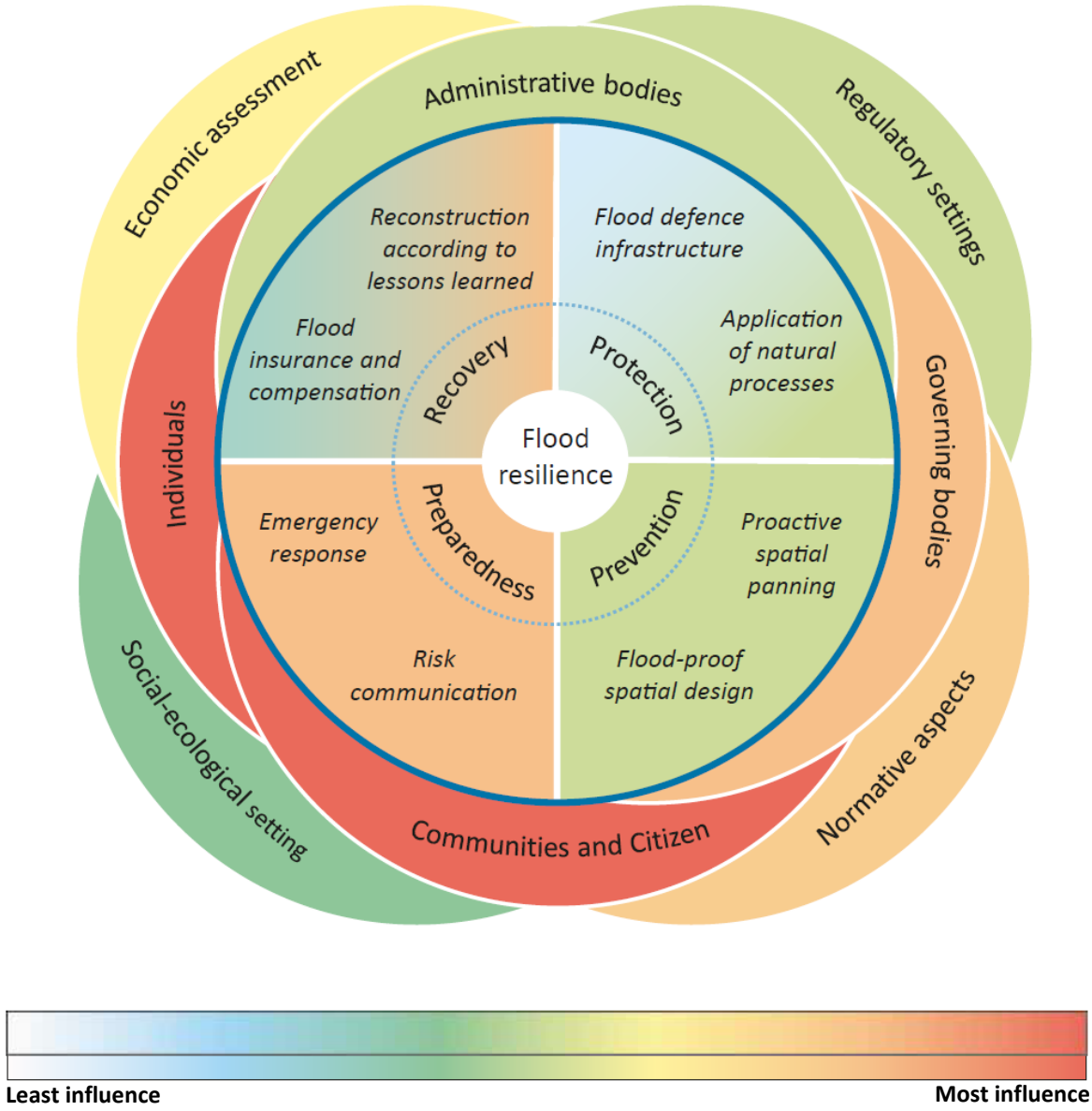

Figure 13: Heat map based on the Flood Resilience Rose showing estimations according to this study in which fields policy entrepreneurs can influence transitions the most.

The fact that none of the fields in this heat mapping are marked in white underlines the great variety of disciplines and fields in which pilot managers operate. In general, they dedicate themselves to working on all central subjects that obstruct project processes and cause management deficits. They strive to accomplish the overarching goal of increasing flood resilience. For this purpose, they promote the multi-layered safety measures of protection, prevention, preparedness, and recovery in their respective institutional and wider contexts. Hence, their involvement in all fields and disciplines can be observed.

The identified challenges that pilot managers in the FRAMES project must face cannot be considered individually but they are highly interconnected (see chapter 5). Hence, the previously conducted research has revealed that it is of paramount importance to include the public into flood risk management planning processes. Therefore, risk-related communication

approaching communities and citizen plays a major role in the work of pilot managers and their teams. In many cases, individuals can constitute valuable resources as, for example, they might enable access to crucial networks. Furthermore, citizens can provide useful contributions to emergency responses due to their knowledge about local circumstances. Engaging with local governing bodies is thus essential as they can play key roles in activating citizen. In addition, paying attention to the local context with its normative aspects is fundamental: for example, the previous research has shown that language and narrative can make the difference between success and failure of certain measures. After the implementation of measures, it is important to outline lessons learned and make use of them in future planning matters. The red and orange color indication in the heat map illustrates these aspects as the most important in the work of pilot coordinators. Flood defense infrastructure and flood insurance and compensation for example play major roles in the greater picture. However, they appear as rather indirectly affected by pilot coordinator´s actions and are thus shown with a lower number of points in the heatmap. These tasks are rather executed by other parties like engineering and bureaucracy teams that are part of the extensive resilience network pilot managers establish by communicative and collaborative means. This is similar for example to the other fields depicted in Figure 13 with a low to medium degree of influence.

It is important to note that this figure illustrates the findings synoptically. It is based on all qualitative findings of this thesis and depicts the author´s estimation of which fields pilot managers influence the most, acknowledging that all fields are of major importance as flood resilience requires holistic approaches and the involvement of numerous stakeholders. The provided and gathered data for this thesis did not allow for an illustration that also integrates quantitative data. However, the figure displays the most prominent findings of the interviews and surveys by pointing out the previously described elements of paramount importance. These include the role of communities, citizens and individuals, approaching governing bodies, paying attention to local and normative circumstances as well as orchestrating networks by means of extensive communication and collaboration measures. This in turn includes learning processes across sectoral and disciplinary boundaries.

7. Conclusion

The guiding research question of this thesis examined what role individual policy entrepreneurs play in the development and acceptance of integrated approaches for flood resilience. It aimed at contributing to the understanding of what practices they can adopt to realize more integrated approaches in flood risk management.

For this purpose, the concept of the Flood Resilience Rose, developed by Karrasch et al. (2020) in the course of the FRAMES project was investigated. It merges the resilience aspects and the multi-layered safety components by taking the institutional and the wider context into account. Additionally, it considers complex interlinkages between the diverse levels and layers and promotes holistic perspectives. It can thus be concluded that the Flood Resilience Rose is currently the most comprehensive approach to operationalize flood risk management. Its awareness- and communication-improving possibilities make it a valuable tool for policy

entrepreneurs like the pilot managers and professionals working in their teams in the FRAMES project, whose task is to foster flood resilience in their pilot areas.

The policy document analysis showed that most documents, on national as well as on local level, employ multi-layered safety approaches. 'Protection', 'prevention', 'preparedness' as well as 'review and recovery' are traceable. The documents in which these terms were not used described similar measures or used synonyms. The documents at national level remained rather generic and imprecise, whereas in more localized documents the keywords and related possible measures are described in more detail according to the context. This finding emphasizes the importance of country-specific and local knowledge and the fact that pilot managers have to keep the greater picture in mind without losing their regard for the local context and the need to adapt to it when choosing adequate approaches. The country specific flood risk governance foci included in this thesis (chapter 4.1.2) provide a brief overview of the differences.

In the introduction of this thesis it was stated that the aim is to create generic findings about the role of policy entrepreneurs in integrated flood risk management approaches in the FRAMES project. It can be concluded that this was successfully possible. All surveys and interviews provided by the University of Oldenburg for this thesis were scrutinized in a search for the five generic practices of policy entrepreneurs stated by Huitema and Meijerink (2010) and Huitema et al. (2011). Results from the survey and interview analyses showed all five strategies of policy entrepreneurs are employed by pilot managers in the FRAMES project. Furthermore, the provided data allowed insight into numerous challenges arising for pilot managers during the project as well as into lines of actions they follow to face these challenges. Based on this, ten generic statements about best practices of pilot managers in the field of flood risk management with special focus on the FRAMES project were developed in this research, namely:

Successful policy entrepreneurs:

1. Gain a full and comprehensive knowledge of the institutional system they operate in and know how to use it.
2. Think alongside the context they are working in but also have to generate own context and are willing to learn from others.
3. Build and manage extensive networks across a large variety of different stakeholder groups. Successful strategies are often collective strategies in which individuals play complementary, sometimes even key roles.
4. Adopt excellent communication and networking skills, use narratives to frame issues, justify change, attract supporters.
5. Take power relations and possible inequalities into account as well as acknowledge that most transitions happen via a combination of bottom-up and top-down strategies.
6. Balance advocacy and brokerage strategies.
7. Create and shop for venues to introduce newly developed ideas into forthcoming decision-making processes.
8. Anticipate and exploit windows of opportunity.
9. Are aware that things need time to change and have perseverance in dealing with complex circumstances.

10. Consider the future. The duration of a project comes to an end and ‘seeds need to be planted’ for the time after a project.

This thesis does not only confirm the five strategies of successful policy entrepreneurs found in literature. It also extends these findings by adding five more statements about practices which arose from challenges that appeared in the application of multi-layered safety approaches in the FRAMES project.

To ensure reliability of these new findings, they were also verified and ranked by policy entrepreneurs in the FRAMES project through the survey in chapter 3.5 of this thesis. The ranking of the statements by the pilot managers and professionals has resulted in the confirmation that all statements have proved to be of great importance. However, communication-related lines of action, taking power-relations into consideration, and having perseverance in dealing with complex issues have resulted to be the most impacting practices. Communication-related practices hold the highest priority as pilot managers can mainly undertake communication means to face challenges and management deficits within projects.

Due to the type of data that was provided for this thesis and collected in the course of it, the localization of actions of policy entrepreneurs in the Flood Resilience Rose could only be addressed by means of a qualitative estimation based on all previous findings. The Flood Resilience Rose including color indications of the estimated most important fields to be addressed by the actions of policy entrepreneurs can be found in chapter 6.2. The highlighted areas are: paying attention to normative aspects, approaching governing bodies, performing risk communication, planning emergency response, and finally including communities and citizens as well as important individuals. Furthermore, lessons learned need to be processed and included into future decision-making processes.

It can finally be concluded that policy entrepreneurs in the field of integrated flood risk management work and intervene in all relevant fields and disciplines to improve flood resilience. These fields and disciplines can be highly diverse. Policy entrepreneurs mainly play a mediating role in which they address complex challenges, which often include a multitude of stakeholders, primarily by means of communication-related actions. This can be said about all investigated pilot areas in the FRAMES project despite their location in different countries. All countries have developed different flood risk governance arrangements which are outlined in chapter 4.1.2. However, the purpose of this thesis is to create generic findings about the role policy entrepreneurs play in integrated flood risk management approaches. For all cases investigated it can be stated that ‘doing’ resilience is a complex network of actions and policy entrepreneurs act as the link that connects challenges with existing expertise holistically by bringing people together in order to work towards overarching and common goals. The ten statements about their successful work developed in the course of this thesis depict their main actions accurately. Because the statements are formulated to be generic, they can be subject to area-specific interpretations. However, independent from the respective context, communication and collaboration-related activities have proved to be the most significant part of the policy entrepreneurs´ work.

7.1. Reflection

This final chapter discusses the contributions of this thesis to the current research state of flood risk management and reflects on the research process. Finally, it provides recommendations for possible future research.

Relevance of this research

This thesis conveys extensive examinations from several perspectives of the resilience concept, including its technical and social facets. Resilience is often used as a buzzword and there is consensus that it is something desirable, but its actual meaning is left unspecified. This research suggests the Flood Resilience Rose as a comprehensive overarching tool for policy entrepreneurs like pilot project managers in water management, whose task is to 'do' resilience. Furthermore, this thesis revealed that policy entrepreneurs can potentially find useful information in official policy documents; especially in policy documents with a local scope, which provide insights on how EU multi-layered safety approaches were transposed into national policy, as well as potentially important activities.

The main contribution of this research are its results on the role of pilot managers and other professionals in the field of flood risk management – referred to in this thesis as policy entrepreneurs. Their role is vital to facilitate holistic flood resilience approaches; particular attention was paid to the challenges they are facing as well as on the best practices they can adopt to overcome these challenges. Additionally, this thesis provides qualitative indications of the fields in which the activities of policy entrepreneurs potentially have the greatest effects. Therefore, the findings in this study can provide useful information for professionals working in future projects focusing on integrated approaches in flood risk management.

Furthermore, the findings underline the complexity policy entrepreneurs in the field of flood risk management have to face. They emphasize the great diversity of disciplines and stakeholders that are relevant for flood resilience approaches and they shed light on the relevance of comprehensive approaches as well as the importance of communication and collaboration.

Reflection on Methodology

This research aimed to generate generic findings about the role of pilot managers in fostering resilience approaches. In order to do this, available data for all pilot areas of the EU-Interreg North Sea Region FRAMES project was taken into account. All of the case studies delivered valuable lessons learned as they revealed challenges pilot managers are facing and practices they can adopt to overcome these. Nevertheless, it should be noted that the results of this thesis are generalized, thus the importance and prioritization of best practices may vary from case study to case study. The implementation of flood risk management strategies based on lessons learned requires an attentive consideration of contextual differences (Nadin and Stead, 2008). All findings remain relevant, but their importance and applicability can differ depending on the pilot area.

Not all interviews and surveys examined were conducted by the author. Those that shed light on the challenges and practices of pilot managers were provided by the University of Oldenburg (Table 3). Unfortunately, both the surveys and the interviews are somewhat lacking

in cohesion. Several surveys show extensive gaps, and the answers often diverted from the questions or consisted only of short bullet points. The semi-structured interviews are partly very dissimilar in the directions the discussions developed. Furthermore, they vary strongly in extent and in the topics that were raised. Some of the surveys and interviews offered much more content suitable for the research questions of this thesis than others. Therefore, the comparability and quantitative approaches for this thesis were limited. In this part of the research there was no face to face interaction with the participants, making it impossible to steer the semi-structured interviews to personally desired directions. Interviewing people about this topic first-hand could potentially have been more insightful regarding the formulated research questions. The semi-structured interviews varied in the directions towards which the discussions developed. Furthermore, depending on the pilot area they varied greatly in terms of extent and topics raised. Some surveys and interviews offered a lot more content suitable for the research questions of this thesis than others. Hence, qualitative findings concerning for instance the fields of the Flood Resilience Rose that are the most important to address for policy entrepreneurs must be interpreted carefully as they illustrate the author´s best estimations. Nevertheless, the provided data allowed for extensive qualitative insights about challenges pilot managers are facing and which lines of action appear adequate to overcome these challenges.

The opportunity to participate at the FRAMES Days in Tunbridge Wells, England was a valuable experience. To meet the people of interest to this study, to participate at workshops and to be part of the activities fostered a better understanding of the work of policy entrepreneurs and of the project. It helped to look critically at the provided datasets and to develop a deeper understanding of the projects´ context, which in turn proved useful to better interpret the data (provided as well as self-gathered).

Recommendations for future research

This research took all pilot project sites for which data was available into account in order to develop generic lines of action pilot managers follow to work successfully to improve flood resilience in their pilot areas. Working towards generic results that can be applied to all case studies inevitably does not allow for specific in-depth case analyses. Therefore, future research could focus on more case-specific flood resilience-related practices which can be executed by policy entrepreneurs. More detailed and context-specific knowledge could potentially enhance mutual learning and therefore foster possibilities for knowledge and policy transfer.

All ten statements about the successful work of policy entrepreneurs presented in this thesis can also be interpreted context-dependent: their exact meaning and significance may vary dependent on the priorities of each pilot and on the country-specific historical development and governance setting. Detailed research on which statements are of paramount importance in each pilot area could deliver findings on actions that are advisable in each localized context.

This research furthermore highlighted the paramount importance of communication and collaboration-related activities of pilot managers to build extensive resilience networks. Further research could focus on such activities to find out which ones are fruitful to raise

awareness, spark public interest and encourage the participation of numerous important stakeholders.

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Belgium	Protection		Prevention		Preparedness		Review & Recovery	
	Term appears	Term does not appear	Term appears	Term does not appear	Term appears	Term does not appear	Term appears	Term does not appear
Document: Belgian National Climate Change Adaptation Strategy (National Climate Commission 2010) (Hoyaux *et al.*, 2010)	x		x		(x)		(x)	
	Measures are described as "hard structures", "control of floods", "counter the risk of flooding" (Hoyaux *et al.*, 2010, p. 37)		Preventive measures are described according to the definition in the Flood Resilience Rose		Preparedness measures like the preparation of flood risk maps are mentioned but not further examined		Making use of lessons learned by revising plans, flood insurance and compensation mechanisms mentioned but not further examined	
Document: The Flemish Climate Policy Plan 2013-2020, a summary (Flemish Government, 2013)	x		x		(x)		(x)	
	Protection measures according to the definition in the Flood Resilience Rose are listed in the attachment 'list of measures' but not further described		Prevention measures according to the definition in the Flood Resilience Rose are listed in the attachment 'list of measures' but not further described		Preparedness is summarized as "conversion and development of forecasting and warning systems" and "increase of public and preparedness" (Flemish Government, 2013, p. 84)		Review & Recovery measures are summarized as "measures after a flood to return to the same or a better position than before the flood" (Flemish Government, 2013, p. 84)	
Document: Stroomgebietbeheerplan voor de Schelde 2016-2017 (Coördinatiecommissie Integraal Waterbeleid, 2016)	x		(x)		X		x	
	Protection measures are described according to the definition in the Flood Resilience Rose and partly specified in detail		Prevention measures appear but special emphasis is on designing buildings in a flood-proof manner rather than on proactive spatial planning		Preparedness measures are described in detail according to the definition in the Flood Resilience Rose		Review & Recovery measures are described according to the definition in the Flood Resilience Rose	
Document: Overstromingsrisicobeheerplan Dender (Maat-ontwerpers and Labo S, 2018)	x		(x)		x			x
	Protection measures are described as actively working on the probability of floods. Some structural measures are outlined		A few prevention measures mentioned e.g. flood resilient building and construction as well as avoidance of building in flood prone areas		Preparedness measures appear but as temporary transition measures during e.g. improvement of concrete protection structures which can be regarded as a context-related interpretation		-	

Table 5: Keyword analysis of Belgian policy documents

Germany	Protection		Prevention		Preparedness		Review & Recovery	
	Term appears	Term does not appear	Term appears	Term does not appear	Term appears	Term does not appear	Term appears	Term does not appear
Document: Deutsche Anpassungsstrategie an den Klimawandel (Umweltbundesamt, 2008)	x		x		(x)		(x)	
	Protection is emphasized, but measures are limited to generic descriptions. Active flow regulation and the construction of dikes are mentioned		Preventive measures are described according to the definitions in the Flood Resilience Rose		Preparedness measures like the preparation of emergency plans, warning systems and information possibilities are mentioned but not further examined		Recovery mentioned in the form of vulnerability reduction for the future. The variety of responsibilities for recovery measures is mentioned but not further examined	
Document: Empfehlungen zur Aufstellung von Hochwasserrisikomanagementplänen (LAWA, 2010)	x		x		x		x	
	Protection measures described according to the definition in the Flood Resilience Rose and specified in detail. Protection, Prevention, Preparedness, Review & Recovery shown in a cyclical approach		Prevention measures described according to the definition in the Flood Resilience Rose and partly specified in detail		Preparedness measures described according to the definition in the Flood Resilience Rose and specified in detail. Emphasis is on information sharing and behavioural precautions		Recovery measures described according to the definition in the Flood Resilience Rose and partly specified in detail. Emphasis is on restoration and evaluation of results to make use of lessons learned	
Document: Hochwasserrisikomanagementplan 2015 bis 2021 für die Flussgebietseinheit Weser (FGG Weser, 2015)	x		x		x		x	
	Protection measures described according to the definition in the Flood Resilience Rose and specified in detail. Protection, Prevention, Preparedness, Review & Recovery shown in a cyclical approach		Prevention measures described according to the definition in the Flood Resilience Rose and partly specified in detail		Preparedness measures described according to the definition in the Flood Resilience Rose and specified in detail. Emphasis is on information sharing and behavioural precautions		Recovery measures described according to the definition in the Flood Resilience Rose and partly specified in detail. Volunteers e.g. fire department, Red Cross, DLRG-lifeguards are mentioned as crucial in emergency situations and recovery measures	

Table 6: Keyword analysis of German policy documents

England	Protection		Prevention		Preparedness		Review & Recovery	
	Term appears	Term does not appear	Term appears	Term does not appear	Term appears	Term does not appear	Term appears	Term does not appear
Document: The National Adaptation Programme and the Third Strategy for Climate Adaptation and Reporting (DEFRA, 2018)	x		x		(x)		(x)	
	Protection measures are described according to the definitions in the Flood Resilience Rose		Prevention measures are described according to the definitions in the Flood Resilience Rose. However, they are mentioned in the category ´adaptation´		Preparedness as well as review & recovery according to the Flood Resilience Rose. However, they are described under ´response´ and ´acceptance´ which appear as synonyms. The described measures resemble preparedness and review & recovery measures		Preparedness as well as review & recovery according to the Flood Resilience Rose. However, they are described under ´response´ and ´acceptance´ which appear as synonyms. The described measures resemble preparedness and review & recovery measures	
Document: Understanding the risks, empowering communities, building resilience. The national flood and coastal erosion risk management strategy for England (EA and DEFRA, 2011)	(x)		(x)		(x)		x	
	Protection appears as “maintain and over time improve standards of protection against flood and coastal erosion risks”. “Maintained river channels; raised embankments, floodwalls as seawalls” (EA and DEFRA, 2011, pp. 1–2) are mentioned		Prevention appears as “adapting to coastal change and acting to reduce the risk to life, damage and disruption caused by flooding” (EA and DEFRA, 2011, p. 1) e.g. by avoidance of building in flood prone areas		Preparedness is rather described with synonyms although e.g. active communication, risk-awareness for businesses and communities, forecasting and warning systems are mentioned		Review & Recovery measures described according to the definition in the Flood Resilience Rose. However, recovery characteristics are detectable in text rather than listed systematically but are described comprehensively	
Document: Flood risk management plan. South East river basin district summary (EA, 2016b)	x		x		x		x	
	Protection measures are mentioned according to the definitions in the Flood Resilience Rose but shortly summarized. Reference is made to a full Flood Risk Management Plan where measures are described in detail		Prevention measures are mentioned according to the definitions in the Flood Resilience Rose but shortly summarized. Reference is made to a full Flood Risk Management Plan where measures are described in detail		Preparedness measures are mentioned according to the definitions in the Flood Resilience Rose but shortly summarized. Reference is made to a full Flood Risk Management Plan where measures are described in detail		Review & Recovery measures are mentioned according to the definitions in the Flood Resilience Rose but shortly summarized. Reference is made to a full Flood Risk Management Plan where measures are described in detail	
Document: Flood risk management plan. Northumbria river basin district summary (EA, 2016a)	x		x		x		x	
	Protection measures are mentioned according to the definitions in the Flood Resilience Rose but shortly summarized. Reference is made to a full Flood Risk Management Plan where measures are described in detail		Prevention measures are mentioned according to the definitions in the Flood Resilience Rose but shortly summarized. Reference is made to a full Flood Risk Management Plan where measures are described in detail		Preparedness measures are mentioned according to the definitions in the Flood Resilience Rose but shortly summarized. Reference is made to a full Flood Risk Management Plan where measures are described in detail		Review & Recovery measures are mentioned according to the definitions in the Flood Resilience Rose but shortly summarized. Reference is made to a full Flood Risk Management Plan where measures are described in detail	

Table 7: Keyword analysis of English policy documents

Netherlands	Protection		Prevention		Preparedness		Review & Recovery	
	Term appears	Term does not appear	Term appears	Term does not appear	Term appears	Term does not appear	Term appears	Term does not appear
Document: National Climate Adaptation Strategy 2016 (NAS) (Ministry of Infrastructure and the Environment, 2016)	(x)		(x)		(x)		(x)	
	Prevention is stated as the most important (level 1) in a 'multi-level risk management approach' with three layers. Prevention and protection are understood differently than the definitions in the Flood Resilience Rose and appear as interchangeable.		Prevention is stated as the most important (level 1) in a 'multi-level risk management approach' with three layers. Prevention and protection are understood differently than the definitions in the Flood Resilience Rose and appear as interchangeable.		Preparedness is not named as part of the ´multi-level risk management approach´. However, reducing vulnerabilities by i.e. raising awareness is further described in the overarching context of climate change		Disaster response is stated as level 3 of the ´multi-level risk management approach´. and is supposed to "form the final safety net" (Ministry of Infrastructure and the Environment, 2016, p. 27) but not further described	
Document: Flood Risk and Water Management in the Netherlands. A 2012 Update (Rijkswaterstaat and Ministry of Infrastructure and the Environment, 2012)	x		x		x		x	
	Description of the 'Multi-layer safety concept' with three layers which is different to the Flood Resilience Rose. However, protection forms layer 1 with flood defence measures		Prevention measures described according to the definitions in the Flood Resilience Rose		Preparedness measures described according to the definitions in the Flood Resilience Rose		Review & Recovery measures described according to the definitions in the Flood Resilience Rose. Furthermore, examples of crisis management and disaster relief are described	
Document: Overstromingsrisicobeheerplan stroomgebied Rijn 2016-2021 (Ministerie van Infrastructuur en Milieu, 2015b)	x		x		x		x	
	Protection measures described according to the definition in the Flood Resilience Rose and measures are listed in overview-tables in the attachment		Prevention measures described according to the definition in the Flood Resilience Rose and measures are listed in overview-tables in the attachment		Preparedness measures described within Review and Recovery measures but listed separately in overview-tables in the attachment. The Document however points out that terms are used interchangeably in different publications		Review and Recovery measures described according to the definition in the Flood Resilience Rose and some measures are listed in overview-tables in the attachment	
Document: Overstromingsrisicobeheerplan stroomgebied Maas 2016-2021 (Ministerie van Infrastructuur en Milieu, 2015a)	x		x		x		x	
	Protection measures described according to the definition in the Flood Resilience Rose and measures are listed in overview-tables in the attachment		Prevention measures described according to the definition in the Flood Resilience Rose and measures are listed in overview-tables in the attachment		Preparedness measures described within Review and Recovery measures but listed separately in overview-tables in the attachment. The Document however points out that terms are used interchangeably in different publications		Review and Recovery measures described according to the definition in the Flood Resilience Rose and some measures are listed in overview-tables in the attachment	

Table 8: Keyword analysis of Dutch policy documents

Denmark	**Protection**		**Prevention**		**Preparedness**		**Review & Recovery**	
	Term appears	Term does not appear	Term appears	Term does not appear	Term appears	Term does not appear	Term appears	Term does not appear
Document: Danish strategy for adaptation to a changing climate (Danish Energy Agency, 2008)	(x)		(x)		x		(x)	
	The term protection appears and measures like “new construction, dismantling or renovation of dikes, channel dredging” (Danish Energy Agency, 2008, p. 9) and other adaptation measures are mentioned but not further described		Prevention measures are described with synonyms. Land-use strategies like “limit building and construction in high-risk areas” (Danish Energy Agency, 2008, p. 31) are mentioned		“Rescue preparedness can be deployed in actions to prevent, limit and aid injuries and damage to people, property and the environment” (Danish Energy Agency, 2008, p. 34). Multiple measure such as improving equipment and its provision are described		Review and recovery measures are described with synonyms. Making use of lessons learned by revising plans and flood insurance and compensation mechanisms are mentioned	
Document: Denmark´s seventh national communication and third biennial report under the United Nations Framework Convention on Climate Change (Rasmussen, 2018)	x		x		x		(x)	
	Protection measures are described according to the definition in the Flood Resilience Rose. Cyclical approach mentioned in line with the Floods Directive as “multi-layer concept with emphasis on prevention-protection-preparedness” (Danish Energy Agency, 2008, p. 295)		Prevention measures described according to the definition in the Flood Resilience Rose. Cyclical approach in line with the Floods Directive as “multi-layer concept with emphasis on prevention-protection-preparedness” (Danish Energy Agency, 2008, p. 295)		Preparedness measures described according to the definition in the Flood Resilience Rose. Cyclical approach in line with the Floods Directive as “multi-layer concept with emphasis on prevention-protection-preparedness” (Danish Energy Agency, 2008, p. 295)		Some institutions that deal with recovery after disasters are stated but no measures described. FRAMES-project mentioned: “The Interreg project FRAMES focus on dynamic planning in the future and the society´s recovery phase after a flood event” (Danish Energy Agency, 2008, p. 337).	
Document: Risikostyringsplan for oversvømmelse Vejle Midtby (Klimakontoret Teknik & Miljø, 2015)	x		x		x		x	
	Prevention, protection, preparedness, emergency measures, recovery & rebuilding as well as evaluation shown in a cyclical approach, categorized in ‘before a flood event’, ‘during a flood event’ and ‘after a flood event’.		Prevention, protection, preparedness, emergency measures, recovery & rebuilding as well as evaluation shown in a cyclical approach, categorized in ‘before a flood event’, ‘during a flood event’ and ‘after a flood event’.		Prevention, protection, preparedness, emergency measures, recovery & rebuilding as well as evaluation shown in a cyclical approach, categorized in ‘before a flood event’, ‘during a flood event’ and ‘after a flood event’.		Prevention, protection, preparedness, emergency measures, recovery & rebuilding as well as evaluation shown in a cyclical approach, categorized in ‘before a flood event’, ‘during a flood event’ and ‘after a flood event’.	

Table 9: Keyword analysis of Danish policy documents

9.2. Appendix B: Survey (University of Oldenburg)

The following survey was conducted by researchers (Dr. Britta Restemeyer and Dr. Leena Karrasch) who at the time were affiliated with the University of Oldenburg. It was made available for this thesis.

Introduction to the survey

This document contains the diagnostic survey for the pilot sites from the FRAMES project. This questionnaire shall help to provide important input regarding flood resilience and the implementation of the multi-layer safety (MLS) concept in the FRAMES target sites. Results of this survey will be used to design a conceptual model and provide management and policy support, which can be used by you as pilot sites, but also by other areas struggling with flood risks. The questionnaire follows the *Flood Resilience Rose* (see figure 1) – a self-assessment tool to analyze the resilience to flooding and the multi-layered safety concept in specific target sites. The questionnaire is structured along three main parts:

1) Context: flood risk in the pilot area and future developments
2) Multi-layer safety: goals, measures and instruments
3) Multi-layer safety: ingredients for managing change

After the survey is completed, we will conduct an 'exit interview' with you, so we can discuss what you have filled in more in depth. Also, questions that might still be open can then be discussed.

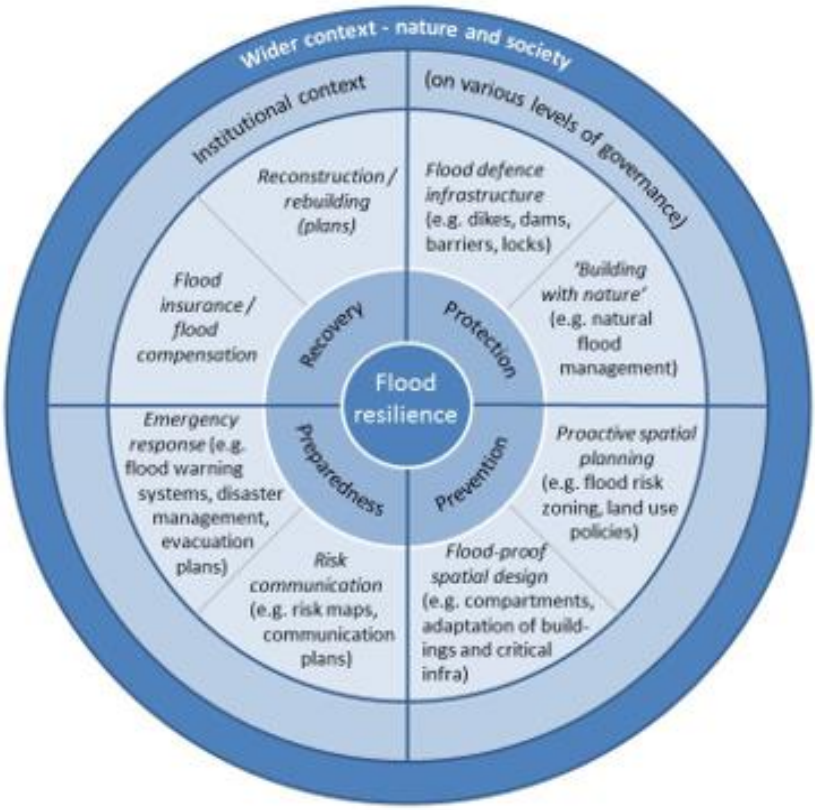
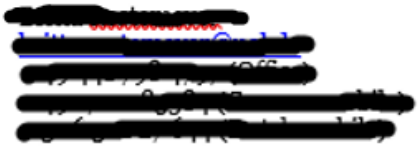


Figure 1: The Flood Resilience Rose, advancing the multi-layered safety approach.

Contact information



Contact information pilot coordinator

Pilot area:
Name Pilot Coordinator:
Organization:
E-mail address:
Phone number:

Important:
We kindly ask the pilot coordinator to complete this questionnaire in consultation with relevant experts/stakeholders in the pilot/region. The pilot coordinator can send this questionnaire and ask these experts/stakeholders to complete (certain) questions, or ask them to review answers. Per pilot we would like to have 1 questionnaire returned.

Who contributed to completing this questionnaire? Please provide names of persons and their organizations:

	Person	Organization
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Part 1 – Context: flood risk in the pilot area and future developments

1.1 What is the size of your pilot area? [number / short text possible]

1.2 Which type of flood risk characterizes your pilot area? (multiple answers possible)

☐	Coastal (storm surges)
☐	Fluvial (River flooding)
☐	Pluvial (Surface flood)
☐	*Other:*

1.3 How many inhabitants live in your pilot area? [number / short text possible]

1.4 How many of these inhabitants live in flood-prone areas? [number / short text possible]

1.5 Which types of critical infrastructure *are prone* to flooding in your pilot region?

☐	electricity generation, transmission and distribution
☐	gas production, transport and distribution
☐	oil and oil products production, transport and distribution
☐	telecommunication
☐	water supply (drinking water, waste water/sewage, stemming of surface water (e.g. dikes and sluices))
☐	flood defence infrastructure (e.g. dikes, dams, embankments, barriers, locks)
☐	agriculture, food production and distribution (also supermarkets)
☐	heating (e.g. natural gas, fuel oil, district heating)
☐	public health (hospitals, ambulances)
☐	transportation systems (fuel supply, railway network, airports, harbours, inland shipping)
☐	financial services (banking, clearing)
☐	security services (police, military)
☐	*Other:*

1.6 Has flooding occurred in your pilot area since 1950?

☐ Yes
☐ No

1.7 If yes, how often has flooding occurred?

once	twice	three times	four times	five times	> five
☐	☐	☐	☐	☐	☐

1.8 If your pilot area has experienced flooding, please list the most recent floods by stating when the flood occurred, what it was caused by, how many people were affected, and how much damage occurred. [During my stay, I would also like to know if there have been any losses of nature.]

When flooded?	Caused by?	People affected [number]	Damage [in Euro / GBP]

1.9 Which of the following forecasts are available for your pilot area? If they are available, please state for which time period they are available, and what are the key expectations? [During my stay, I would also be interested in (policy) documents describing the forecasts.]

	Forecasts available?		If yes, for which time period?	If yes, what is expected? (only mention key points)
Climate changes	☐	Yes		
	☐	No		
Demographic changes	☐	Yes		
	☐	No		
Economic changes	☐	Yes		
	☐	No		
Other	☐	Yes		
	☐	No		

1.10 Please characterize your pilot area by choosing 3 pictures:

- 1 picture relating to the physical geography / water aspects of your pilot area
- 1 picture relating to the population / culture of your pilot area
- 1 picture relating to the economy of your pilot area

[During my stay, we will discuss why you chose these pictures.]

Part 2 - Multi-layer safety: goals, measures and instruments

2.1 In your pilot area, which goals are you trying to achieve with the multi-layer safety approach? Please explain briefly.

2.2 *Why* do you want to increase multi-layer safety in your pilot area? Multiple answers possible.

☐	Current flood risk management strategy is insufficient
☐	MLS provides a better way to deal (unknown) future developments (e.g. climate change, demographic change, economic change…)
☐	MLS provides improved safety levels (because more holistic management approach)
☐	MLS provides benefits for the environment (e.g. increased biodiversity)
☐	MLS provides benefits for the people (e.g. improved spatial quality)
☐	MLS provides financial benefits (e.g. savings in the long run, opportunity to exploit (funding) synergies) > hence MLS is cheaper than existing FRM approach
☐	MLS provides opportunities for economic development (e.g. exploitation of touristic potential)
☐	*Other:*

2.3 Which actors are the main drivers behind this transition towards increased multi-layer safety in your pilot area? Multiple answers possible.

☐	European Union
☐	National government
☐	Regional / Provincial government
☐	Local government
☐	Local community / citizens
☐	Businesses
☐	NGO / charity
☐	Knowledge institute / University
☐	*Other:*

2.4 Please shortly specify your answer in the text box below: which organizations and individuals are driving the transition towards increased multi-layer safety, and what are their ambitions?

2.5 Which measures and instruments have been in place to reduce flood risk in your pilot area *before your pilot activities have started*? Please list them per layer (protection, prevention, preparedness, recovery). Check the Flood Resilience Rose (fig. 1) if you are not sure where to place a certain measure. If you are not sure, you can also add a remark.

	Current measures and instruments	Remarks
Protection	1. 2. 3. 4. 5.	
Prevention	1. 2. 3. 4. 5.	
Preparedness	1. 2. 3. 4. 5.	
Recovery	1. 2. 3. 4. 5.	

2.6 Which measures and instruments *are planned* for the future? Please name them per layer and indicate for each measure / instrument for when it is planned (under 'time frame'). Especially for the long-term, these can also be rough estimations.

	Planned measures and instruments	Time frame
Protection	1. 2. 3. 4. 5.	
Prevention	1. 2. 3. 4. 5.	
Preparedness	1. 2. 3. 4. 5.	
Recovery	1. 2. 3. 4. 5.	

2.7 Bearing in mind the specific environment of your pilot area, are there any measures and (policy) instruments that you consider to be very appropriate or very inappropriate for your pilot area? Please think about it per layer, and add to the table below.

	Very appropriate	Very inappropriate
Protection		
Prevention		
Preparedness		
Recovery		

2.8 What makes your pilot activity innovative? Please explain briefly.

3 – Multi-layer safety: ingredients for managing change

3.1 Which actors are *currently involved* in your pilot activities? Please list them and indicate if they are state or non-state actors and provide their level of jurisdiction, e.g. (inter)local, (inter)regional / provincial, national, European.

Actor name	*State / Non-state*	*Level of jurisdiction*

3.2 Which actors are you still *planning to involve* in your pilot activities? Please list them and indicate if they are state or non-state actors and provide their level of jurisdiction, e.g. (inter)local, (inter)regional / provincial, national, European.

Actor name	*State / Non-state*	*Level of jurisdiction*

3.3 In your view, to what extent are the following factors *enabling* the adoption and implementation of the multi-layer safety approach in your pilot area? Please rank from 1 (not at all) to 5 (very much).

Enabling factor	*1*	*2*	*3*	*4*	*5*	*don't know*
Societal acceptance of MLS measures	☐	☐	☐	☐	☐	☐
Active civic involvement / commitment to MLS measures	☐	☐	☐	☐	☐	☐
Political support for MLS approach	☐	☐	☐	☐	☐	☐
Well-established integration of different (policy) sectors	☐	☐	☐	☐	☐	☐
Well-established collaboration and network between key actors	☐	☐	☐	☐	☐	☐
Openness towards new ideas / capability of actors to adopt new policy approaches	☐	☐	☐	☐	☐	☐
Sufficient funding for multi-layer safety approach	☐	☐	☐	☐	☐	☐
Sufficient expertise for multi-layer safety approach	☐	☐	☐	☐	☐	☐
Other:	☐	☐	☐	☐	☐	☐

3.4 In your pilot activities, how do you want to make use of the enabling factors (the ones scoring 4 or 5 in question 3.3)? Please describe shortly.

3.5 In your pilot activities, how do you want to tackle the less enabling factors (the ones scoring 1 or 2 in question 3.3)? Please describe shortly.

3.6 On a scale from 1 (very little) to 10 (very much), how much would you say that there is currently a window of opportunity to implement multi-layer safety measures in your pilot area?

1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

3.7 If you have identified a window of opportunity, what is this window of opportunity? Please specify.

3.8 In general, what else would you still like to share in regard of this survey?

Thank you very much for filling in the survey!

9.3. Appendix C: Codes used in MAXQDA

The tables below show the codes and categories that were used in the software MAXQDA to structure the interviews and surveys provided by the University of Oldenburg for this study.

Deductive codes were derived from the five strategies of successful policy entrepreneurs identified by Huitema and Meijerink (2010) and Huitema et al. (2011).

Inductive categories and codes were added during the investigation which are particularly related to sub-question 3 of this thesis: Which practices used by pilot managers and professionals in their teams have been applied for the implementation of more integrated multi-layered safety approaches in flood risk management?

Deductive codes:

(1) Developing new ideas
(2) Building coalitions and selling ideas
(3) Recognizing and exploiting windows of opportunity
(4) Orchestrating and managing networks
(5) Recognizing, exploiting, creating and/ or manipulating multiple venues in modern societies

Inductive categories and codes:

Category:	Code:
Communication:	- Unclear responsibilities - Lack of risk awareness - Lack of communication/ communication skills/ language - Lack of holistic approaches/ disconnection of layers - Lack of interest - Project difficult to 'sell' - Important roles of individuals
Power-relations:	- Inequalities - Desire of responsible parties to have a good reputation - Dominant positions/ urge to keep control - Top-down/ hard for small groups of stakeholders to be heard - Bureaucracy/ contracts/ laws - Lack of trust (in established authorities) - Influence of strong stakeholders/ interest in 'business as usual'
Resources:	- Lack of resources (people/ time/ unfeasible workload/ financing) - Coordination and appropriate use of available resources - Who takes the lead when the project is over? - Lack of info/ outdated and/or undetailed data and maps - Change requires a lot of time - Duration of the project

9.4. Appendix D: Survey about the ten statements

The following survey was sent to pilot managers and other professionals in the FRAMES project. It was conducted in the course of this thesis to verify the ten statements.

Country:	Surveys sent:	Replies:
Belgium	3	3
Germany	2	1
England	17	8
Netherlands	4	3
Denmark	2	2
Total number:	28	17

Email and email attachments which were sent out as a survey by the author of this thesis to the policy entrepreneurs:

"Good morning dear FRAMES-partners!

I really enjoyed the partner meeting in Kent. It was very nice to meet you!
During the FRAMES-Days in Tunbridge Wells I presented a poster which amongst other things contained statements regarding successful strategies of policy entrepreneurs (in this case: Pilot managers and those who are closely involved in the project). These are generic statements based on related literature and especially on identified challenges in all pilot projects.
As you know, I am working on my master thesis and it would be great if I could include your ranking. Your evaluation would help a lot to enrich the picture of relevant strategies during the project. It would also help me a lot to concretise the findings of my thesis.

Rules of the game:

- Please find attached to this email the table with 10 statements and write your ranking in the right column.
- Only 1 statement, the most preferred one, must receive 100 points
- Only 1 statement, the least preferred one, can receive 0 points
- Please use a difference of at least 5 points (95-90-85-80-etc.)
- The higher the difference, the higher the gap between statements (100 most preferred, 95 next preferred, 75 next preferred…)
- Statements can have the same preference (except 100 and 0 points)

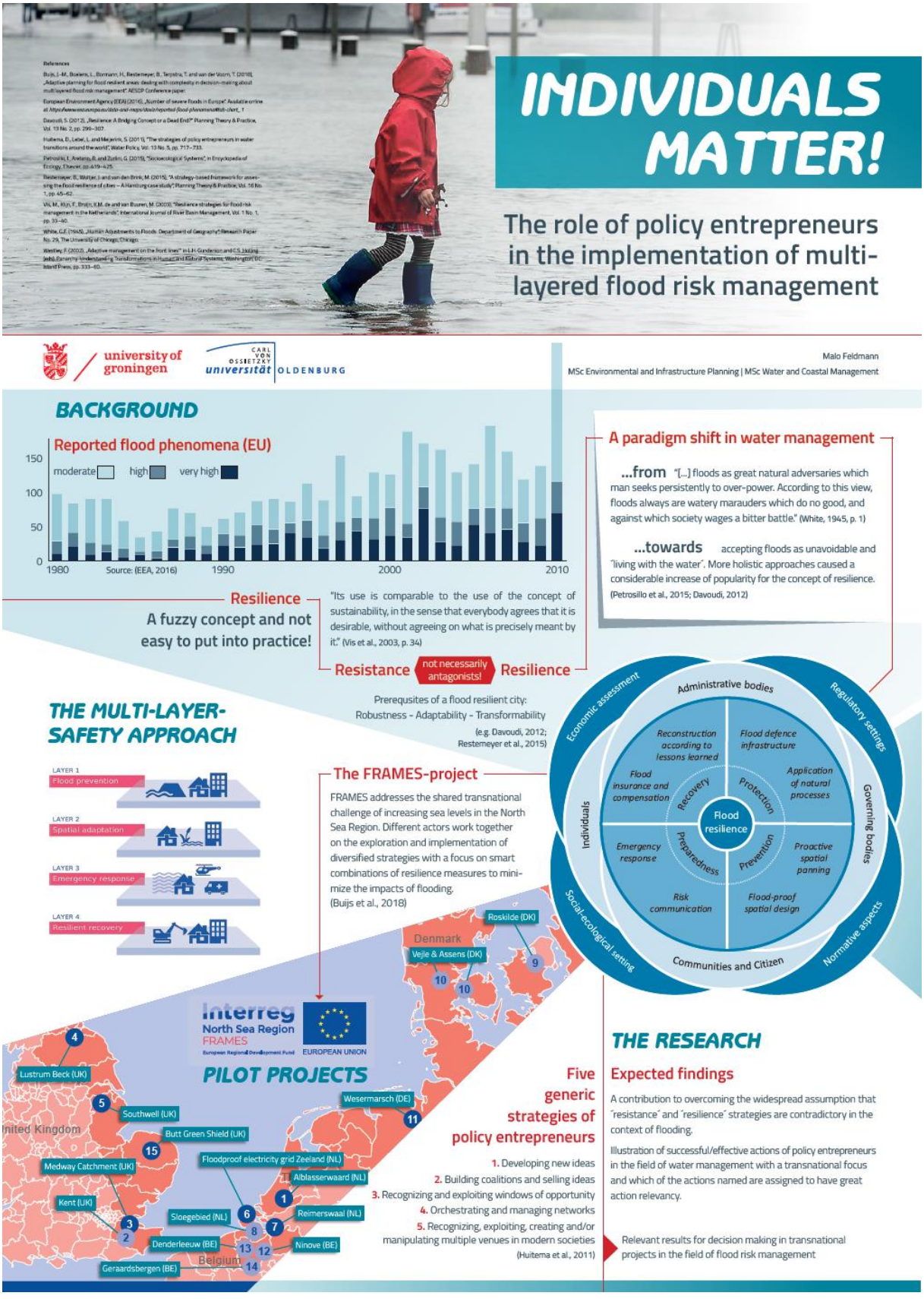
There is an example table attached to this email.

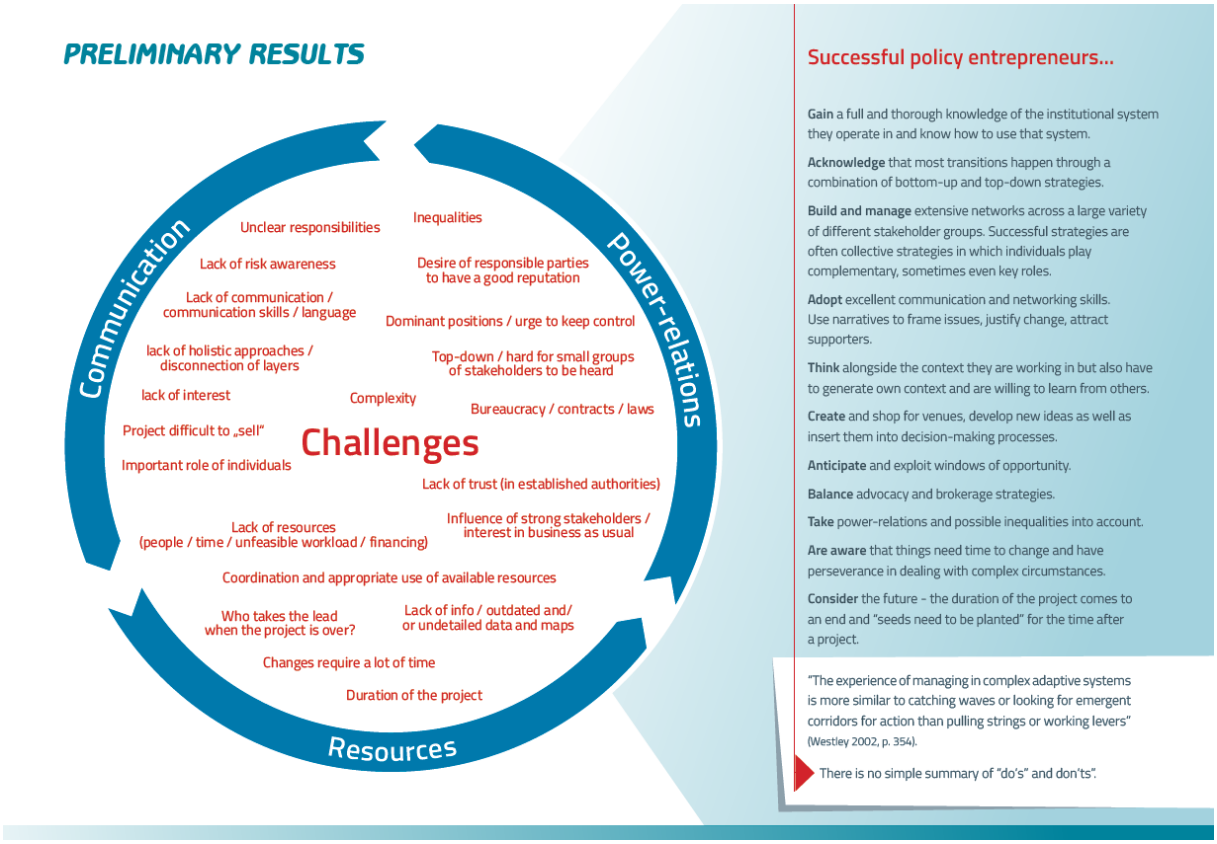
Thank you so much for your time! As experts in the field I really value and appreciate your opinion.
I am looking forward to your preferences. I would be very grateful if you could send me back the document within 2 weeks.

Best regards,
Malo Feldmann"

Research posters presented at the FRAMES Days in Kent (11th-14th November 2019):

The posters and example table were attached to the email which contained the survey.





This poster still contained eleven statements. The only change which was made from here to the final survey was narrowing them down to ten. They did not change content-wise but ten as an even number appeared to be better suitable for the survey and subsequent data analyses.

Example table which was attached to the email for clarification on how to fill in the survey:

Must have Christmas decoration	Preference
• Garlands.	75
• Roping.	50
• Candles.	100
• Swags.	80
• Ribbons.	50
• Poinsettias.	80
• Christmas tree ornaments.	95
• Wreaths.	0

Table to be filled in by the policy entrepreneurs:

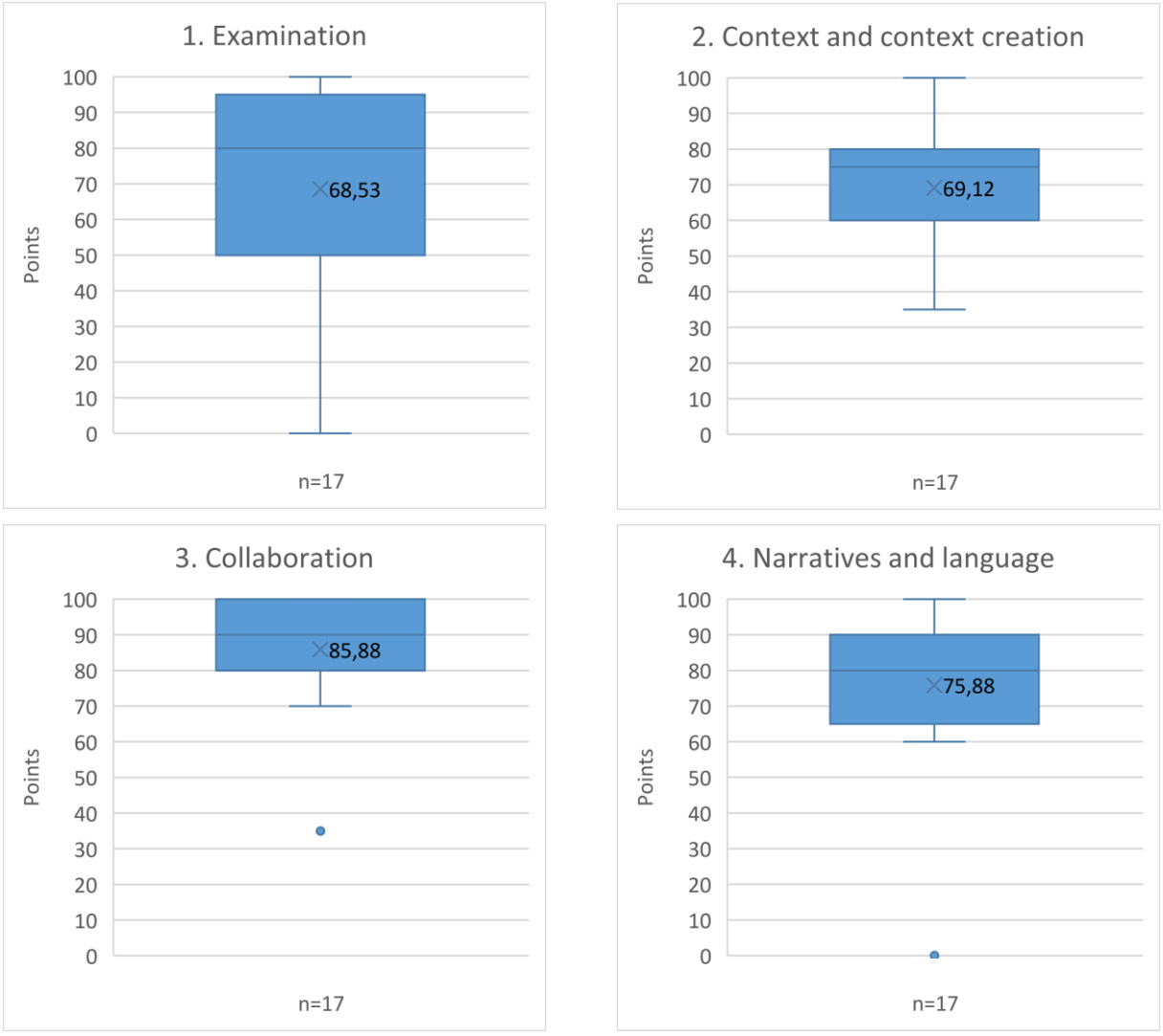
Successful policy entrepreneurs…	**Preference**
1. Gain a full and comprehensive knowledge of the institutional system they operate in and know how to use it.	
2. Think alongside the context they are working in but also have to generate own context and are willing to learn from others.	
3. Build and manage extensive networks across a large variety of different stakeholder groups. Successful strategies are often collective strategies in which individuals play complementary, sometimes even key roles.	
4. Adopt excellent communication and networking skills, use narratives to frame issues, justify change, attract supporters.	
5. Take power relations and possible inequalities into account as well as acknowledge that most transitions happen via a combination of bottom-up and top-down strategies.	
6. Balance advocacy and brokerage strategies.	
7. Create and shop for venues to introduce newly developed ideas into forthcoming decision-making processes.	
8. Anticipate and exploit windows of opportunity.	
9. Are aware that things need time to change and have perseverance in dealing with complex circumstances.	
10. Consider the future. The duration of a project comes to an end and „seeds need to be planted“ for the time after a project.	

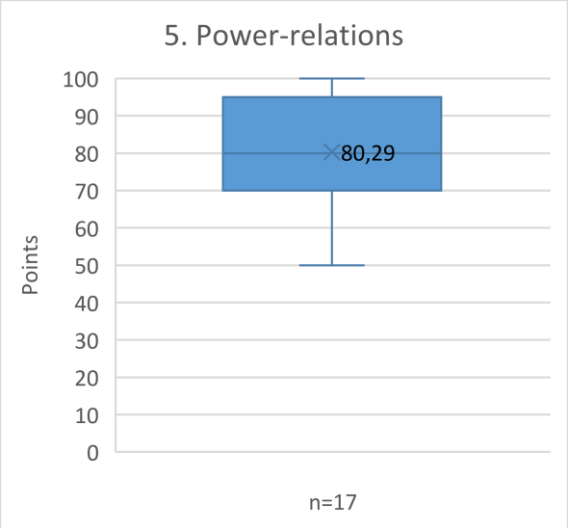
Total number of surveys sent: 28 | Total number of replies: 17

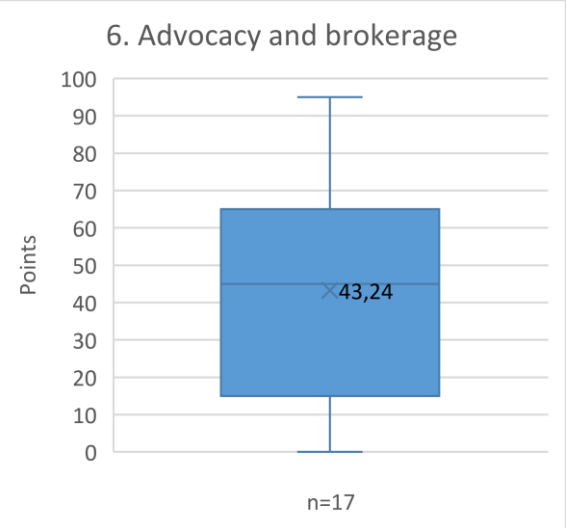
9.5. Appendix E: Statistical representation of the survey

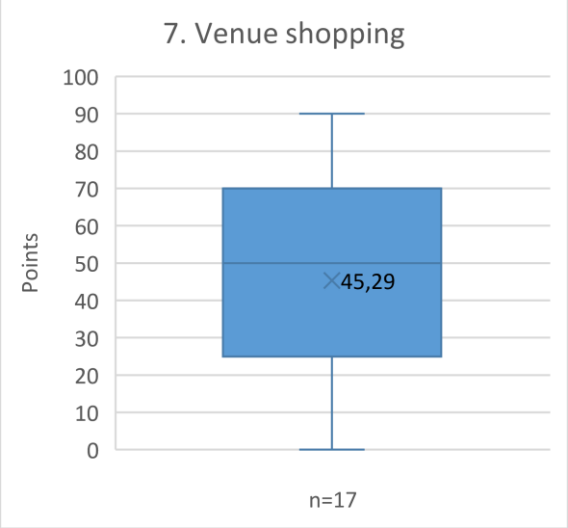
The following boxplots are the statistical representation of the point distribution based on the preference of 17 pilot managers and professionals working in the field.

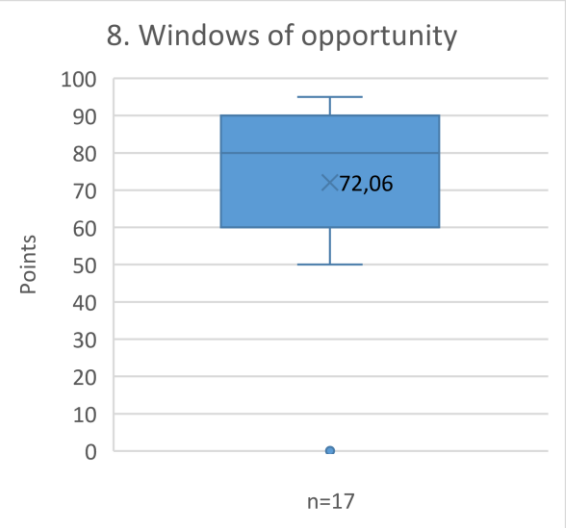
Figure 14: Box plots illustrating the results of the survey

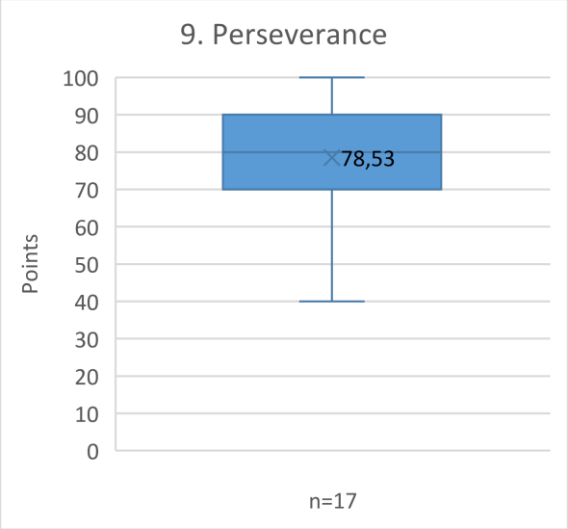


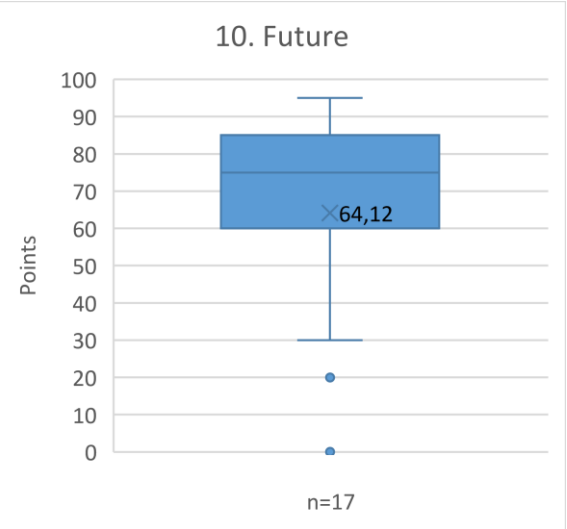

5. Power-relations
Points
100
90
80
70
60
50
40
30
20
10
0
80,29
n=17


6. Advocacy and brokerage
Points
100
90
80
70
60
50
40
30
20
10
0
43,24
n=17


7. Venue shopping
Points
100
90
80
70
60
50
40
30
20
10
0
45,29
n=17


8. Windows of opportunity
Points
100
90
80
70
60
50
40
30
20
10
0
72,06
n=17


9. Perseverance
Points
100
90
80
70
60
50
40
30
20
10
0
78,53
n=17


10. Future
Points
100
90
80
70
60
50
40
30
20
10
0
64,12
n=17